

How to Build an All-Season Mouse Guard for Langstroth Honey Bee Hives

Courtney Brummel, University of Nebraska-Lincoln, Entomology Department, graduate student.

Shelby Kittle, University of Nebraska-Lincoln, Entomology Department, graduate student.

Dr. Louise Lynch-O'Brien, University of Nebraska-Lincoln, Assistant Professor of Insect Biology.

Dr. Susan Weller, University of Nebraska State Museum Director.

Dr. Judy Wu-Smart, University of Nebraska-Lincoln, Extension & Research Entomologist.

Abstract

Mice can damage beekeeping equipment by chewing the wooden boxes and frames, the beeswax comb, and contaminating surfaces with feces to the point the equipment is unusable. Mouse exclusion techniques for stored beekeeping equipment is to seal the boxes containing frames of comb and apply chemical fumigants, mouse traps, and toxic baits, if necessary. Protection of boxes and combs occupied by bees is more difficult because the entrance must remain open for bees to enter and exit. Current mouse exclusion tools have several limitations, including cost, impeded hive mobility, and time to install and remove.

The All-Season Mouse Guard (ASMG) is a one-time modification to the hive entrance by adjusting the bottom board or floor of a traditional Langstroth beehive. This innovative mouse excluder was designed by Dr. Marion Ellis, a former faculty member at the University of Nebraska-Lincoln. Here, we present this simple, easy to construct woodworking project that provides year-round mouse exclusion by structurally preventing mice from entering beehives.

The ASMG is a one-time modification, excluding mice year-round from Langstroth honey bee hives

Introduction of Problem:

Common field mice are notorious for getting into unwanted places and causing damage. Honey bee colonies are quite attractive to mice, as colonies provide food (honey, beeswax, and bees), as well as warmth and shelter during the winter. Because honey bees cluster and often move toward the upper portion of the hive during the winter, mice may create a nest underneath the cluster of bees. Mice will enter hives and chew wax and wooden equipment (*Figure 1*). In addition to the permanent damage they cause, mice also contaminate equipment with their feces and spoil food stores meant for the bees. Mouse activity and disturbance in a hive can disrupt bees in a winter cluster, which may result in higher incidences of bee dysentery and mortality.

Traditional Exclusion Methods and Limitations:

Beekeepers in North America traditionally use the Langstroth hive (Ramirez, 2000) (*Figure 2*). This structure houses honey bees (*Apis mellifera* L.) and consists of wooden parts that fit together, including moveable frames where beeswax comb is built and utilized to rear offspring and stock food stores (Nadel, 2010). The frames sit inside boxes. The hive rests on a wood base, called the bottom board.



Figure 1. **Left image:** Example of mouse nest made in the bottom of the hive, including a mouse skeleton. **Right image:** Example of mouse damage caused to beeswax comb where food and brood are stored (Photo credit: Luke Norris).

The bottom board includes a passageway for bees to enter and exit called an entrance. The hive entrance unfortunately provides an entry for intruders, such as mice.

To prevent intruders, beekeepers traditionally use commercially supplied accessories such as wooden entrance reducers (*Figure 3*) or metal guards, or metal mesh to exclude mice. Wooden entrance reducers make the entry and exit slot of the hive smaller so the bees can effectively guard their resources. The traditional wood entrance reducer has two levels of entrance reduction, which beekeepers must manually rotate. The reducer is rotated to provide a smaller entrance when the bee population is small, typically during the early spring, late fall, and winter. The reducer is rotated to the larger opening when the bee population is larger, typically in the summer, because there are more bees entering and exiting the hive, and more bees available to guard the larger entrance. Traditional entrance reducers can easily be pushed out of place by invading mice in the winter, so beekeepers replace or pair the wooden entrance reducer with a traditional metal mouse guard to exclude mice. Beekeepers use the entrance reducer because it is readily available in beekeeping supply stores and has been the conventional method.

The traditional metal mouse guards are available either commercially (*Figure 4*) or hand-crafted out of metal mesh (*Figure 5*). The traditional metal mouse guards must be attached to the hive when winterizing in the late fall because the guard is anchored via screws to the bottom board. The hive box cannot be easily separated for management once the metal mouse guard is installed. Because the traditional metal mouse guard is not added until fall, the hive is vulnerable to invasion throughout the season.



Figure 2. The Langstroth hive is used traditionally by beekeepers in North America (Ramirez, 2000) (Photo credit: Courtney Brummel).



Figure 3. Three commercial, wooden entrance reducer settings for hive entrance reduction. Left image: Small setting of entrance reducer used when bee populations are small. Middle image: Large setting used when bee populations are medium-sized, typically late spring and early fall. Right image: Wooden entrance reducer removed when hive population is largest, typically in summer. (Photo credit: Courtney Brummel).

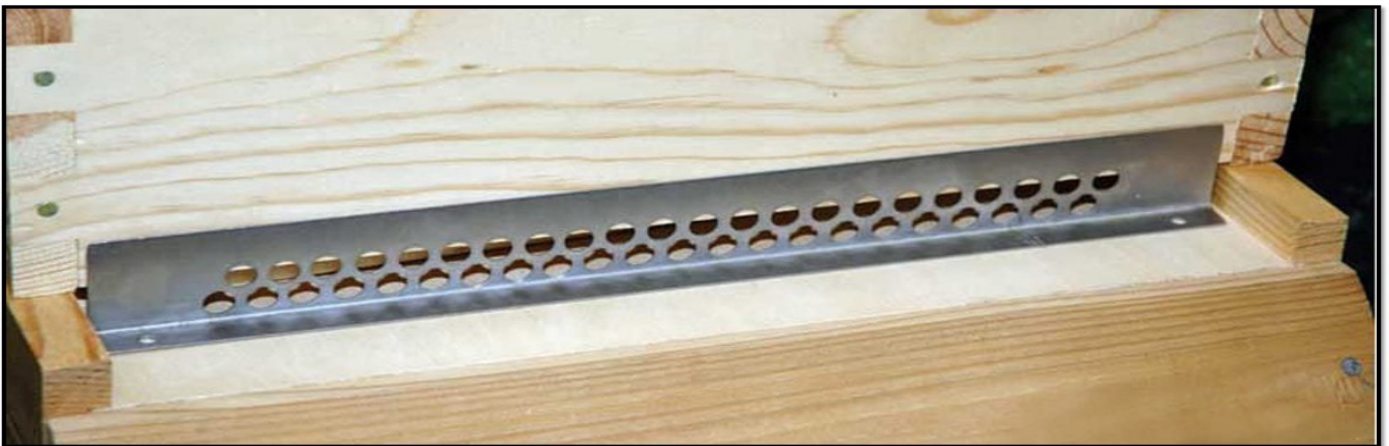


Figure 4. Traditional, commercially available, metal mouse guard. These additions must be added and removed throughout the season. (Photo credit: Mann Lake) (Mann Lake LTD, 2021).



Figure 5. Example of homemade mouse guard made from ½” (12mm) mouse-proofing mesh. (Photo credit: Phillip Cairns) (Cairns, 2011).



Figure 6. External view of the installed All-Season Mouse Guard. (Photo credit: Courtney Brummel).



Dr Marion Ellis, Legacy to Nebraska Beekeeping

Dr. Marion Ellis was a faculty member for the Entomology Department at the University of Nebraska-Lincoln (UNL) for 20 years, and an instructor for 14 years. Between teaching a beekeeping class and leading educational outreach, he also researched problems affecting honey bee health including honey bee diseases, parasites, pests, and chemical injury. One of his many accomplishments was designing a modification to the traditional honey bee Langstroth bottom board that prevents mice from entering and destroying the hive, while simultaneously serving as an entrance reducer. His invention was inspired by an incident when he opened a bee box and a mouse ran out of the hive and up his pant leg. The All-Season Mouse Guard has been used extensively at the UNL Bee Lab since 1982. The UNL Bee Lab has used 105 ASMGs over five years and have experienced zero cases of mice invading the hives equipped with the ASMG.

Advantages of the All-Season Mouse Guard (ASMG):

In response to the shortcomings of commercially available solutions to small rodent pests (the entrance reducer and metal mouse guard), Dr. Marion Ellis (*Figure 7*) adopted an efficient combination of these two hive accessories, called the All-Season Mouse Guard or “ASMG” (*Figure 6*). An all-season mouse guard is beneficial for multiple reasons:

1. ASMG device is a one-time modification. The ASMG is nailed to the bottom board and the dimensions of the spacers serve as a permanent entrance reducer. Alternative metal mouse guards must be inserted and removed in a timely manner and require two or more trips to the apiary. The ASMG is located under the bottom hive box and can be painted with weather-resistant paint, allowing it to remain functional longer (*Figure 8*).
2. ASMG device effectively prevents mouse entry. Since the ASMG is anchored with nails, there is no accidental removal or movement of the entrance reducer.
3. ASMG device prevents bees from chewing holes in portion of the combs nearest the entrance.
4. ASMG device encourages use of entire comb for brood rearing, effectively giving the bees another comb in the brood nest. The portion of combs near the entrance are difficult for bees to thermoregulate.
5. ASMG device makes it easier for colonies to resist robbing.
6. ASMG device is cost effective. The goal of the first year of beekeeping is for the bees to draw comb on the new equipment, and therefore have comb ready for production in year two. If the comb and frames are not protected from damage, the losses can be extensive. The ASMG can save beekeepers both time and money spent on replacing damaged equipment, time, and production value in honey and/or pollination services. The ASMG also serves as a cost and time effective combination of two necessary accessories for entrance reduction and mouse exclusion. The cost of the traditional entrance reducer is \$3 and the traditional metal mouse guard is \$15, costing \$18 total per hive, as well as time for rotation and installation at least two times a year for each hive. Each individual All-Season Mouse Guard costs \$1 for materials, and less than 15 minutes to paint, cut, and assemble once.



Figure 8. All-Season Mouse Guard installed into bottom board. This specific ASMG has been used for over 5 years, year-round use, and is still in prime condition for excluding mice, albeit ready for a new coat of paint. (Photo credit: Courtney Brummel).

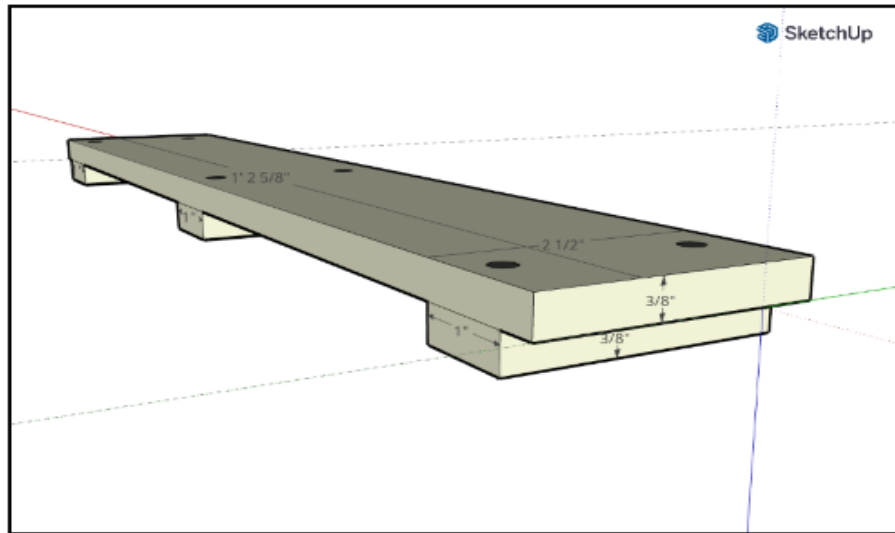


Figure 9. Blueprints of the All-Season Mouse Guard. (Photo credit: Courtney Brummel via SketchUp program).

Construction of the ASMG:

Materials:

- Plywood (3/8" thickness)
- Hammer
- 1 ¼" (3.17cm) long nails (quantity: 6)
- Table saw (for "rip-cuts" that divides or cuts wood parallel to the grain)
- Miter saw (for "crosscuts" that divides or cuts wood perpendicular to the grain)
- Measuring tape
- White exterior latex paint
- Paint brush
- Wood glue

Methods:

1. Use the table saw to rip-cut plywood board into strips that are 2 ½" (6.4 cm) wide.
2. Use the miter saw to crosscut the previously cut strips into sections that are approximately 14 5/8" to 15" (37.1 cm to 38.1 cm) long. Length may vary depending on the width of your bottom board. (Figure 10).
3. Crosscut 3 spacers for every mouse guard, 1" wide by 2½" long and 3/8" deep (2.5 cm x 6.4 cm x 1 cm), so the spacers fit flush underneath the top of the guard. (Figure 11).
4. Paint the mouse guard pieces and bottom board before installation to ensure no moisture will penetrate the bottom of the guard. Figures 10-13 show the bottom board unpainted for demonstration to clearly see the placement of the ASMG pieces.
5. Nail and glue the long section on top of the spacers to create a shortened entrance to keep mice out while letting bees into the hive. We use six 1 ¼" (3.2 cm) nails and wood glue to extend the life of the device. (Figure 12).
6. Ensure the mouse guard is back far enough before nailing to be flush with the front of the bottom hive box. This example was approximately 2" (5.1 cm) from the front of the bottom board. (Figure 13).



Figure 10. The red lines indicate where the hive box sits. Mark this out to ensure the spacers are placed under the box and not exposed to the elements. (Photo credit: Sheldon Brummel).

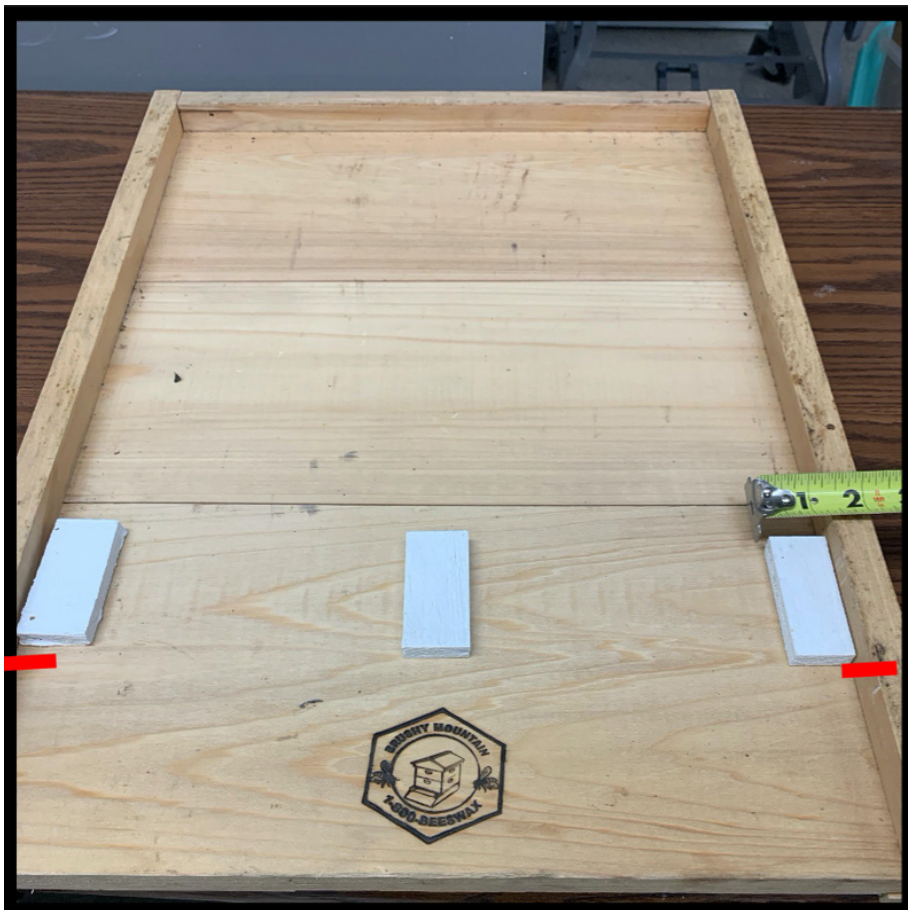


Figure 11. Place the three spacers on the bottom board, equidistance to one another. (Photo credit: Sheldon Brummel).



Figure 12. Place the long section on top of the spacers and nail where the “x” is marked. (Photo credit: Sheldon Brummel).



Figure 13. Place the hive box on top of the ASMG prior to nailing to ensure the ASMG is flush with the front of the box. (Photo credit: Sheldon Brummel).

Conclusion:

The All-Season Mouse Guard effectively serves to protect hives from mouse damage. While there are numerous devices that can work, the permanency of the ASMG does reduce user error of timing, reduces mouse intrusions, reduces the amount of equipment needed for set-up, and is cost-effective, simple to make, and effective.

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Resources:

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