INTRODUCTION TO MEDICAL & VETERINARY ENTOMOLOGY

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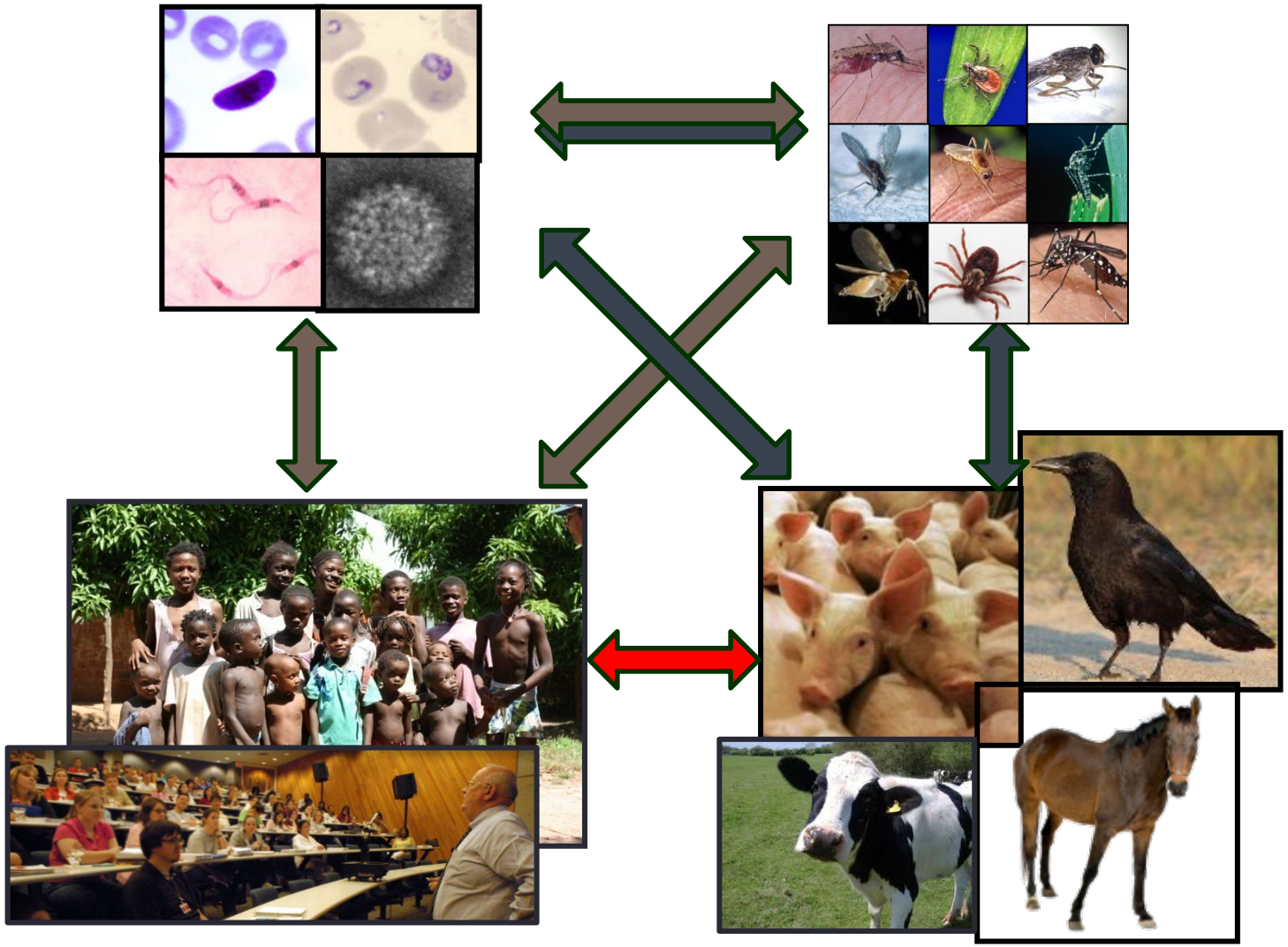
Medical Entomology

- **Human Protection**
- **Human pests and disease agent transmission**
- **Integrated pest management around properties**
- **Reduce encounters**

Veterinary Entomology

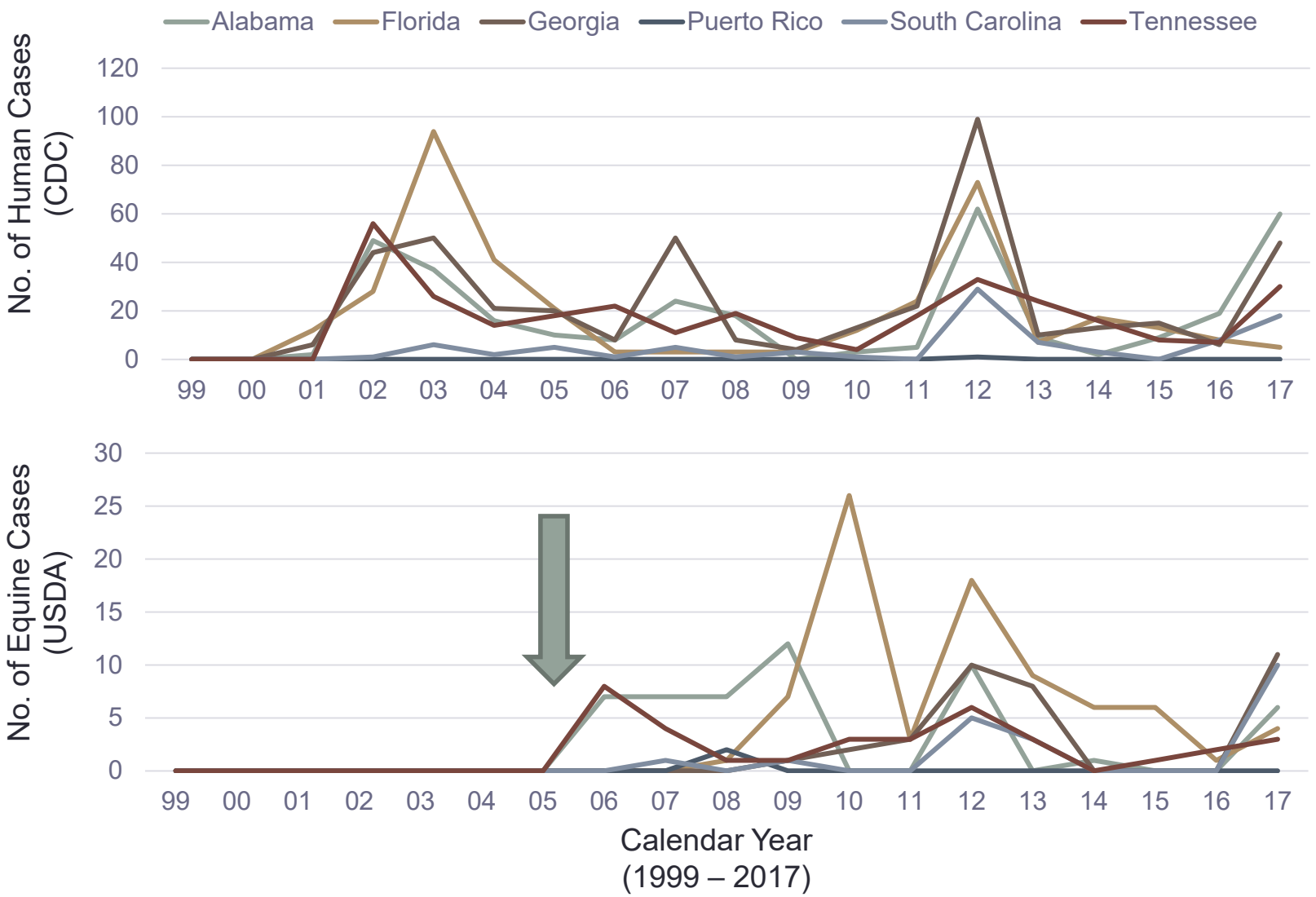
- **Animal Protection**
- **Human pests and disease agent transmission**
- **Parasitology in wildlife & natural systems**
- **Integrated pest management in livestock-animal agriculture**

Medical & Veterinary Entomology

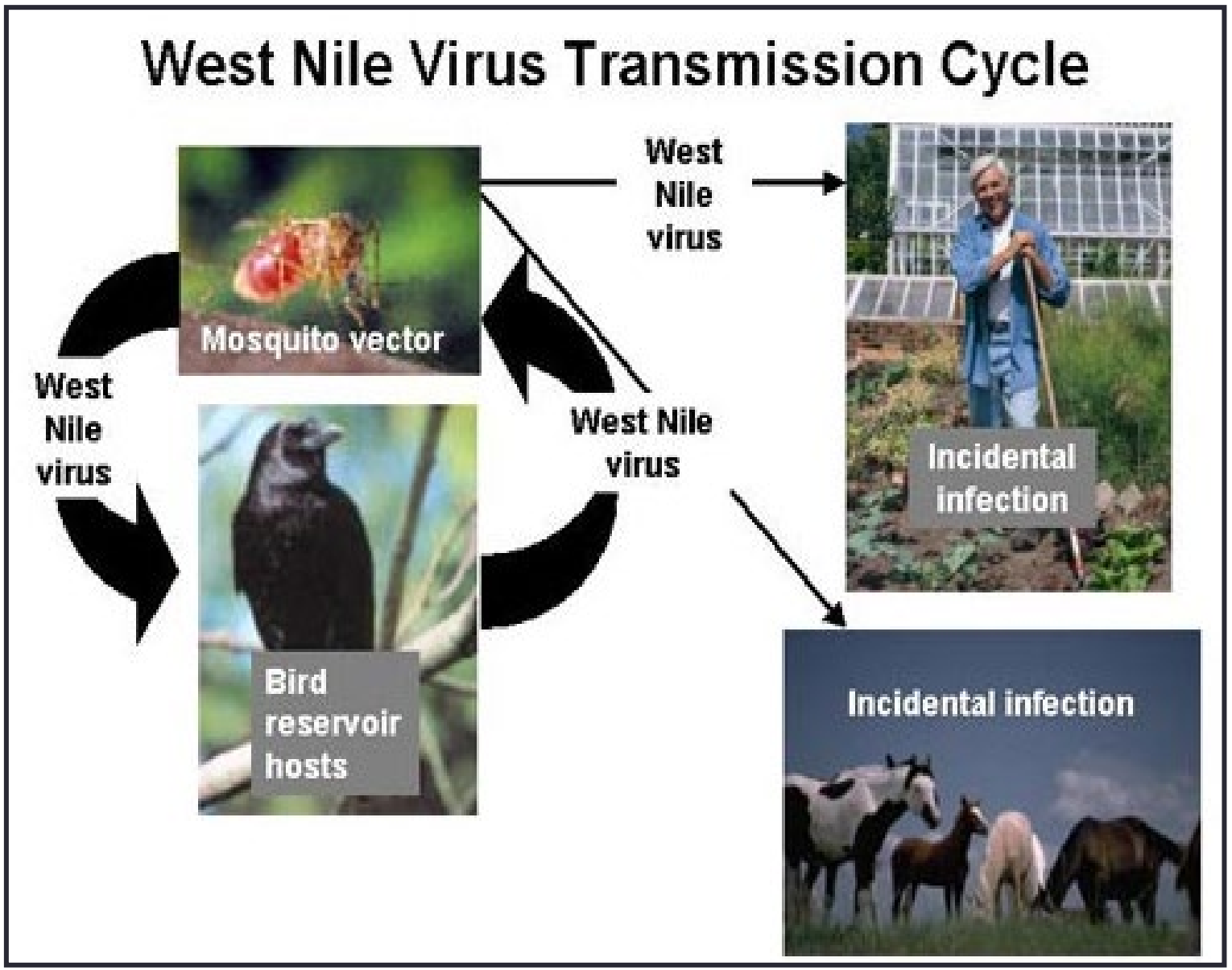


Background * Pest Examples 6 * Management

20 Years since West Nile virus



20 Years since West Nile virus

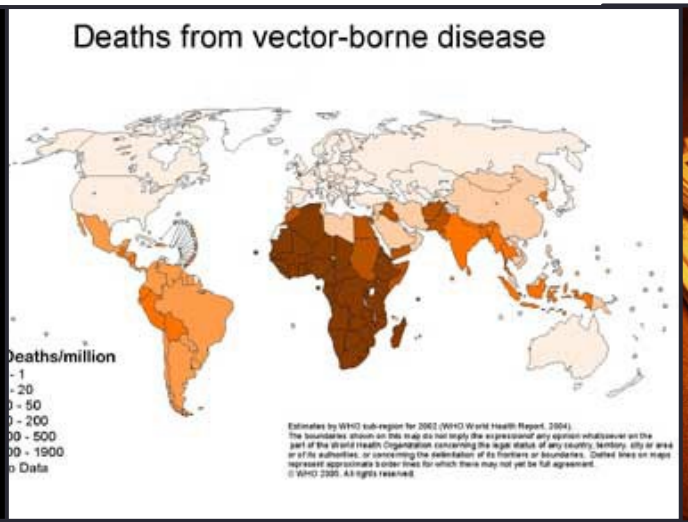


What is a Pest?

- **An organism that does something you do not want it to do**
- **Annoyance, disturbance, or harm**
- **Not all pests are insects**
- **"Pest" is a personal point of view**
- They **damage** something that we care about
  - (bodies, crops, houses, pets, livestock, forests)
- They are **abundant**
  - High reproductive rate and/or high survival rate
  - High survival implies **ineffective** natural mortality
  - Are all pests abundant? Not necessarily…

Economic Impacts of Arthropods

- **Direct Damage**
  - **Biting, blood loss, myiasis, toxins, disturbance**
- **Indirect Damage**
  - **Pathogen transmission, weakening, psychoses**
- **Peripheral**
  - **Quarantine, restrictions, misdiagnoses**



Direct Damage from Ticks to Moose

It's a telltale sign that the calf was becoming a "ghost moose"—an animal so irritated by ticks that it rubs off most of its dark brown hair, exposing its pale undercoat and bare skin.

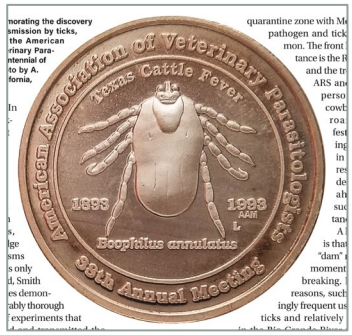
The ticks had taken so much blood that her starving body was raiding its bone marrow, muscles, and even heart for precious protein. The moose, for all intents and purposes, was eating itself alive.

Factors Contributing to "Pest"

1. Adapt to a New Host
2. Introduce Pest to a New Region
3. Use, Misuse, or Unnecessary use of Insecticide
4. Change in Production or Management Practices
5. Human Attitudes
6. Environment

Cattle Fever Tick

1) Adapting to new host



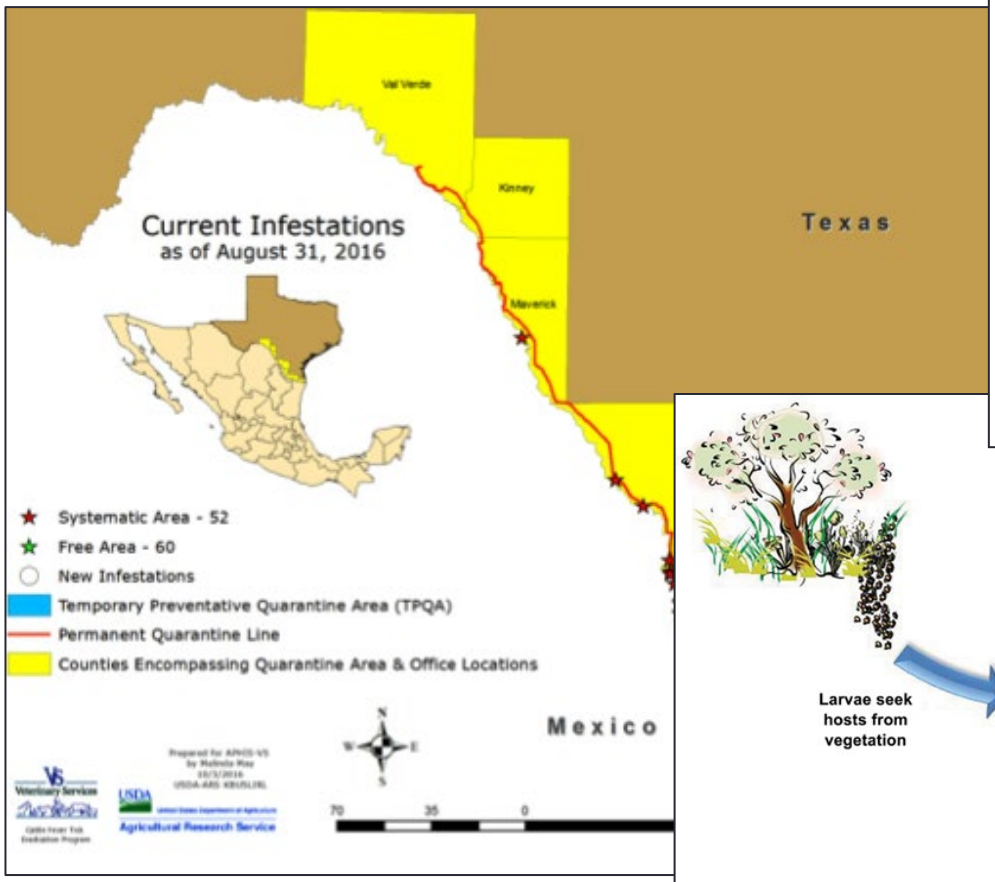
- Single cow as a host
- First demonstration of vector involvement in pathogen transmission and the first proven case of transovarial transmission

Direct, Indirect, & Peripheral Damage

- blood feeding ↓s weight gain & feed efficiency
- Transmit *Babesia* pathogen (1st)
- Treatment: cattle dips, check stations, & quarantines

Cattle Fever Tick

Quarantine breaking



Cattle tick spread may be worst in 73 years

U.S. cattle ranchers might be facing broadest infestation in 73 years

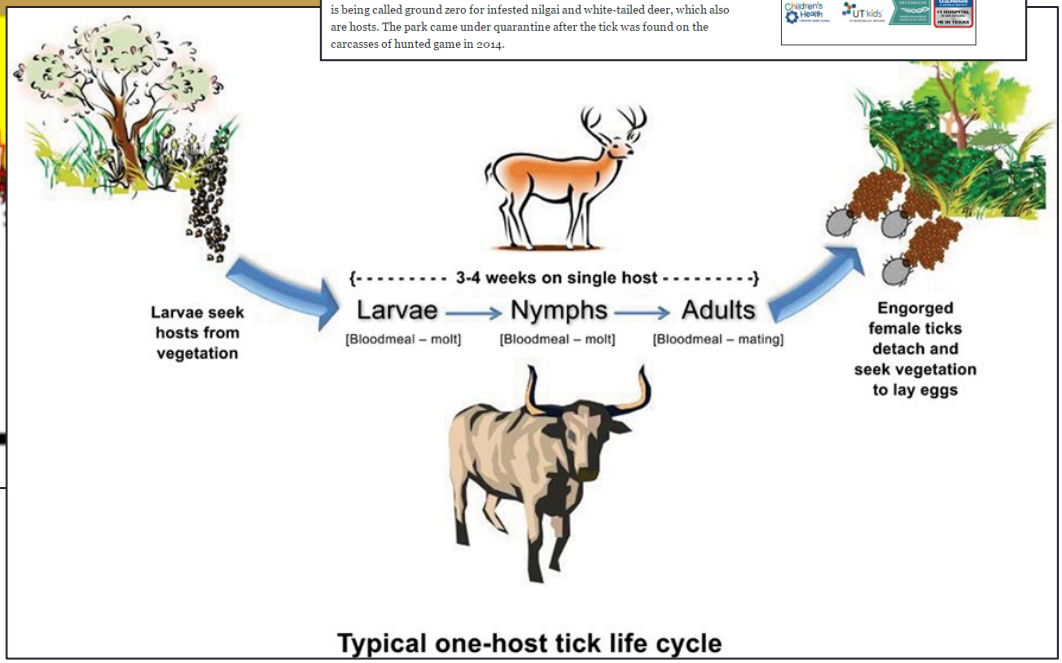
By Lynn Brezosky | April 22, 2016 | Updated: April 23, 2016 11:11pm

Photo: Courtesy Photo /Natural Resources /

IMAGE 1 OF 10
A cow is dipped in a vat full of an acaracide and water mixture used to kill fever ticks on cattle. The Texas Animal Health Commission has a proposed rule to add a vaccine to eradication efforts, but ranchers ... more

The nilgai, a once-exotic antelope imported from Asia for zoos and let loose for trophy hunts on Texas ranches, are now being blamed for spreading the potentially devastating cattle fever tick the farthest into the U.S. interior in decades, possibly since it was declared eradicated in 1943.

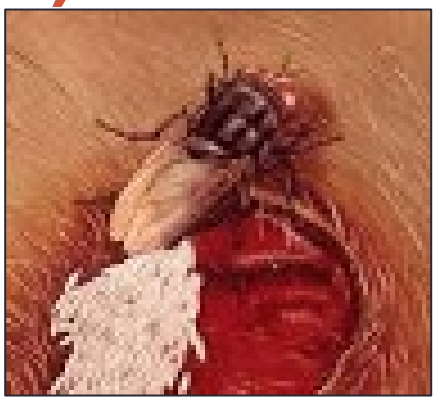
The Laguna Atascosa National Wildlife Refuge in lower Cameron County, about two miles north of the Mexican border at the Southern-most tip of Texas, is being called ground zero for infested nilgai and white-tailed deer, which also are hosts. The park came under quarantine after the tick was found on the carcasses of hunted game in 2014.



Now use wildlife (nilgai) as suitable hosts for development & dispersal

Primary Screwworm

2) Introduce Pest to Region

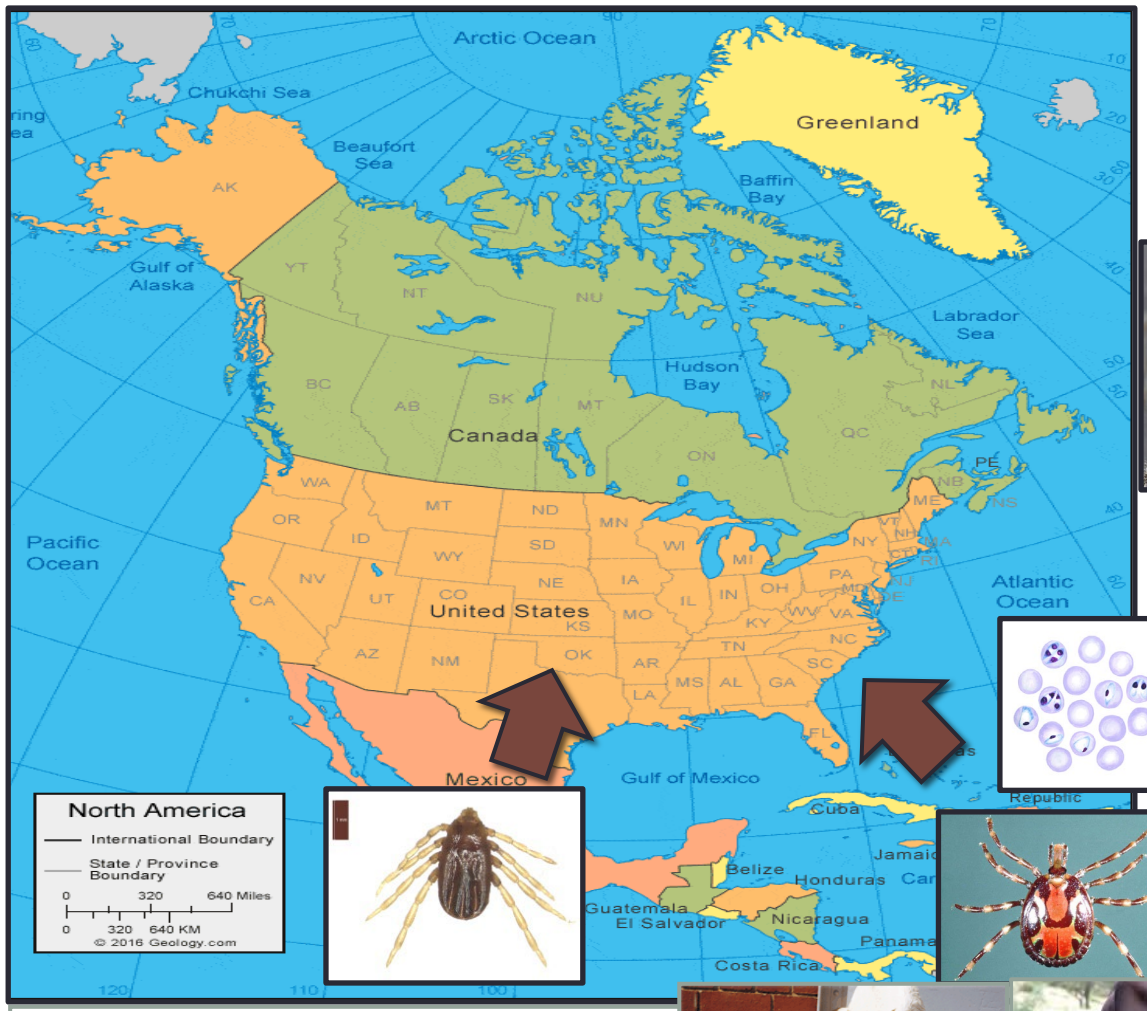


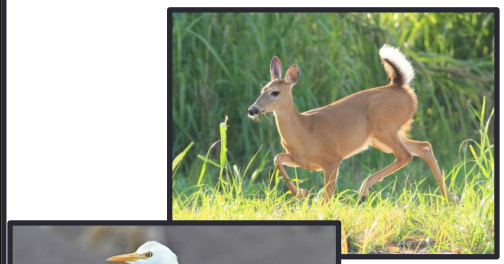
Control: Sterile insect technique funded by National Cattlemen's Association

Direct, Indirect, & Peripheral damage

fly larvae feed on live tissue of wildlife & livestock

2) Threat of Invasive Ticks





Journal of Wildlife Diseases, 23(2), 1987, pp. 215–219

SUSCEPTIBILITY OF WHITE-TAILED DEER TO EXPERIMENTAL HEARTWATER INFECTIONS

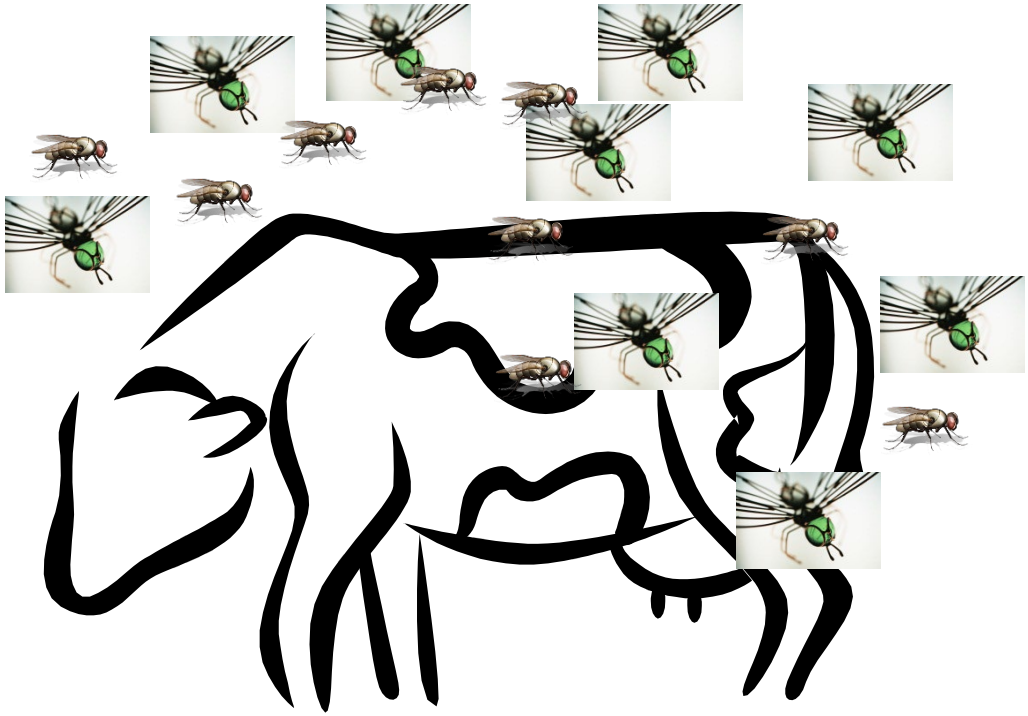
A. H. Dardiri,[1] L. L. Logan,[2] and C. A. Mebus[1]

[1] United States Department of Agriculture, Agricultural Research Service, NAA, Plum Island Animal Disease Center, P.O. Box 848, Greenport, New York 11944, USA

[2] Department of Pathology, School of Veterinary Medicine, University of California, Davis, California 95616, USA

3) Use, Misuse, or Unnecessary use of Insecticides

2 fly species
Both are obligate parasites of cattle
But green fly is WAY worse than red fly

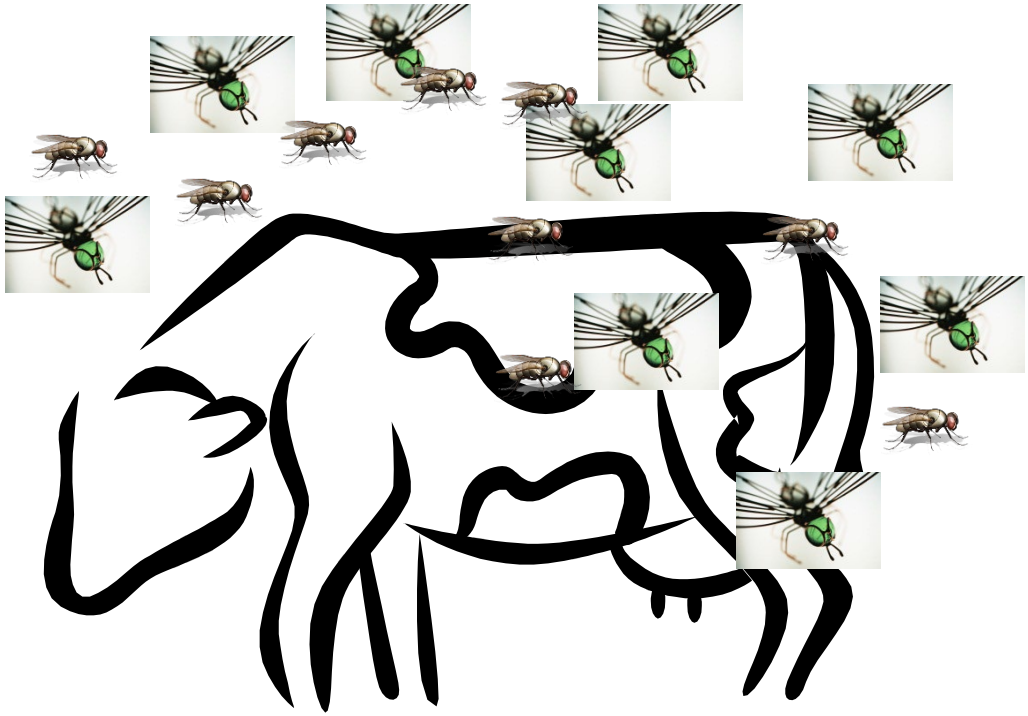


Green fly is the primary pest
Red fly is the secondary pest

3) Use, Misuse, or Unnecessary use of Insecticides

B/c green fly is WAY worse than red fly

We apply an insecticide to get rid of green fly

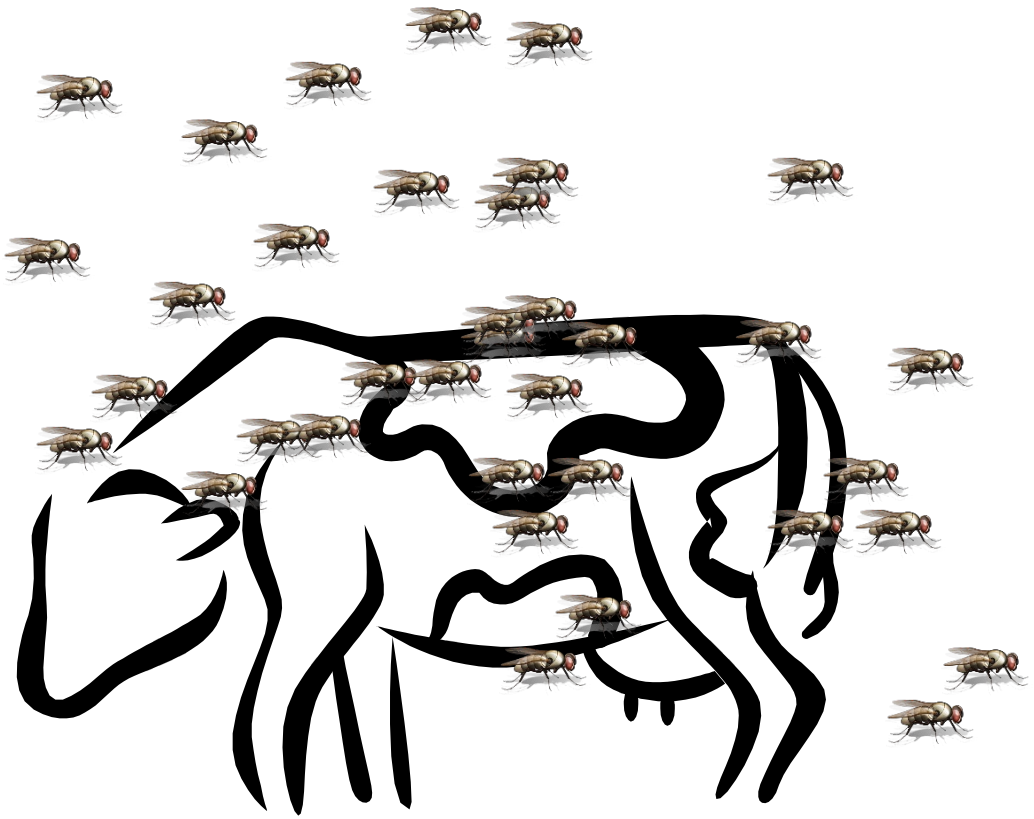


3) Use, Misuse, or Unnecessary use of Insecticides

Now that green fly is gone, red fly has an "opportunity"

And after a few generations, red fly is now a problem…

A secondary pest is now a primary pest



Replacement- either secondary pest or resistance

Cattle Grubs

3) Non-target effects

- *Hypoderma* larvae cause significant damage to production
- 1980s Ivermectin eliminated grubs

- *Hypoderma* surveys in western Canadian had 27–46% seropositivity, indicating natural exposure of those young cattle to cattle grubs (Colwell 2013).
- Cattle grub resurgence?
  - Macrocyclic lactones for nematodes led to widespread & serious resistance which may lessen use in animal agriculture & perhaps encourage a cattle grub resurgence

Stable Flies

4) Changing production practices

- Larvae develop in organic material
- Adults blood feed once a day
- Round bales dropped into pastures or within “feeder rings”
- Pastured cattle now have bad issues with stable flies
- In integrated plant agriculture, any changes in handling plant residues can carry associated risks for exacerbating stable fly problems

- **Estimated damage:**
  - **Dairy = $360m/y**
  - **Cow/calf = $358m/y**
  - **Feed: $226m/y**
  - **Pastured: $1268m/y**
  - **=$2,211m/y!!!**

Direct (blood loss), Indirect (transmit pathogens, feed conversion efficiency, animal breeding success), Peripheral (non-target effects of infested animals on pasture & water quality)

Chicken Mite

5) Human Attitudes to Animal Welfare

Direct, Indirect, & Peripheral damage

- Moving laying hens into cages provided major savings in labor, reduced parasites, and greatly increased profits
- As hens were crowded into cages, producers needed to invent and implement beak trimming methods
- Animal welfare - eliminate conventional cages
  - cage-free options gave chicken mites back their near-host harborage
  - chicken mite vaulted to key pest status by 1990s

Eastern Tent Caterpillar (ETC)

6) Environment

- **MRLS: Illness caused abortions, stillborn foals, & weak offspring**

Observation:

- **First observations in 2001 & 2002**
- **> 1500 cases in Kentucky = $330-550M**
- **Lots of ETC year in pastures**
- **Caterpillar-induced equine abortion from bacteria on caterpillar setae**
  - **Australia (3 caterpillar species)**
  - **Florida (2005, walnut caterpillar)**

Management Strategy

- **Learn the life cycle & biologies of ETC**
- **Identify their egg masses (treat infested trees)**
- **Plant cherry trees on west side of pasture**

Factors Contributing to "Pest"

1. **Adapt to a New Host (Cattle fever tick)**
2. **Introduce Pest to a New Region (Screwworm fly & Asian longhorned tick)**
3. **Use, Misuse, or Unnecessary use of Insecticide (grubs)**
4. **Change in Production or Management Practices (Stable fly)**
5. **Human Attitudes (Chicken mite)**
6. **Environment (Eastern tent caterpillars)**

So how do we manage or watch for these pests?

SURVEILLANCE: monitoring for problems

Question of Treatment

Givens

- **Pest Presence ≠ Treatment**
- **Pest Absence ≠ Working**

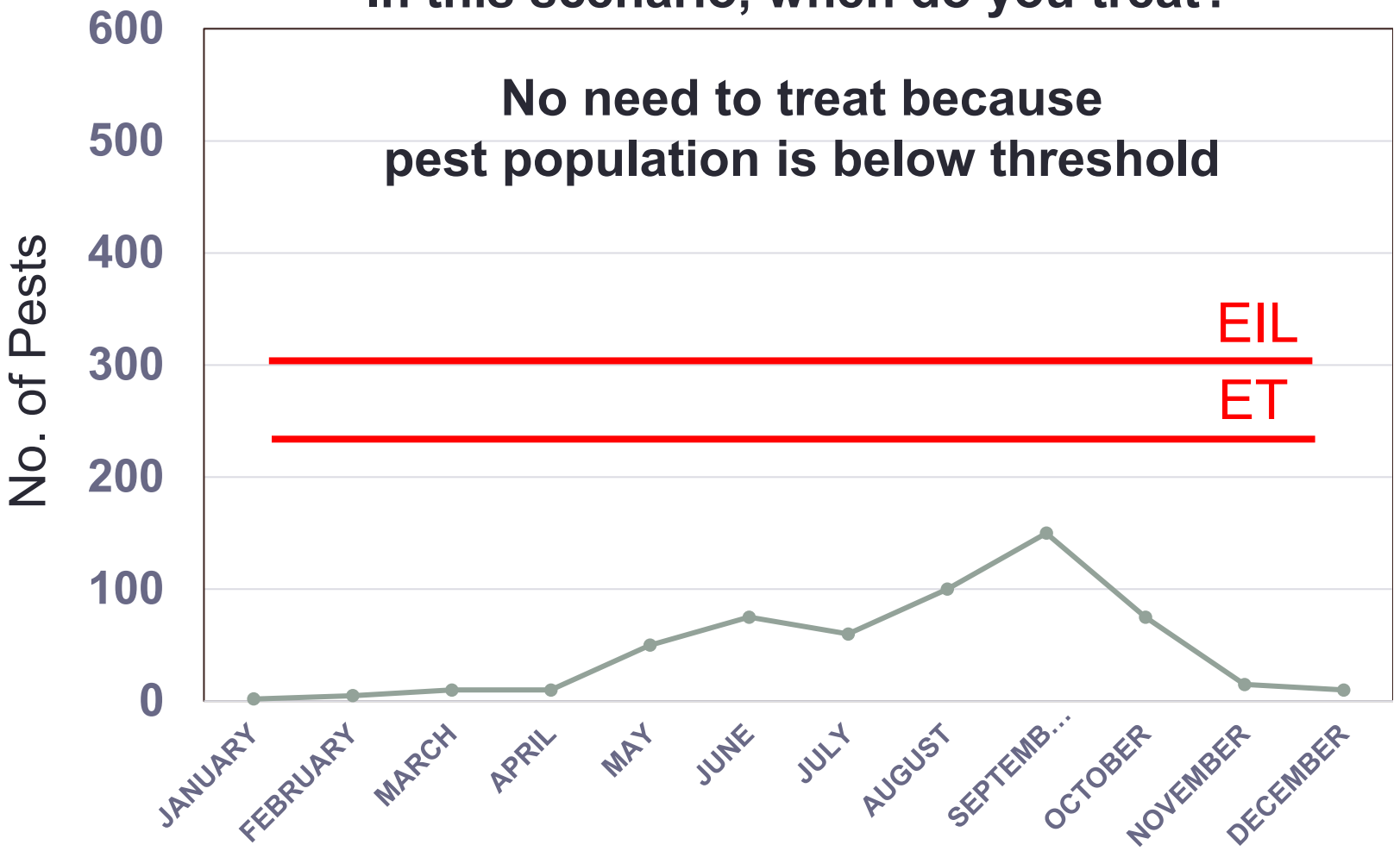
- **In order to minimize potentially harmful effects (e.g., resistance, non-target effects), it is important to determine which cases merit treatment and which do not.**

- **One must determine a tolerable pest population density. We must define "tolerable" for each pest on each commodity in each area.**

Determination of Pest Levels

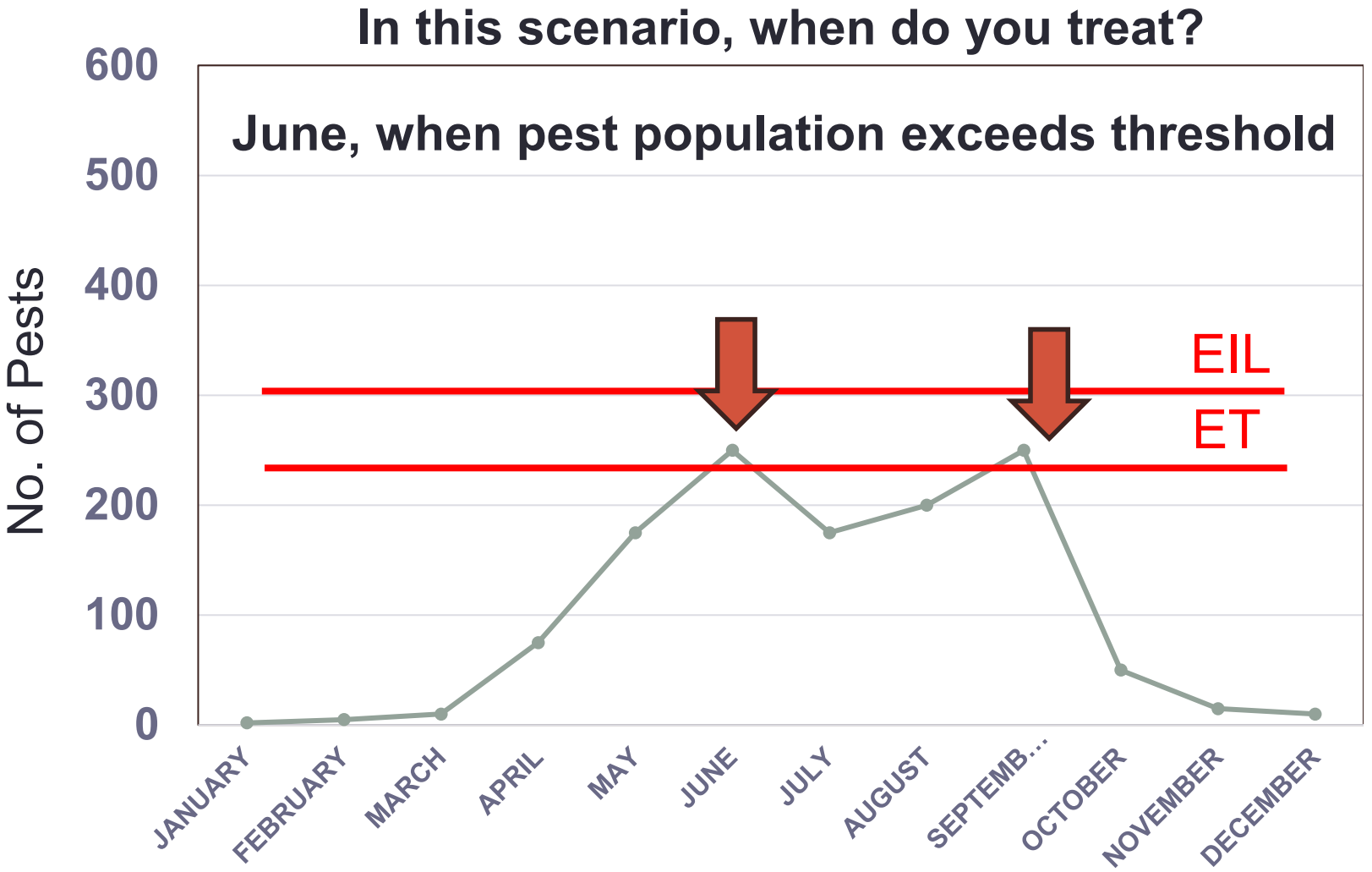
Not a pest (pest population below threshold)

In this scenario, when do you treat?



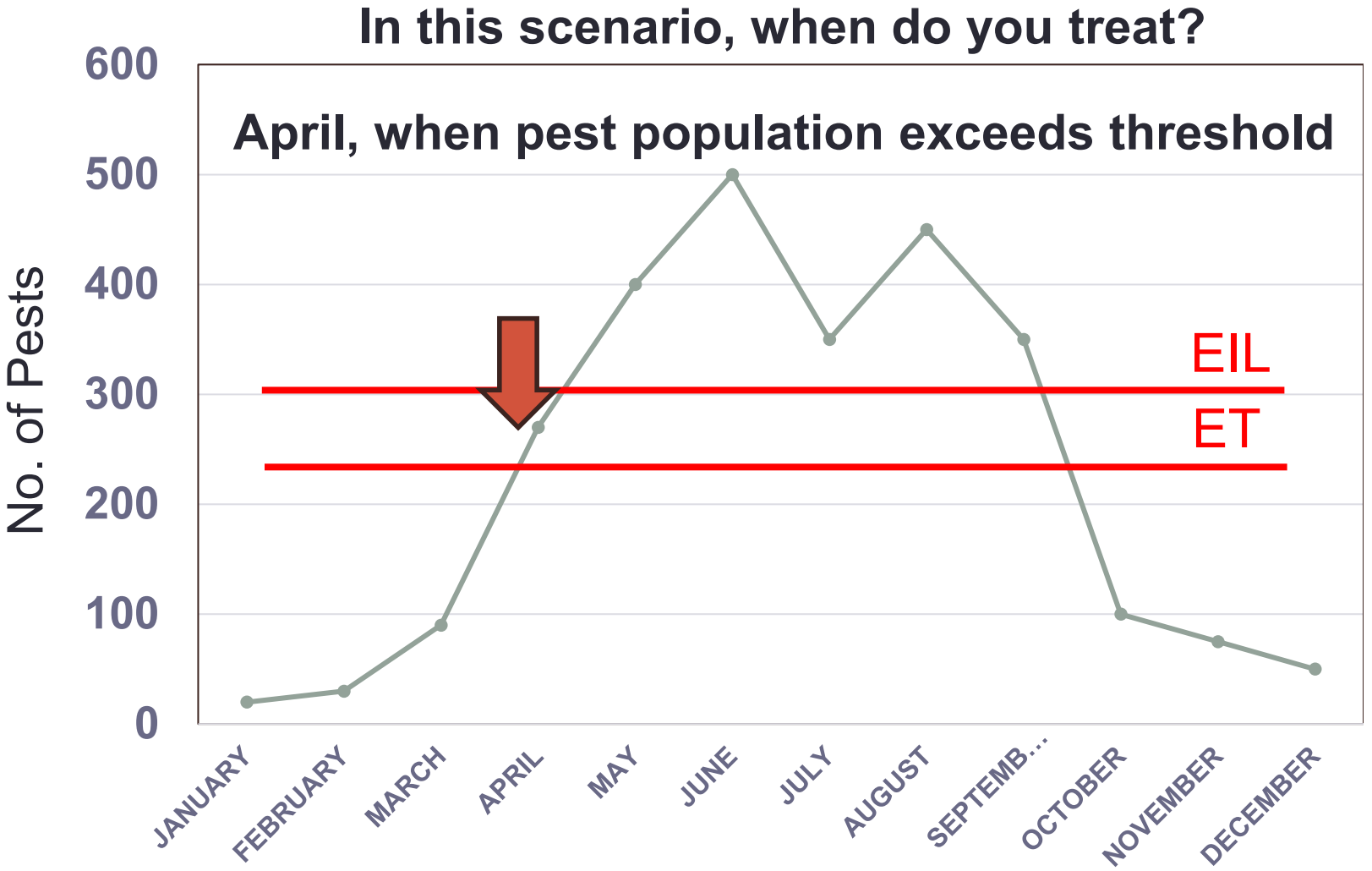
Determination of Pest Levels

Occasional (fluctuates around threshold)



Determination of Pest Levels

Severe pest (population over threshold)



Determination of Pest Levels

Limitations of Thresholds

- Economics-based approach and works for many agricultural commodities where yield is quantifiable
- Human attitudes demand "near perfection"
  - EIL is so low that it is not used in the decision-making process
- Vectors of pathogens & pests that transmit pathogens
  - Threshold of 1 is unacceptable
  - Thresholds are too low

Exercise: Tolerance and Action

- In one day, how many face flies can you tolerate?
- In one day, how many face flies will make you take action?

- In one evening, how many mosquito bites can you tolerate?
- In one evening, how many mosquito bites will make you take action?

- In one evening, how many WNV-infected mosquito bites can you tolerate?
- In one evening, how many WNV-infected mosquito bites will make you take action?

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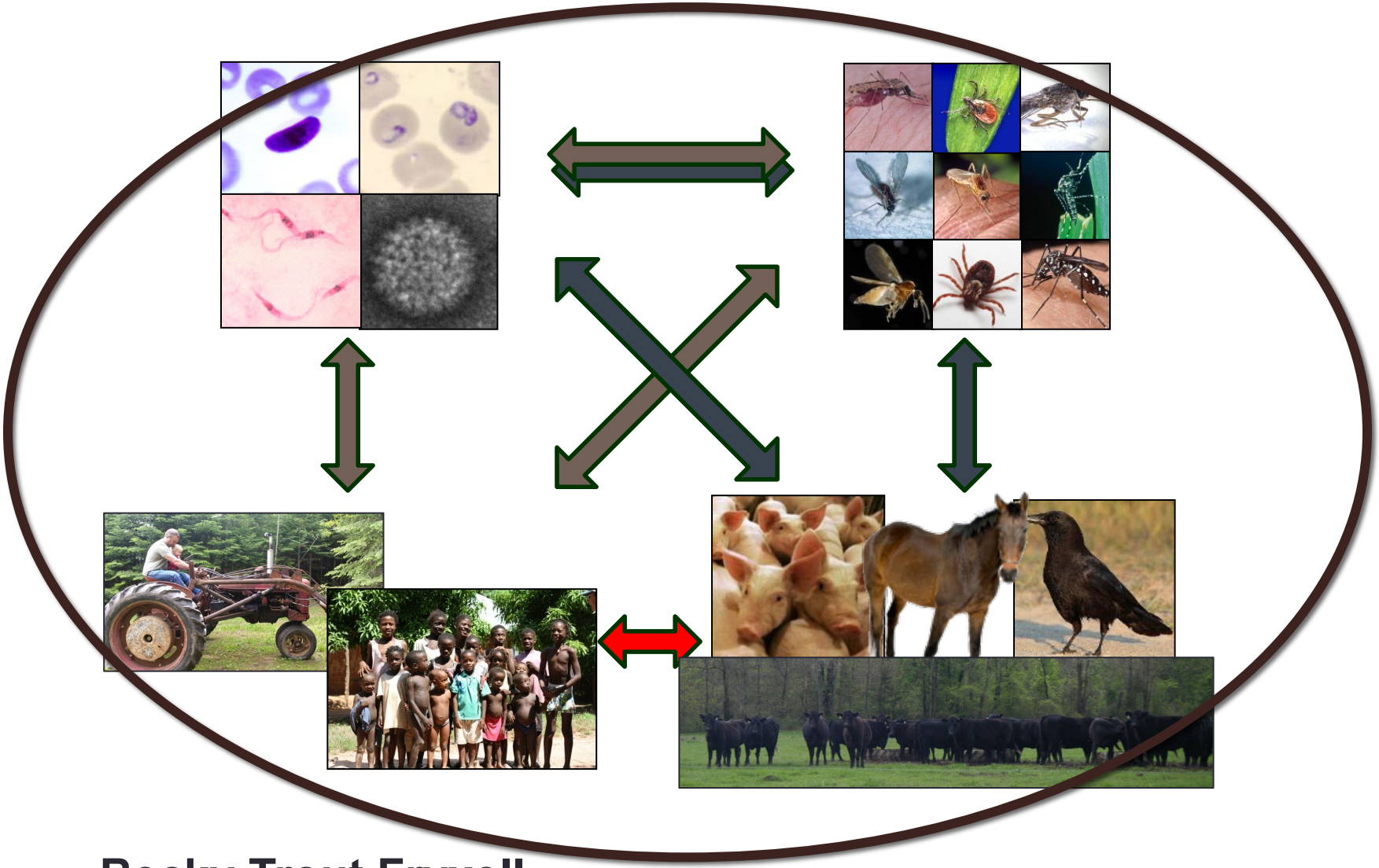

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