Vector Control and Pest Management

Introduction

- Importance of control
- Control measures available in disaster events
- Pest management practices (IPM)
- Biology and characteristics of disease vectors

Learning Objectives

By the end of this module, participants will:

- Increase understanding of the impact of vector control in disaster events
- Increase understanding of control measures needed in disaster events
- Increase understanding of the role of environmental health practitioners in addressing vector control issues
- Be able to identify key response partners

Environmental Health Functions

- Assess the situation to determine the extent of vector problems
- Determine measures of control needed
- Act as conduit for information to partners and the public
- Serve as a resource for local officials regarding temporary shelters, mass feeding, refuse disposal problems, etc.

Reasons for Concern

- Diseases transmitted to humans & animals
- Population growth
- Environment for population increase
- Frequency of natural disasters
- Introduction of new diseases
- Lack of funding for control programs

Key Partners

- Emergency management agency
- State and local departments of environmental health, housing, mosquito control, rodent control
- Centers for Disease Control and Prevention
- Emergency Support Functions (ESF)
  - 8, Public Health and Medical Services
- Industry
- Media

Roles

- Assessment
- Consultation
- Environmental monitoring
- Public information
- Preparation
- Planning activities
- Leadership
- Support activities
- Liaison activities

Priority Activities

- Assess effects of the disaster on vector populations
- Assess damage to transportation and communication systems and how it will affect vector control operations
- Assess staff status and availability of personnel for vector control operations
- Apply appropriate vector control measures
- Establish surveillance programs to determine control measures
- Apply long-term vector control measures as needed

Injury Prevention/Safety

Safety Is Job #1

- Personal sanitation
- Electrocution
- Carbon monoxide
- Musculoskeletal hazards
- Thermal stress
- Structural instability
- Hazardous materials
- Confrontations
- Fire
- Drowning, mechanical
- Personal protective equipment: use it!
- Driving, animals, insects, slips/falls
- Stress, fatigue
- Confined spaces: must be trained

Vector Control in Disaster Events




New Orleans News Article

"As more and more residents return to their flooded homes, they're having to reclaim their urban and suburban realms from nature, in all its creeping, crawling, slithering grandeur. They're finding large wharf rats and their smaller, more common cousins, Norway rats; swarms of mosquitoes and millions of voracious Formosan termites; marauding raccoons, opossums and armadillos; and snakes.

And, of course, alligators.

Rats appear to be a frontrunner in breeding and nesting in homes."

Why Be Concerned About Rodent Control After a Disaster?

- Rats and mice are responsible for more human illness and death than any other group of mammals.

Rodentborne Diseases

Rats and mice are responsible for the spread of a number of diseases

- Directly – by contamination of food, water and air with their urine and feces
- Indirectly – by way of rodent fleas and mites

Direct	Indirect
Rat bite fever	Plague
Salmonellosis	Scrub typhus
Leptospirosis	Murine typhus
Hantavirus	Tularemia
Lymphocytic choriomeningitis	

Integrated Pest Management

Integrated Pest Management (IPM) is the coordinated use of pest and environmental information with available pest control methods to prevent unacceptable levels of pest damage by the most economical means and with the least possible hazard to people, property, and the environment.

Integrated Pest Management

IPM uses a variety of common sense pest management techniques that focus on

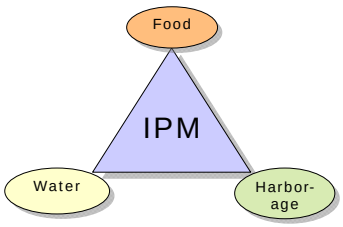
- Pest prevention
- Pest reduction below threshold levels
- Elimination of conditions that lead to pest infestations

Pest Management	Nonintegrated Pest Control	Integrated Pest Management
Program strategy	Reactive	Preventive
Customer education	Minimal	Extensive
Potential liability	High	Low
Emphasis	Routine pesticide application	Pesticides used when exclusion, sanitation, etc., is inadequate
Inspection and monitoring	Minimal	Extensive
Pesticide application	Regular schedule	Only as needed
Insecticides in occupied spaces	Sprays and aerosols	Baits and gels
Application of sprayed insecticides	Surface treatment	Crack-and-crevice treatment
Use of insecticide space spraying and fogging	Extensive	Minimal
Use of nonchemical controls	Minimal	Extensive
Positive identification of Pests	Sometimes	Required
Use of pest thresholds	Minimal	Extensive
Outcome evaluation	Sometimes	Required

Integrated Pest Management

The foundation of IPM is managing the environment to eliminate pest access to

- Food
- Water
- Harborage



IPM Foundation - Food

IPM Foundation - Water

IPM Foundation - Harborage

NPMA Recommendations

Five steps for an IPM program

1. Inspection
2. Identification
3. Establishment of threshold levels
4. Employment of two or more appropriate control measures
5. Evaluation of effectiveness.

Domestic Rats and Mice

Biological factors

- Domestic rodents – include Norway rats, roof rats, and house mice
- Commensal – live at humans' expense, eating their food, living in their homes, and sharing diseases without contributing anything beneficial to the relationship

Norway Rat

- Burrowing rodent; largest domestic rat
- Also known as the brown rat, house rat, barn rat, sewer rat, and wharf rat
- 7-18 ounces (200-500 grams)
- Length of head and body, 6-8.5 inches
- Total length w/tail, 13-18.6 inches
- Usually brown with coarse fur, whitish belly, blunt nose
- Small ears rarely over ¾ inch long

Norway Rat

- Large droppings, up to ¾ inch long capsule shaped
- Sexual maturity in 3-5 months after birth
- Gestation period, averages 22 days
- 12-18 young per litter
- Approx. 4-7 liters per year
- Average life span is about 1 year
- Range is about 100-150 feet

Norway Rat

Harborage

Outdoors – burrows in the ground, under building foundations, in rubbish/garbage dumps and in sewers

Indoors – between floor and ceilings, in walls, enclosed spaces, cabinets, shelving, appliances, and other spaces concealed from view

Norway Rat

Food

- Garbage, meat, fish, vegetable, fruit, and cereal baits are well accepted; daily requirement, ¾ to 1 ounce of dry food, more of moist food

Water

- Daily requirement, ½ to 1 ounce

Roof Rat

- Smaller than Norway rat and a more agile climber
- Slender and graceful
- Body weight 4 -12 ozs.
- Length, head and body 6.5 – 8 inches.
- Tail, 7.5 – 10 inches long, longer than head plus body
- Total length, 14-18 inches

Roof Rat

- Fine body fur, variable colors
  - black to slate-gray
  - brownish above and grayish –white below
  - brownish above and white-to-lemon-yellow below
- Pointed nose, large eyes, large prominent ears (> ¾ in.) can be pulled over eye.
- Dropping medium size, up to ½ inch

Roof Rat

- Sexual maturity, 3 to 5 months after birth.
- Gestation period, average is 22 days
- Young: 6-8 per litter
- Usually 4-6 litters per year
- Life span, ~1 year
- Range 100-150 feet

Roof Rat

- Harborage - above ground level
  - Indoors – in attics, between floors and ceilings, in walls and in enclosed spaces of cabinets and shelving
  - Outdoors – in trees and dense vine growth
- Food – vegetables, fruits, and cereal grains preferred. Daily requirement ½ to 1 ounce of dry food, more if moist
- Water – up to 1 ounce each day

House Mouse

- Found throughout the world
- Slender and graceful
- Weight – ½ to ¾ ounces
- Length of head and body: 2 ½ - 3 ½
- Tail: 3 – 4 inches long
- Fur: fine, brownish-gray on back, gray on belly
- Nose: pointed
- Ear: large, prominent, with some hairs, can be pulled over eye

House Mouse

- Eye: large
- Droppings: small, up to ¼ inch
- Sexual maturity: reached 1½-2 months after birth
- Gestation period: averages about 19 days
- Young: 5-6 per litter
- Number of litters: as as many as 8 per year
- Length of life: maximum less than one year

House Mouse

- Food: cereal grained preferred, but most types of edible materials; a nibbler; daily requirement 1/10 ounce
- Water: daily requirement, 3/10 ounce; can use metabolic water in food to survive

ECONOMIC IMPORTANCE

- Rats in the human environment cause enormous economic loss
  - Consume and contaminate vast quantities of food
  - Cause fires by gnawing the insulation from electric wires
- Commensal rodents cost billions of dollars each year in the United States.
  - Internal destruction to computers and other sensitive equipment
  - Structural damage to homes and businesses

Rodents in Disaster Environments

You may hear “There is an explosion in the rat population!” or “The rats are taking over!”

In reality…

- Rats and mice endure suffering similar to humans during disasters
- Populations are frequently decimated
- Survivors are often displaced and will wander to new areas (including homes and buildings) in search of food and shelter
- May be fearful, disorganized and aggressive after disaster events

Rodents in Disaster Environments

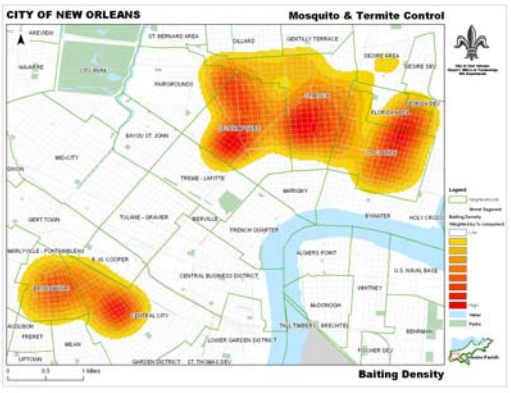
- It will take time for rodents to regroup, reorganize their social behavior, become familiar with their new environment, find safe haven, locate food and water and memorize their movements
- Colony building and reproduction will only begin when their new ecosystem has stabilized
  - Typically takes 6-10 months under favorable conditions

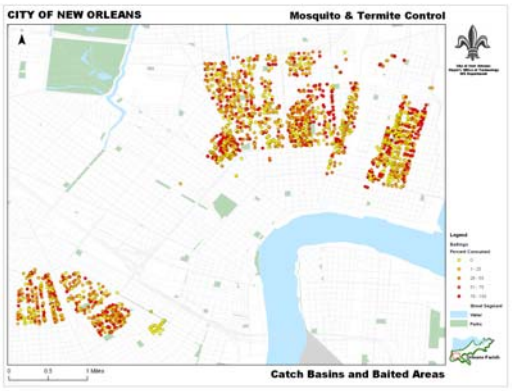
Rodent Control Activities After A Disaster

- Keep an up-to-date epidemiologic map of the geographical area, indicating where rodent-borne infections have been detected (lack of funding locally will limit information)
- Identify the areas most vulnerable to access by rodents and contact with people (shelters, food storage areas, garbage dumps, abandoned vehicles, etc.)
- Search for indications of growth of rodent populations
- Capture and study rodents to determine potential health threats
  - Should include examining for the presence of fleas, mites, and lice and any illnesses they may carry
  - Should only be performed by specialized personnel and if time and funding is available

Rodent Control Activities After A Disaster

- Understand the local and state capability (rodent programs)
- Do not over react
- Be prepared for rodent hysteria
- Understand your rodenticides and mode of action
- Do not use rodenticides indiscriminately





•Provide treatment in populated areas.

•Have contracts established prior to the disaster

Treatment along the Mississippi River

Survey and Treatment of critical facilities.

•Not all cities have a rodent control program or staff
•Contractors
•Populated areas
•Hospitals
•Superdome
•Convention Center

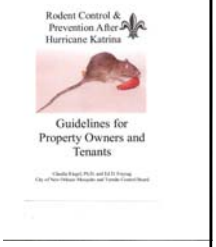
Excellent record keeping is critical – your records and FEMA

Rodent Control Activities After A Disaster

- Protect food from rodents. Encourage storage of food in metal boxes or tightly sealed heavy-gauge plastic containers.
- Remove food sources.
- Encourage proper solid waste disposal. Remove trash piles including damaged furniture, mattresses, etc. from homes as soon as possible.
- Promote good general hygiene and sanitation practices.
- Urge anyone bitten by a rat to wash the wound thoroughly with soap and water and see a doctor immediately.

Rodent Control Activities Following A Disaster

- **Educate, educate, educate!** Rodent control activities without community support will be ineffective.
  - Get the message out by all forms of available media
  - Develop or use existing flyers on rodent control and distribute to neighborhoods, shelters, and civic groups.
  - Meet with local policy makers and community leaders to discuss vector control strategies.



Recognizing Rat and Mouse Signs

Gnawings: Rat incisor teeth grow 4 to 6 inches a year. Must gnaw each day to keep their teeth short.

Recognizing Rat and Mouse Signs

Fresh droppings (< 3 hours) are usually moist, soft, shiny, and dark. Old droppings are dull and grayish, easy crumble and are often moldy or covered with fungi. Under magnification, hairs are usually visible.

It is difficult and often unreliable to determine the age (fresh or old) of droppings so the best thing to do is to remove them and see if dropping appear. It can then be determined that if dropping appear then rodents are active in that area.

Recognizing Rat and Mouse Signs

Burrows: Norway rats prefer burrows for nesting and harborage. Often found in earthen banks, under concrete slabs, along walls, and under rubbish. If in use, its entrance will be free of cobwebs and debris. Fresh fragments of food or freshly dug earth at burrow entrance also indicates recent usage. Burrows are seldom far from a source of food and water.

Recognizing Rat and Mouse Signs

Runways: Paths consistently used by rodents between food, water, and harborage. Outside runways are narrow pathways of beaten earth swept clear of debris. Inside, greasy runways are found along walls, steps, and rafters.

Recognizing Rat and Mouse Signs

Rub marks: Dark markings rodents make with their bodies along runway walls. Fresh marks are soft and will smear if rubbed. As grease ages, it dries, gathers dust and will flake off.

- Norway rat: along runways near ground level
- Roof rat: overhead as swing marks beneath beams and rafters
- Mice: no rub marks unless heavy infestation

Recognizing Rat and Mouse Signs

- **Visual sightings:** An obvious sign, the presence of live or dead rodents
- **Rodent Sounds:** High-pitched squeaks
- **Rodent Odors:** Odors produced from urine and body glands. Especially apparent and more noticeable in enclosed rooms with heavy infestations.

Never underestimate rodent ingenuity…

Infrastructure Damaged:

Trash piles grow

Rodent Control Sanitation

Solid waste collection systems may be down or severely impeded after a disaster. The EH responder should work with local authorities to develop alternative strategies for solid waste storage and removal until collection systems are fully operational.

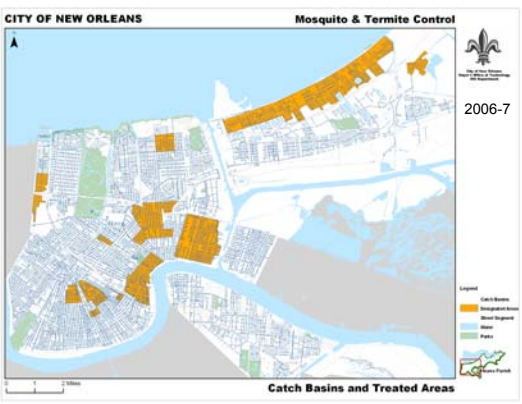
Rodent Control Sanitation

- Open dumps generated from the disaster should be removed and the site cleaned immediately.
- Check with local public health authorities for solid waste disposal recommendations. For some disasters, burning and/or burial may be temporarily authorized.

Control of Rodent Populations

Basic principles

- Controlling rodent populations, not individual rats or mice, is key to a successful rodent-control program in a community
- Permanent reduction of one or more vital factors (food, water, and harborage) will result in a permanent reduction in the rodent population
- A rodent population cannot be greater than the capacity to support it
- Environmental sanitation is the first and foremost requirement for permanent rodent control



Rodent Extermination

Important: Rodent extermination without environmental improvements, particularly good sanitation, will be ineffective

Poisons and baits

- Multidose poisons
- Single-dose poisons
- Sterilants (usually not recommended)

Rodenticide	Formulation	Effect	Concen-tration (%)	WHO hazard classification (Class)[a]
Brodifacoum	Bait, wax block	Anticoagulant[b]	0.005	Ia
Bromadiolone	Bait, oil-based, wax block, powder concentrate	Anticoagulant[b]	0.005	Ia
	Tracking powder		0.1-2.0	
Bromethalin	Bait	Acute	0.005-0.01	Ia
Calciferol	Bait	Sub-acute	0.075-0.10	NA
Chlorophacinone	Bait	Anticoagulant	0.005-0.05	Ia
	Oil-based concentrate		0.25	
	Tracking powder		0.20	
Coumatetralyl	Wax block, bait	Anticoagulant	0.0375	Ib
	Tracking powder		0.75	
Difenacoum	Wax block, bait	Anticoagulant[b]	0.005	Ia
Difethialone	Wax block, bait	Anticoagulant[b]	0.0025	Ia
Diphacinone	Powder concentrate	anticoagulant	0.1-0.5	Ia
	Water soluble concentrate		0.1-2.0	
	Bait		0.005-0.05	
Flocoumafen	Wax briquette	Anticoagulant[b]	0.005	Ia
Warfarin	Concentrate	Anticoagulant	0.5-1.0	Ib
	Tracking powder, bait		0.025-0.05	
Zinc phosphide	Bait	Acute	1-5	Ib

ala = extremely hazardous; Ib = highly hazardous; NA = not available
b Second generation anticoagulant

FIRST GENERATION ANTICOAGULANTS

1. Warfarin (Kaput, etc.)
2. Chlorophacinone (AC Formula90, RoZol, etc.)
3. Diphacinone (Ditrac, Eaton's BaitBlocks, etc.)

- Anticoagulants interfere with blood clotting and death can result from excessive bleeding
- Multiple feedings
- Time-to-death is delayed
- Less persistent in animal

Rodent Extermination

Baiting recommendations

- Be generous with bait
- Place baits out of reach of children and pets
- Maintain wholesome and attractive fresh bait
- Place baits in areas where rodents frequent
- Use bait stations where applicable

SECOND GENERATION ANTICOAGULANTS

1. Brodifacoum (Talon, Final, Formus, etc)
2. Bromadiolone (Contrac, Maki, Brigand)
3. Difethialone (Generation, First Strike)
4. Difenacoum (MultiKill, etc.)

- Highly toxic and persist a longer in body tissues
- Designed to be toxic in one feeding
- Time-to-death is several days so toxicant levels in carcasses may be many times the lethal dose
- Predators or scavengers that feed on poisoned rats may consume to be harmed.

NON-ANTICOAGULANTS

1. Bromethalin (FastTrac, Fast-Kill)
   Nerve toxicant that causes respiratory distress
2. Cholecalciferol (TeraD3, etc.)
   Massive dose of vitamin D3 causes release of calcium into the bloodstream causing heart failure
3. Zinc Phosphide (ZP Bait, etc.)
   Liberation of toxic phosphine gas in the stomach

Rodent Extermination

Multidose baits

- Bait blocks
- Pellets
- Toss packs – epa changed in 3/2012
- Tracking powders

Rodent Extermination

Trapping

- Place trap in areas rodents frequent

When to trap

- When poisons fail or are too risky
- If the odor of unrecovered rodents is a problem
- To capture rodents for parasite and blood sample studies

Rodent Extermination

PPE for trapping

- Gloves and DEET in open areas
- Minimum of N-95, gloves, and DEET in confined areas

PPE for rodent processing

- Minimum of N-95 (N-100 or PAPR if hantavirus is suspected)
- Full body protection (Tyvek or other) plus DEET
- Double latex gloves and eye protection

Note: Fit testing and training required for respirators

Significant changes have recently occurred for residential rodenticide use and for exterior commercial baiting programs.

www.epa.gov

EPA Risk Mitigation Decision for Ten Rodenticides

May 28, 2008, updated March 2012

- **To minimize children's exposure to rodenticide products used in the home, residential and general consumers are restricted as follows –**
  (12,000 – 15,000 exposures/year in ages under 6)
  - rodenticide baits only sold in bait stations
  - loose baits (pellets and meal) banned for sale
- **To reduce wildlife exposure and ecological risks -**
  *Limits for general consumers on 4 of the 10 rodenticides that pose the greatest risk to wildlife (brodificoum, bromodiolone, difenacoum, and difethialone).
  *Bait stations required for all outdoor, above ground uses.
- **Professional and agricultural market restrictions**

Precautions for Building Entry After a Disaster

- Homes and other buildings that were damaged or abandoned may be infested with rodents
- If the building has been abandoned for an extended period of time, it may be helpful to let it air out for 2-3 days before reentering
- If signs of rodent activity are present, a thorough cleaning will be necessary

Volunteers are often:
•Untrained
•Young
•Do not understand the dangers (risks)

Precautions for Building Entry After a Disaster

- Do not vacuum or sweep rodent urine, droppings or contaminated surfaces until they have been disinfected
- Spray urine and droppings with a disinfectant or a 1:10 chlorine solution until thoroughly soaked
- Remove urine and droppings with a paper towel and discard outdoors in a sealed container
- For heavy infestations or where hantavirus has been identified, respiratory protection will be needed (N-100 or PAPR)

Note: Fit testing, physicals, and training required for respirators

Removal of Dead Rodents

- Check traps regularly
- Spray dead rodents with a disinfectant or chlorine solution
- Using gloves, remove rodent from trap and place in double sealed bags
- Discard rodent in a sealed outdoor waste receptacle
- Disinfect gloves if they will be reused
  - After removing gloves, wash hands thoroughly with soap and water (or use a waterless alcohol-based gel)
- Decontaminate traps before reusing

FEMA trailer parks

Holds water

1-2 stations per park
Checked once every 3 months.

Mice enter the travel trailers:
•Plumbing penetration
•Vents
•stove

Displaced Animals

Snakes

- Floods may force snakes into homes and other buildings
- Before reentry into homes or beginning clean-up, search thoroughly for snakes
- Be alert for snakes in any type of building, piles of debris, building materials, or trash
- Wear heavy leather or rubber high-top boots and heavy gloves
- Use rakes, pry bars, or other long-handled tools when removing debris
- Keep a heavy stick or long-handled tool nearby
- After dark, carry a strong light

Snakes

- Block openings where snakes might enter buildings
- If you realize you are near a snake, remain still. If it doesn't move away after a few minutes, slowly back away.
- Explain the dangers of snakes to children along with precautions they should take (e.g., no playing around debris.)
- Do not kill snakes indiscriminately
  - If a venomous snake is killed, use a long-handled tool or stick to remove it for disposal
- Seek medical attention immediately if bitten

Plague Control
After 1906
San Francisco
Earthquake

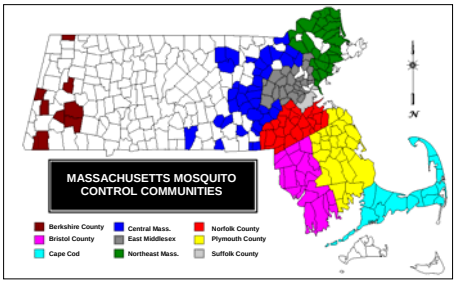
Plague Control
After 1906
San Francisco
Earthquake

Questions?

VECTOR CONTROL
Part 2

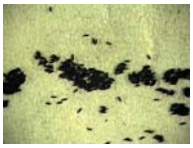
9 Mosquito Districts in Mass.

- Berkshire County MCP
- Bristol County MCP
- Cape Cod MCP
- Central Mass. MCP
- East Middlesex MCP
- NE Mass. Wetlands Mgmt. & MC District
- Norfolk County MCP
- Plymouth County MCP
- Suffolk County MCP

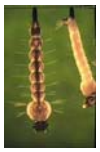


Mosquito Districts in Mass.

Mosquito Life Cycle



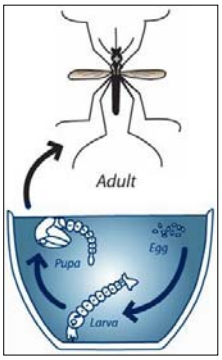
Egg



Larva

Pupa

MOSQUITO LIFE CYCLE



Mosquito Eggs

- Damp soil
- Containers
- Permanent water
- Emergent vegetation
- Dependent on species

Mosquito Larvae

- 4 stages called “instars”
- 1/8” – 1/4” long
- Breathes air
- Can develop in as few as 5 days into pupae

Mosquito Pupae

- Does not eat
- Breathes air like larvae
- Fully developed mosquito inside
- Final stage before adult

Mosquito Adult

- 2,600 species, ~162 in USA
- 51 species in Mass.
- Vector of several diseases in the Northeast
- Flight range <100 yds. to 25 miles

Habitat Types

- Retention/Detention areas
- Permanent water
- Cedar/Maple swamps
- Woodland pools & Reflood areas
- Degraded ditches
- Artificial containers
- Salt marsh

What is Integrated Mosquito Management ?

- Surveillance
- Disease Surveillance
- Biological Control
- Physical Control
- Chemical Control
- Resistance Management
- Education and outreach

Preventing mosquito breeding through habitat manipulation

•Ditching can be used to facilitate drainage in salt marshes and will help movement of predators such as fish.
•Freshwater habitats are brought back to historic flow patterns
•Reduction of standing water, less pesticide use

Physical barriers

Physical barriers such as window screens are very effective ways of preventing mosquitoes from gaining access to a blood meal.

Unfortunately, in many disasters, the windows and screens that can keep mosquitoes out of a structure are damaged or lost..

Also, windows are often left open during a power outage because the air conditioning is not on.

Other Program Elements

Arbovirus Monitoring

Public Education

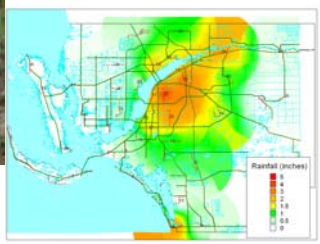
Resistance Monitoring

Integrated mosquito management targets the larval mosquito stage first since successful control of this stage will prevent biting adult mosquitoes altogether.

Surveillance for mosquito larvae begins with monitoring rain And tide data to know the most likely sources of water that will stimulate flood water mosquito breeding.

Rain Gauge

Mapped rain data



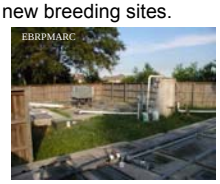
Mosquito larvae are located by using a white dipper to sample water habitats. The stage of development, temperature, and species will indicate how much time is left before they become adults.

Larvicides applied to larval breeding areas

•Larvicides include biological pathogens, such as *Bacillus sphaericus* and *Bacillus thuringiensis israelensis* (Bti).

•Larvicides include other materials, such as juvenile hormones, monomolecular films, and oils.

It takes a district years to map sites to effectively use larviciding and reduce adulticiding. A disaster can completely alter the landscape and create new breeding sites.



Adult mosquito surveillance can be accomplished with several different types of traps as well as landing rate observances.

CDC Light Trap

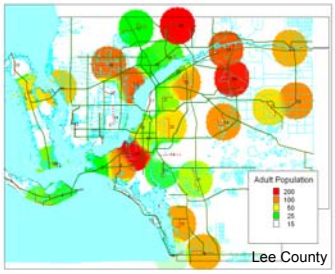
New Jersey Light Trap

Landing Rate Counts

Gravid Trap

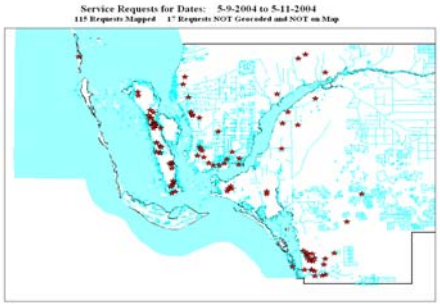
Resting boxes

Adult mosquitoes are collected, identified, counted and mapped to prioritize areas of needed control



Mapped Mosquito Abundance

Service requests are mapped as an additional indicator of where to concentrate surveillance and control efforts



Lee County, FL

Service requests are mapped as an additional indicator of where to concentrate surveillance and control efforts

City of New Orleans

Ground Adulticiding

- Accomplished using a ULV (Ultra Low Volume) fogger mounted onto a vehicle

Adult Control Products

- Synthetic pyrethroids
- Not a residual product, rapid decomposition in the environment
- Low toxicity to humans, pets, etc.
- **Toxic to fish & bees**

Pyrethroids

- Animal Products (flea spray, flea shampoos)
- Restaurant applications
- Food & grain storage
- Available to homeowners as

Yard Guard®, Repel®, etc.

What is Ultra Low Volume?

- ULV spraying involves the creation of a cloud of drops of concentrated material in a very specific micron size range designed to contact and kill flying mosquitoes.
- Very small volumes are used to cover large areas. The application rates usually range from a few ounces to less than an ounce per acre.

VMD

- Volume Median Diameter
- Measurement of droplet size in microns
- Half of the volume contained droplets smaller than VMD and other half contained larger than VMD
- Ideally there is an optimum droplet size range that offers the most efficient mosquito mortality (7-22 microns)

How small is a micron?

The volume of one BB shot would yield…

9,761,000 droplets of 20 microns

74,088,000 droplets of 10 microns

Aerial mosquito adulticiding is ideally done at night when weather conditions are most favorable and vector species are active. Missions are flown using night vision goggles and satellite navigation systems.

Aerial adulticiding can also be done at first light in the morning or at dusk if night time navigation is not possible.

Mosquito Control Post Emergency Event

- The need for mosquito control is primarily a recovery issue that is going to occur several days to weeks after a flooding event.
- Normal breeding cycles can be disrupted but conditions may be present that will facilitate a rapid buildup of tremendous numbers of mosquitoes

Survey

- Lost most traps
- CDC
- Landing rates
  virtually no mosquitoes one month after disaster
- Find our trucks with ULV units

C130 Hercules US Air force Reserve
910th Airlift Wing at Youngstown Air Reserve Station, OH

EEEV Aerial Spray in August 2010

- In response to increasing EEE found in mosquito species (esp. *Cq. perturbans*).
- Data collected showed lower mosquito populations
- Certain areas not sprayed, i.e. endangered species habitat, drinking water supplies

http://www.mass.gov/agr/mosquito/docs/mepa/2010-EEEv-AERIAL-SPRAY-SUMMARY.pdf

EEEV Aerial Spray (cont.)

- Emergency rooms & poison control centers notified ~100 calls, mostly about timing of the spray event
- No confirmed exposures with complications
- Some non-target impact noted

http://www.mass.gov/agr/mosquito/docs/mepa/2010-EEEv-AERIAL-SPRAY-SUMMARY.pdf

EEEV Aerial Spray (cont.)

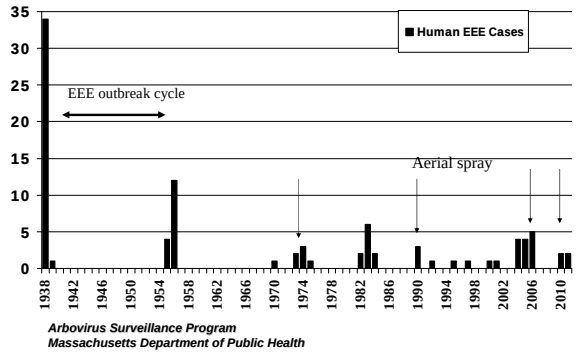
- 7 locations monitored in the cranberry growing area
- Sumithrin was not detectable after spray
- PBO (synergist) was found in some areas 3 hours post spray, below 1 part per billion – below human health concern and low ecological risk.

http://www.mass.gov/agr/mosquito/docs/mepa/2010-EEEv-AERIAL-SPRAY-SUMMARY.pdf

Eastern Equine Encephalitis

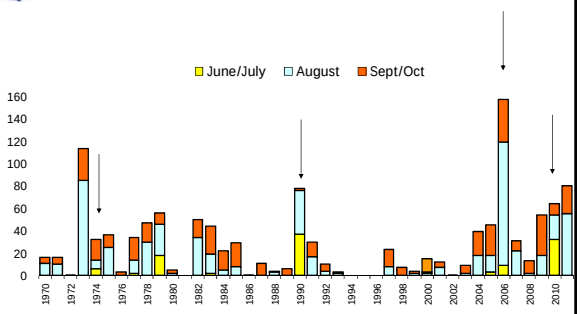
1831	Epidemic of brain disease in horses in Massachusetts
1931	Differentiated from other equine encephalitides
1933	Virus isolated
1933-36	Birds implicated as reservoir of virus
1938	Outbreak of "brain disease" in horses in Massachusetts (~ 300 cases)
1938-39	Outbreak of human EEE in Massachusetts (35 cases)
1947	Louisiana and Texas outbreaks
1955-56	Second Massachusetts outbreak (16 cases), aerial spraying, DDT
1957	Taunton Field Station of the USPHS
1969	Taunton Field Station closed, State Laboratory continues surveillance
1973	Equine vaccine
1973-75	Outbreak (7 cases), aerial spraying, malathion
1982-84	Outbreak (10 cases)
1990	Outbreak (3 cases), aerial spraying, malathion
2004-06	Outbreak (13 cases), aerial spraying, sumithrin
2010	Record mosquito EEE isolations (2 cases), aerial spraying, sumithrin

Human EEE Cases in Massachusetts 1938-2011



Arbovirus Surveillance Program
Massachusetts Department of Public Health

Timing of EEEv Isolates within season



Arbovirus Surveillance Program
Massachusetts Department of Public Health

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- FEMA ESF List National Response Framework (NRF) Resource Center - www.fema.gov/emergency/nrf

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- Pan American Health Organization (PAHO) Rodents in Disasters page: www.paho.org/english/dd/ped/te_rdes.htm
- The PAHO site - www.paho.org/english/dd/ped/te_rdes.htm - is valuable in that it shows how to prioritize vector and rodent control programs after a disaster
- National Library of Medicine (NLM) and National Insititues of Health (NIH) Animal Diseases and Your Health page: http://www.nlm.nih.gov/medlineplus/animaldiseasesandyourhealth.html
- Returning Home After a Disaster: Be Healthy and Safe - http://www.bt.cdc.gov/disasters/hurricanes/returnhome.asp CDC recommended guidelines for entering buildings after disasters.

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QUESTIONS