Fly Identification Resource

This guide provides an informed background on fly identification, fly monitoring, and the practicality of implementing fly management practices.

Several fly species (house, stable, face, horn) are common pests impacting California beef and dairy operations. High prevalence of flies can be detrimental to cattle, causing a multitude of direct and indirect behavioral, physiological, and economic consequences. Fly loads exceeding a certain economic injury level (EIL) have demonstrated increased physiological indicators of stress (Schwinghammer et al., 1987) and fly avoidance behaviors (Mullens et al., 2006), and decreased milk yield and weight gain (Mullens et al., 2006; Campbell et al., 2001). Flies have additionally been implicated as vectors for many diseases (e.g., bovine keratoconjunctivitis (IBK), mastitis, bovine respiratory disease (BRD)), with antimicrobial resistant (AMR) bacterial strains being among the pathogens transmitted (Yin et al., 2022). ***Fly control can be an important method of disease prevention.***

Thus, it is important to employ practical pest management techniques to improve animal welfare. There are many control options to consider implementing; this guide provides the resources and tools to develop and evaluate a suitable pest management program.

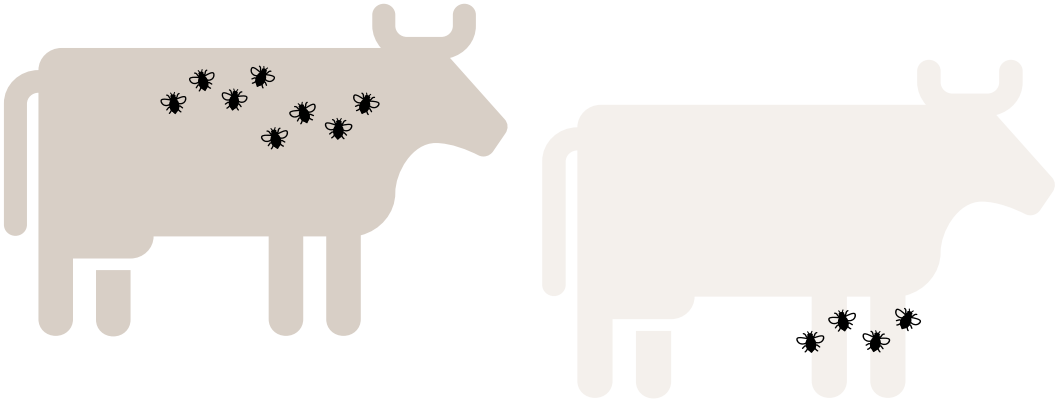
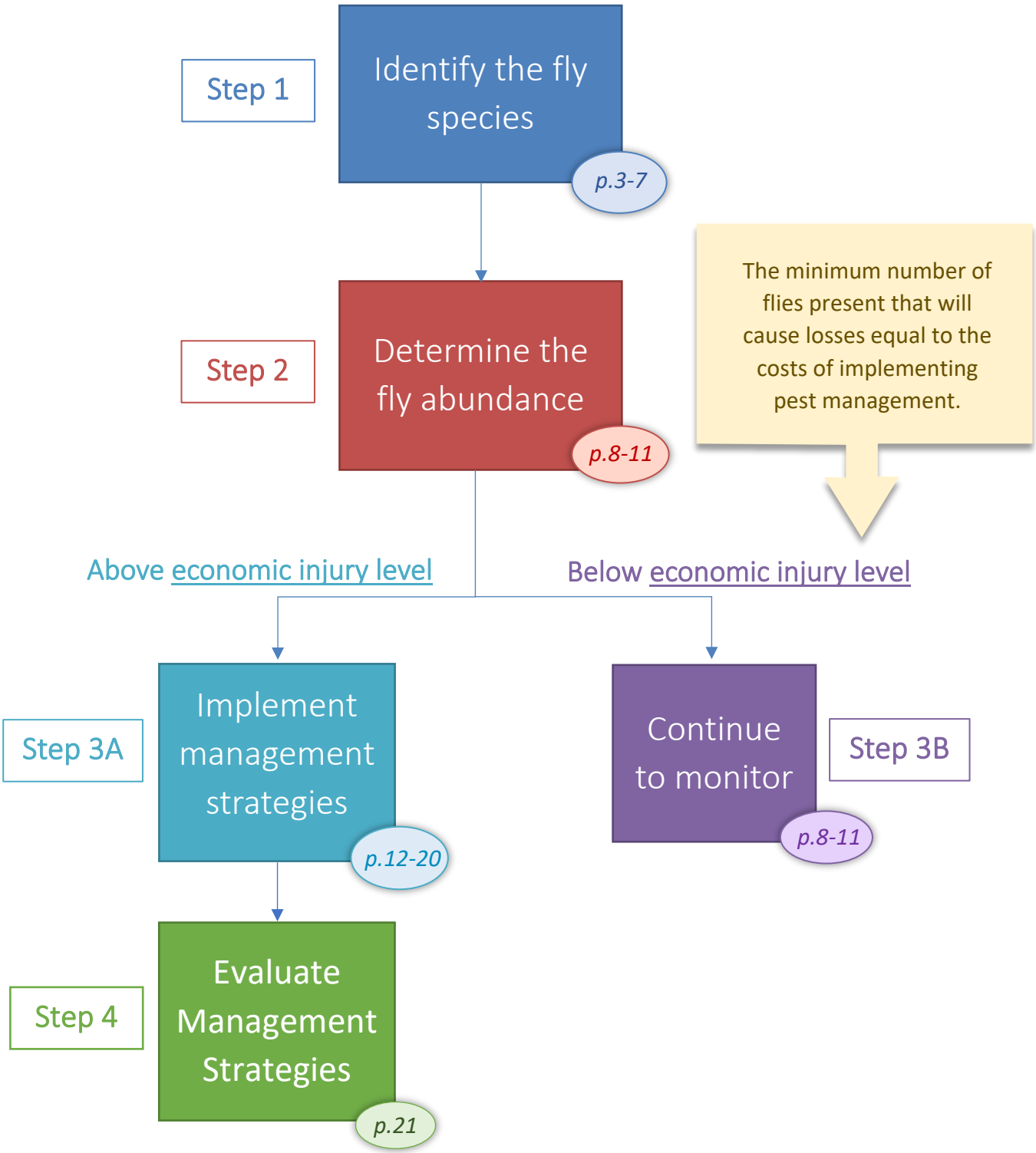


Table of Contents



Fly Identification by Species

Each fly species of interest has **individual attributes and behaviors that aid in their identification**. In this section, we explore these species-specific attributes to aid in identification prior to monitoring fly populations. For a brief overview of the species of interest in this document, refer to the references below:

Stable Fly

Stable Fly: Biology, Management, and Research Needs

Face Fly

Face Fly: Biology, Pest Status, Current Management Prospects, and Research Needs

House Fly

House Fly: Biology, Pest Status, Current Management Prospects, and Research Needs

Horn Fly

Horn Fly: Biology, Management, and Future Research Directions

Additional Identification Services

In some cases, on-farm identification may be difficult, which could lead to inappropriate employment of management tools. Therefore, **expert species identification may be warranted prior to designing interventions**. One state identification resource, as provided by the CDFA Plant Pest Diagnostic Laboratory, can be found in this processing guide and pricing for identifying pest samples.

Stable fly (*Stomoxys calcitrans*)

This costly, biting species is mostly found in **confined barnyard environments**, but is also a prevalent pest on **pastured environments**. Stable flies transmit the pathogen causing **anthrax** and have been implicated as a vector for **bovine leukosis virus**. Control is difficult on pasture, as most management techniques do not effectively target their breeding and feeding location(s). **Sanitation and trapping** are the most effective tools for managing this species.

Species Attributes
4-7mm long, gray body, dark red-brown mouthpiece, two pairs of dark thoracic stripes, tessellated black abdominal pattern

Location on Cow
Legs

Corresponding Fly-Avoidance Behavior(s)
Foot stamps, tail switching, standing in water

Feed on
Blood

Breeding Habitat
Moist, decaying fibrous substrates, manure, composted bedding/crop byproducts

Pathogens Transmitted by Flies
Bacillus anthracis (anthrax), implicated for bovine leukosis virus

Best Management Tools

Egg, Larval, and Pupal Stages

Management and cleanup of feed bunks, compost, and other substrates *(p.13)*

Larvicides—insect growth regulators* *(p.20)*

Adult Stage

Sticky traps *(p.16)*

Non-chemical and chemical insecticidal sprays on lower extremities of animals* *(p.15,19)*

*These methods do not have the highest efficacy or may not have the strongest supporting evidence for this species; however, as it may still be helpful in certain scenarios, information is provided below.

Face fly (Musca autumnalis)

These face feeding flies are pests of **pastured cattle** due to their preferred breeding habitats. Although not a biting species, face flies can cause annoyance to cattle, eliciting defensive behaviors that result in **economic damages**. They can also **transmit costly diseases**, most notably pinkeye.

Species Attributes
6-10mm, gray thorax with four longitudinal black stripes; sexually dimorphic: yellow abdomen on side (male) and mottled gray-black abdomens (female)

Location on Cow
Eyes, mouth, muzzle

Corresponding Fly-Avoidance Behavior(s)
Head throws

Feed on
Exudates; excretions from head/face (female); nectar and dung (male)

Breeding Habitat
Fresh cattle dung pats (specifically on rangeland and pasture)

Pathogens Transmitted by Flies
Moraxella bovis (bovine conjunctivitis/pinkeye), nematode eye worms *Thelazia* spp., bovine rhinotracheitis (IBR) virus

Best Management Tools

Egg, Larval, and Pupal Stages

- Competitive, predatory, and parasitic species *(p.14-15)*
- Feed-throughs (larvicides and insect growth regulators) *(p.20)*

Adult Stage

- Insecticide-impregnated ear tags *(p.17)*
- Insecticidal dust bags *(p.18)*
- Insecticidal sprays and pour-ons *(p.19)*
- Non-chemical pesticides *(p.15)*

House fly (Musca domestica)

Implicated in **costly pathogen transmission** for both humans and animals, this species is mainly a pest of **confined environments**, such as farmyards where animals are in closer proximity. Monitoring and management are multi-faceted, but mainly focus on **trapping and baits** due to the house fly's affinity for certain chemical odors.

Species Attributes
3-8mm long, yellow abdomen, red eyes, four dark dorsal thorax stripes, sponge-like mouthparts

Location on Cow
Face

Corresponding Fly-Avoidance Behavior(s)
Head throws

Feed on
Blood, sweat, tears, saliva, bodily fluids

Breeding Habitat
Rotting organic material, livestock manure, soiled bedding

Pathogens Transmitted by Flies
Antimicrobial resistant *E. coli*, *S. aureus* (mastitis), and *Salmonella* spp.; *Corynebacterium pseudotuberculosis,* Bovine Respiratory Disease (BRD)

Best Management Tools

Egg, Larval, and Pupal Stages

- Hygiene, sanitation, and substrate management *(p.13)*
- Parasitic wasps *(p.14)*

Adult Stage

- Non-chemical traps *(p.16)*
- Chemical traps and baits *(p.18)*

Horn fly (Haematobia irritans irritans)

Regarded as one of the **most economically-impactful external parasites of cattle**, horn flies can cause damage and stress to cattle through their bites—with one fly feeding up to 38 times a day—**reducing livestock productivity** significantly. These pests are mainly found on **pastured herds** due to their breeding habitat preferences. Effective management targets adult populations of this species.

Species Attributes

3-5mm long, dark gray, two dark thoracic stripes, few spots on top of abdomen, wings held partially open (forming a V-shape)

Location on Cow

Backs, sides, withers, belly

Corresponding Fly-Avoidance Behavior(s)

Skin twitches, tail switching, bunching, kicking at belly, grooming

Feed on

Blood

Breeding Habitat

Under edges of fresh cattle manure pats (specifically on pasture)

Pathogens Transmitted by Flies

Mastitis-causing pathogens (i.e., *Staphylococcus aureus*), skin helminths, implicated for bovine leukosis virus

Best Management Tools

Egg, Larval, and Pupal Stages

- Competitive, predatory, and parasitic species *(p.14-15)*
- Feed-throughs (larvicides and insect growth regulators) *(p.20)*

Adult Stage

- Insecticide-impregnated ear tags *(p.17)*
- Insecticidal sprays, pour-ons, and dust bags *(p.18-19)*
- Walk-through traps *(p.16)*
- Non-chemical pesticides *(p.15)*

Fly Monitoring

To employ the most ideal control tactics when managing flies, it is important to first determine the severity to which each fly species is present. Each of the following self-counting factors should be considered and will be covered for all four fly species of interest below.

Number of Animals Needed to Count

A minimum number of animals is required for an **accurate estimate of fly count in the herd as a whole**. Averaging fly counts across many animals accounts for individual differences, providing a better representation of the herd.

Method

When counting flies, **each species of interest may be found at different locations on the animal** (or not on the animal at all). Thus, the method of counting can provide the most accurate species-specific fly count.

Economic Injury Level

When counting flies, the economic injury level (EIL) is defined as the **minimum number of flies present** that will cause **losses to yield equal to the costs of implementing pest management**.

Alternate Methods

Fly species abundance can be estimated using alternate methods such as **trapping** or determining **the frequency of fly-avoidance behaviors** performed by impacted animals. The frequency of fly-avoidance behaviors (e.g., tail flick, head toss) can be used to estimate fly abundance if a direct count is unobtainable.

Peak Seasonal Activity

CA nuisance fly species are most **active in warmer seasons, such as late spring to early autumn**. While specific fly species have a peak seasonal activity, it is suggested to periodically monitor fly species across the entire fly season and consider annual temperature variations influencing peak activity, to ensure the most accurate fly burden estimate.

Fly Identification Resource

Fly Monitoring by Species

Stable Flies

Number of Animals
15

Economic Injury Level (EIL)
10 flies per animal

Method
On the front legs of the animal, count flies that are oriented in a "head-up" position

Alternate Methods
Greater than 10 tail flicks per minute is the EIL. Alsynite fiberglass traps for monitoring (no EIL has been determined)

Peak Seasonal Activity
Mid-spring to early summer, with peaks from late May to early June

Click here for Monitoring Guide

Face Flies

Number of Animals
10 - 15

Economic Injury Level (EIL)
10 - 15 flies per animal

Method
Count flies around eyes, ears, nose, and mouth

Alternate Methods
Sticky traps may also be used to monitor abundance

Peak Seasonal Activity
Summer months, with peaks in late summer

Click here for Monitoring Guide

3 House Flies

Number of Animals
N/A*

Economic Injury Level (EIL)
50 - 75 flies per sticky tape or ribbon; 100 spots per week for spot cards

Method
Traps (sticky, baited) and spot cards recommended

Alternate Methods
N/A*

Peak Seasonal Activity
Hottest summer months

Click here for Monitoring Guide **The best monitoring method for this species does not involve these factors*

4 Horn Flies

Number of Animals
5 - 10

Economic Injury Level (EIL)
200 flies per animal

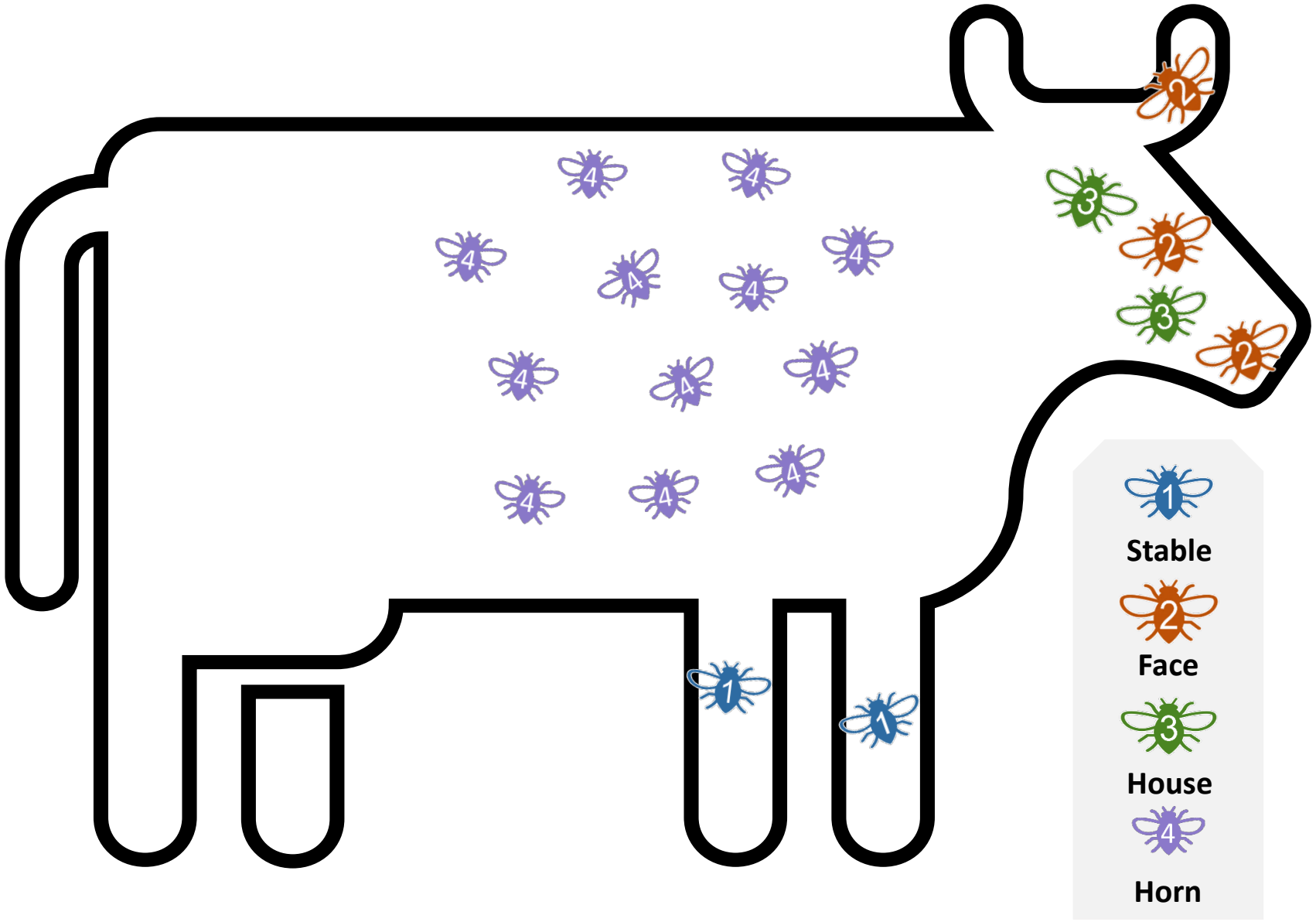
Method
Count all flies on the back, belly, and sides, one side at a time

Alternate Methods
More than a few head tosses and tail flicks per minute is the EIL

Peak Seasonal Activity
Midsummer (cool climates), early to late summer (hot climates)

Click here for Monitoring Guide (includes Stable flies)

Typical Location of Fly Species on Cow for Self-Counting



Fly Management Tools and Strategies

Fly management involves the development of an **integrated pest management program (IPM)** that encompasses both **non-chemical** and **chemical management strategies**. The following list provides introductions, pros and cons, and recommended links for more information on many of the best management strategies for fly control. Some of these tools may be species-specific. For a **general introduction to implementing an IPM**, refer to this guide. For **general species-specific management guides and information**, refer to this video, research article (Table 2: Monitoring and management strategies for horn flies, face flies, and stable flies in the United States), and/or below:

- Managing Stable Fly Production at Pasture Feeding Sites
- Stable Fly: Biology, Management, and Research Needs
- Stable Flies on Livestock: Biology, Control, and Prevention

- Face Fly: Biology, Pest Status, Current Management Prospects, and Research Needs
- Face Flies on Cattle: Biology, Prevention, and Control

- House Fly: Biology, Pest Status, Current Management Prospects, and Research Needs
- House Flies in Livestock Facilities: Biology, Prevention, and Control

- Horn Fly: Biology, Management, and Future Research Directions
- Horn Flies on Cattle: Biology, Prevention, and Control

Non-chemical Management

Non-chemical management involves the utilization of **sanitary, physical/mechanical, and biological** practices and tools. These methods should be prioritized as they do not contribute to chemical resistance. Additional chemical management may be required depending on fly burden and species present. For more information on general non-chemical strategies for pest management, refer to this fact sheet or this guide.

Hygiene, Sanitation, Substrate/Cultural Management

*Fly species of interest are **filth flies** (house and stable), which lay eggs in decomposing organic matter (i.e., manure, soiled bedding, rotting feed), and **dung flies** (horn and face), which exclusively lay eggs in cattle dung pats. Behaviors such as discarding, drying, composting, and disruption of fresh manure pats and organic matter, feed bunk cleaning, and securely sealing garbage receptacles can help reduce fly breeding sites. **Effective fly control begins with sanitation and proper substrate management**; this management method should be a **priority**.*

PROS

- Inhibits fly life cycle
- Promotes composting and nutrient recycling
- Reduced cost/risks associated with chemical use

CONS

- Time and labor intensive

Informational and Implementation Guide(s):

Pest Management Recommendations for Dairy Cattle (Cornell and PennState Extension)

Managing flies on cattle farms (UMN Extension)

Biological – Competitors (i.e., Dung Beetles)

Dung beetles, part of the Scarab beetle insect family, are an important organism in pasture ecology. Through consumption and removal of manure from pats, dung beetles compete for manure and disrupt the habitat of developing face and horn fly species.

PROS

Can be naturally promoted

Disrupt fly life cycle

CONS

May disrupt manure ecology and dry out manure, impacting other species

Informational and Implementation Guide(s):

Dung Beetles Aid in Reducing Flies and Gastrointestinal Parasites in Pastures (Cornell Cooperative Extension)((CLSI), 2020)

Biological – Parasitoids (i.e., Parasitic Wasps)

Host-specific parasitic wasps lay their eggs in developing fly pupae. Upon hatching, wasp larvae feed on and kill the developing fly pupae. Fly mortality is fly species-dependent due to biological and behavioral differences that limit the parasitoid's efficacy.

PROS

Disrupt fly life cycle at pupa stage

Can be host-specific

Readily available for purchase online and at insectaries

CONS

Efficacy not well researched in pasture settings

Not tailored toward face and horn fly control

Less effective when there are neighboring, untreated herds

Informational and Implementation Guide(s):

Biological Control of Flies (UKY Entomology)

Parasitic wasps: A complementary fly control (AgProud)

Biological – Predatory (i.e., Mites and Beetles)

Beetles (e.g., Carabidae, Staphylinidae families) and mites (e.g., Macrochelidae family) feed on some immature, dung-inhabiting fly species. While the efficacy of these predators as a control tactic is not well-studied, the benefits of their natural presence may be conserved through avoiding the use of certain insecticides (i.e., macrocyclic lactones), especially during periods of high fly abundance.

PROS

Disrupt fly life cycle

Naturally occurring in some environments

CONS

Efficacy not well researched

Effects can be disrupted through chemical application

Informational Guide(s):

A Hister Beetle *Carcinops pumilio* (UF IFAS Extension); Rove beetles (UF IFAS)

Non-chemical Feed Additives and Bio-Pesticides/Sprays

The utilization of natural/organic feed additives (e.g., garlic powder and essential oils) and sprays (e.g., essential oils) has shown promising efficacy in reducing fly density and fly-repelling behaviors, but has not been widely adopted in livestock production due to limited research thus far.

PROS

Reduced labor and time

Relatively low cost

No risk of resistance development or environmental harm

CONS

More research needed regarding efficacy

Topicals require routine animal handling, may be more labor and time intensive, and cause stress to animals

Implementation Guide(s):

Natural Insecticides for Veterinary Use in Livestock (Parasitipedia)

Mechanical/Physical – Non-chemical Traps/Attractants, Screens, UV Lights, Targets

Non-chemical trap options include those using a variety of attraction (e.g., vacuum, light, color, glue/sticky boards) and repellent (e.g., screens) mechanisms. Some traps may use "walk-through" systems, in which an animal walks through the trap that captures flies, while others involve no contact with the animal. Some traps may additionally be used for monitoring of some fly species. Refer to "Species-Specific Information and Implementation Guides" below for species-specific trapping methods.

PROS

- Low-cost options available
- Reduced labor and time
- No resistance risks

CONS

- May be forced usage
- Some options are higher in cost
- Some traps (e.g., sticky) require frequent replacement
- Reduced efficacy when fly burden reaches economic injury level—use in conjunction with other management tactics

Species-Specific Information and Implementation Guide(s):

Stable: Alysnite fiberglass/visual traps (i.e. Olson Trap, Knight Stick Trap (Hogsette et al., 2017)) have high efficacy (Rochon et al., 2021: "Traps")

House: A variety of non-chemical sticky traps and spot cards may be used for monitoring and management (i.e., fly ribbon)

Horn: Walk-through traps (i.e., Bruce Trap and Cow Vac) have high efficacy (Brewer et al., 2021: "Mechanical Controls")

Chemical Management

A pest management program should first ensure good general management, and then if flies persist, consider supplementary chemical management. A chemical management program should **rotate through different chemical classes**, to reduce the development of resistance to a particular chemical treatment. Consider using chemicals when fly abundance is high (reaching economic injury levels) in your operation—see "Fly Monitoring" to determine fly abundance levels.

Insecticide-Impregnated Ear Tags

*Insecticidal ear tags provide controlled release of insecticides, which are then distributed across the animal during contact between the ear tag and parts of the body. This option has high efficacy in **reducing horn and face flies**, but must be utilized with discretion, as **risk of resistance development** is high if applied too early in the season. Always follow manufacturer's guidelines.*

PROS

- Inexpensive
- One-time application and removal
- Long-lasting protection

CONS

- Risk of resistance development

Informational and Implementation Guide(s):

Ear-Tags Impregnated with Insecticides for Veterinary Use in Cattle (Parasitipedia)

Mechanical/Physical – Odor-Based Traps and Baits

*Some fly species, particularly **house flies**, are attracted to various chemical odorants. Baits are useful in conjunction with other methods, especially when fly burden is reaching economic injury levels. Popular commercial baits include Farnam Fly Attractant and Starbar Fly Trap.*

PROS

Reduced cost

CONS

Reduced efficacy when fly burden reaches economic injury level—may be used in conjunction with other methods for increased efficacy

Implementation Guide(s):

House: Attractant-based traps (i.e. Starbar Fly Trap products) have high efficacy due to house fly biologic disposition and may also be used for monitoring this species.

Dust Bags and Back Rubbers

*Dust bags and back rubbers contain insecticides applied through contact with the animal—typically through forced contact, in which an animal passes against a dust bag or back rubber in order to reach a target (e.g., waterer). This option has shown high efficacy in treating **horn flies**.*

PROS

Reduced cost

Reduced labor

CONS

Forced usage

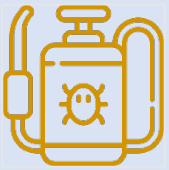
Reduced efficacy on stable and face flies

Informational and Implementation Guide(s):

Insecticide Dust Bags for Cattle Insect Control (UKY Extension) *Pesticide recommendations in this publication are state-specific, check state registration prior to use.

Dusts and Back Rubbers to Control Flies of Livestock (Parasitipedia)

Sprays and Pour-Ons



*Spray insecticides are applied along the backline (neck to tail) of the animal, while pour-on insecticides are directly poured along the backline. This targets **horn flies**, which are located mainly along the backs and sides of cattle but has some efficacy against other fly species.*

PROS

Immediate treatment

Convenience and ease of use

CONS

Risk of resistance development

Labor and time intensive due to frequency of reapplication

May cause stress to animals upon application

May wash off through contact with wet grass and water

Some pour-ons may cause irritation

Informational and Implementation Guide(s):

Pour-Ons, Spray-Ons, and Backliners for Veterinary Use in Livestock (Parasitipedia)

Feed-Through Additives and Insect Growth Regulators (IGRs)

Feed-through additives and oral larvicides target the larval stage of the fly life cycle in fly species that reproduce in manure pats and should be offered at least 30 days before the onset of the fly season. Insect Growth Regulators (IGRs) mimic hormones and can target immature stages of the fly life cycle, inhibiting adult fly development.

PROS

More selective and less harmful to the environment

Reduced risk of resistance development

CONS

Less effective when there are untreated neighboring herds

Steady consumption necessary

May not be approved with organic herds

Informational and Implementation Guide(s):

Feed Through 101: How do Larvicides Work? (ClariFly)

Larvicides for fly control in beef and dairy cattle production areas (MWI Animal Health)

Horn Flies and Insect Growth Regulators (OK Extension)

Insect Growth Regulators for Veterinary Use in Livestock (Parasitipedia)

Evaluating Management Strategies

After implementing management strategies, it is important to **continue to monitor fly populations** (i.e., through aforementioned techniques and tools) in order to **track the efficacy of chosen strategies**. Evaluating and reflecting on previous management methods will help ensure the development of the most appropriate pest management programs on-farm. Additionally, these practices consider the variability of fly abundance as influenced by differences in style of operation and environment. Ultimately, there is no "one-size-fits-all" prescription for IPMs—**documenting progress and making changes is necessary for effective management**. CDFA AUS has prepared several fly monitoring and management documentation sheets to assist in this process—refer below.

AUS Fly Monitoring / Tracking Worksheets

Click on links below to view worksheets available on AUS' website:

| General Fly Monitoring | Management Tool / Strategy Tracking |

| Species-specific Fly Monitoring & Abundance Graph |