

Bee House Building Instructions

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Eagle Scout Service Project

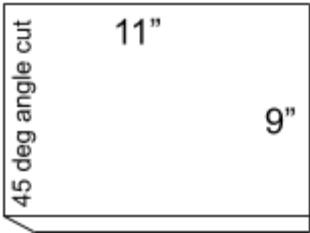
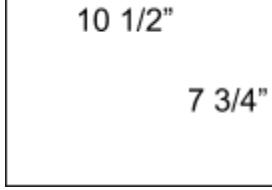
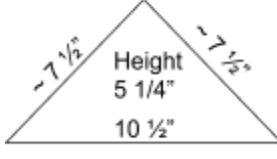
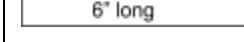
Troop 330 Campbell



November 2020

Bee House Materials

(Counts are of cut pieces)

Description	Drawing	Count	Source
Roof: 12" Redwood Fence Board (Can be 9-12" wide)		2	Economy Lumber
Sides: 8" Redwood Fence Board		2	Economy Lumber
Shelves: 8" Redwood Fence Board		3	Economy Lumber
Gable: 8" Redwood Fence Board		1	Economy Lumber
Roof Support 1x1 Stick		1	Home Depot
Small Nesting Block 2x4 Fir / Pine		5	Economy Lumber
Large Nesting Block 4x4 Fir / Pine		2	Economy Lumber
Roof Trim: 1 1/2" Aluminum Angle		1	Home Depot (Link)

Backside: 1/4" thick Plywood		1	Economy Lumber
Screws roof support, shelves and gable: Kreg Pocket hole screws 1 1/4"		14	OSH
Screws Top Shelf to Roof: Kreg Pocket hole screws 1 1/2"		4	OSH
Screws backside: Flat head #6 x 3/4"		12	Home Depot
Bamboo Rods		~36	OSH
Paper Straws 8mm diameter x 7 3/4" long		200 -300	Amazon (Link)
Large Brass Bees		2	Etsy (Link)
Nails for Roof Trim: Stainless Wire Nails #18 x 3/4"		6	Home Depot
Nails for Brass Bees: 10mm Gold Nails		4	Amazon (Link)

Recommended Tools

Tool	Purpose	Source
Circular Saw / Table Saw / Mitre Saw	Cutting wood pieces	common
Reciprocating saw or hacksaw	Cutting bamboo rods and roof trim	common
Drill / Screwdriver	Drilling and screws	common
Electric sander (Belt sander recommended)	Preparing rough fence board	common
Drill Press or drill guide	Straight drilling of nesting block holes	Amazon (link)
$\frac{3}{8}$ " x 12" long drill bit	Drilling 7" holes in nesting blocks	Amazon (link)
Pocket hole jig	Drilling pocket holes for shelves and gable	Lowes or Amazon (link)
#2 square bit for pocket hole screws	Fastening pocket hole screws in tight quarters	OSH or Amazon (link)
Clamps, corner clamp	Securing wood during cutting and assembly	common

Part 1: Sanding

You can sand all fence board wood pieces based on your preferences, from rough fence-like surface to a smooth furniture-like finish. Sand boards ahead of cutting the pieces to size. A belt sander is useful to quickly remove the rough surface. If redwood pieces are part heartwood (red) and part sapwood (yellow), it is often better to use the sapwood side for the rear end of the house. As edges of the fence boards are often damaged, it is recommended to sand the edges for the front side of the house round or beveled.

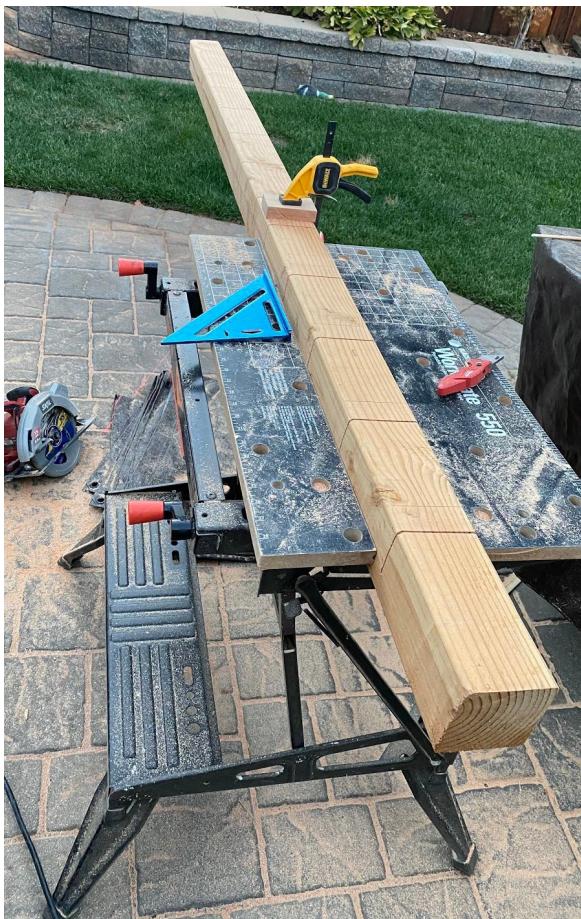
Part 2: Cutting Wood Pieces

Cutting the wood pieces depends greatly on your equipment, whether to use a circular saw, table saw, or miter saw. For Scout projects please follow safety guidelines, operation of power saws requires an adult to operate.

Please follow the measurements shown in the materials list for cutting.

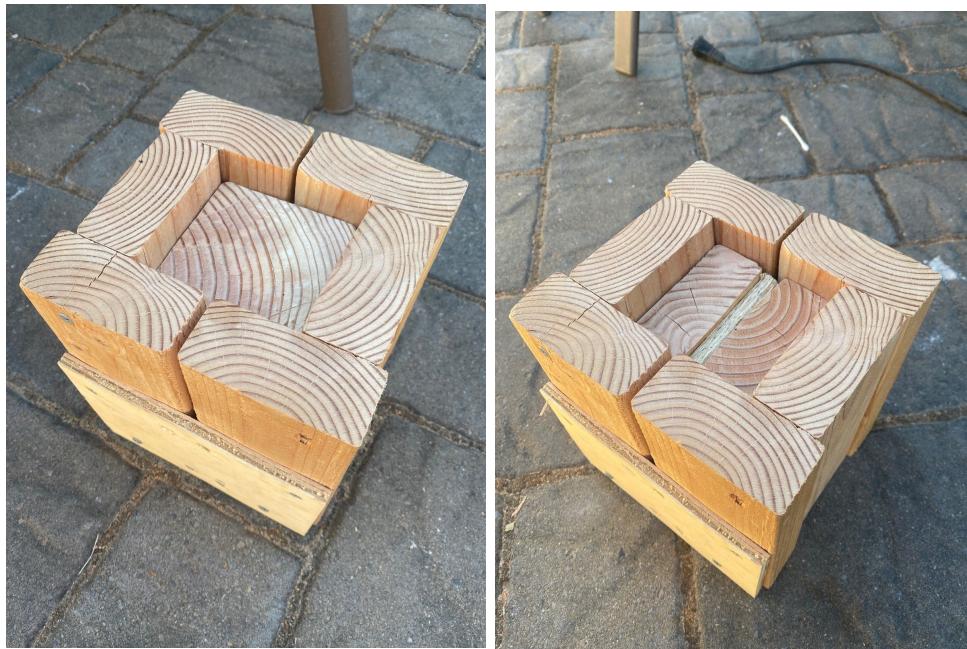


When cutting the 4x4 blocks with a regular size circular saw, you will need to cut twice from top and bottom. Use a sander to smooth the cut surface.



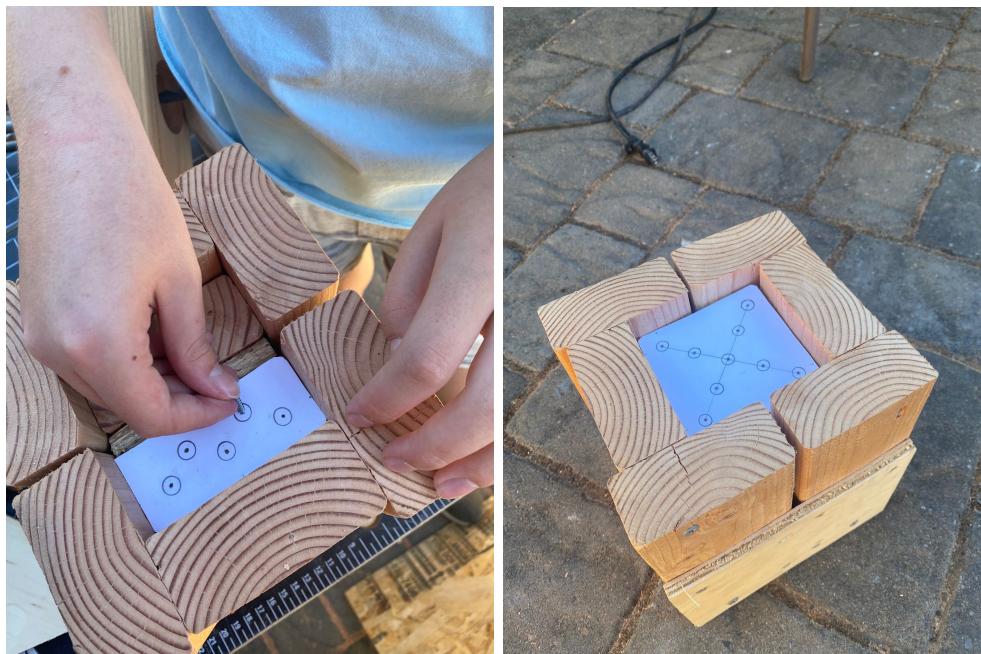
Part 3: Nesting Block Drilling

In this station, your job is to drill holes into the nesting blocks that will be assembled into the bee hotels. These instructions use a self-made rig to drill straight holes into the blocks. A horizontal or vertical drill press can also be used.



Step 1: Push the nesting block into the holder. If this is a 4x4 block, it will fit into the block, if it is a 2x4 block, you need to push two blocks and a spacer into the holder.

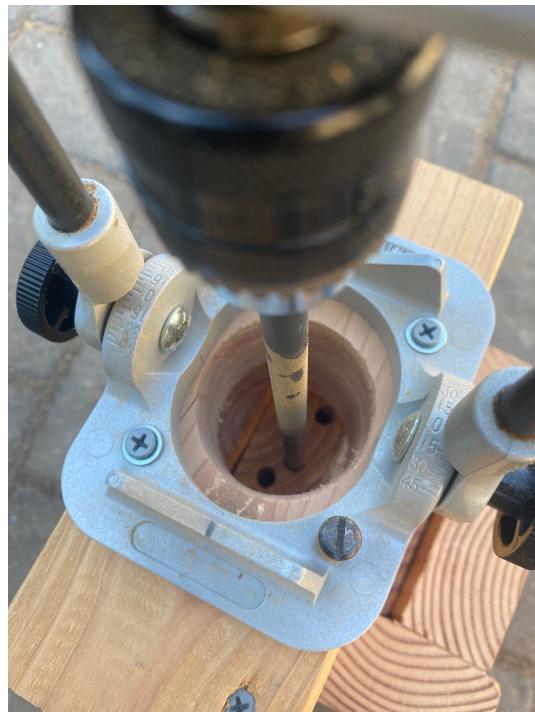
Step 2: first, you need to mark where the holes in this nesting block will go. Luckily we have made stencils for 2x4 and 4x4 blocks to mark where the holes will go. First place the stencil over the block you are drilling and poke a sharp object through the holes to form your marks.



Step 2: Use a drill with $\frac{1}{8}$ size drill-bit to make short guidance holes.

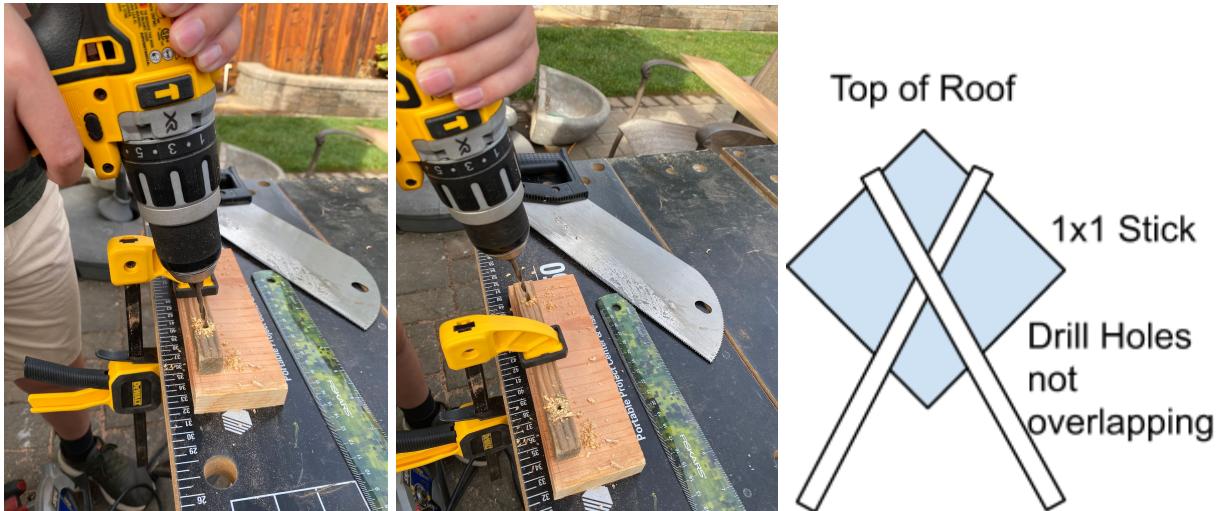


Step 3: Use the large drilling rig to make large deep holes onto your guidance holes. Position the large drill tip on a guidance hole and start drilling. You need to pull the drill out every 1-2 inches to remove the sawdust. Drill all the way until the lower end of the drill press stops the drill. Keep the same orientation of the rig over the holder between holes.



Part 4: House Assembly

Step 1: drill four holes in 1x1 with a slight angle. Holes should not overlap. (drill size 5/32)



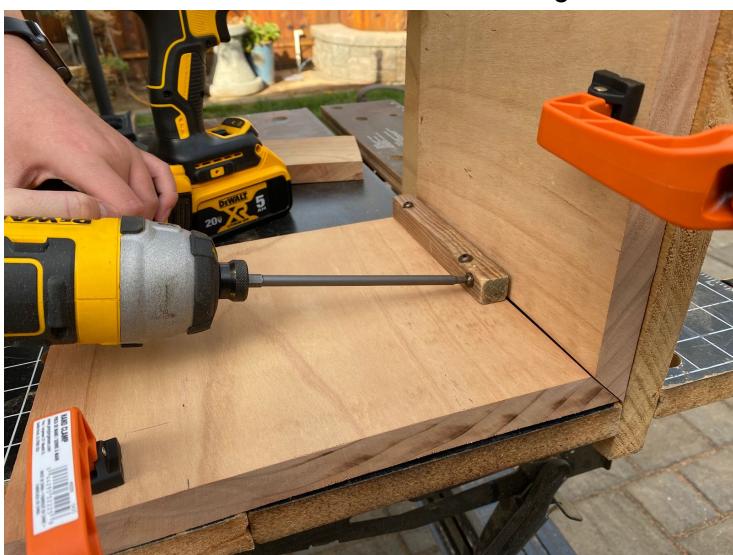
Step 2: properly clamp the roof together at right angle using a second board attached to the workbench. Make sure the sides align and the gap is as small as possible.



Step 3: align 1x1 with the back of the roof.



Step 4: Screw four screws($1\frac{1}{4}$ ") into the holes you made in step 1. (Note if the roof slips or misaligns immediately remove the last screw). Having your teammate hold the 1x1 while you screw in the screws will decrease the chances of the 1x1 slipping.



Step 5: using the pocket hole rig make 2 angled holes in the triangle on the rough side facing the inside of the roof.



(TODO: Pocket hole pic)

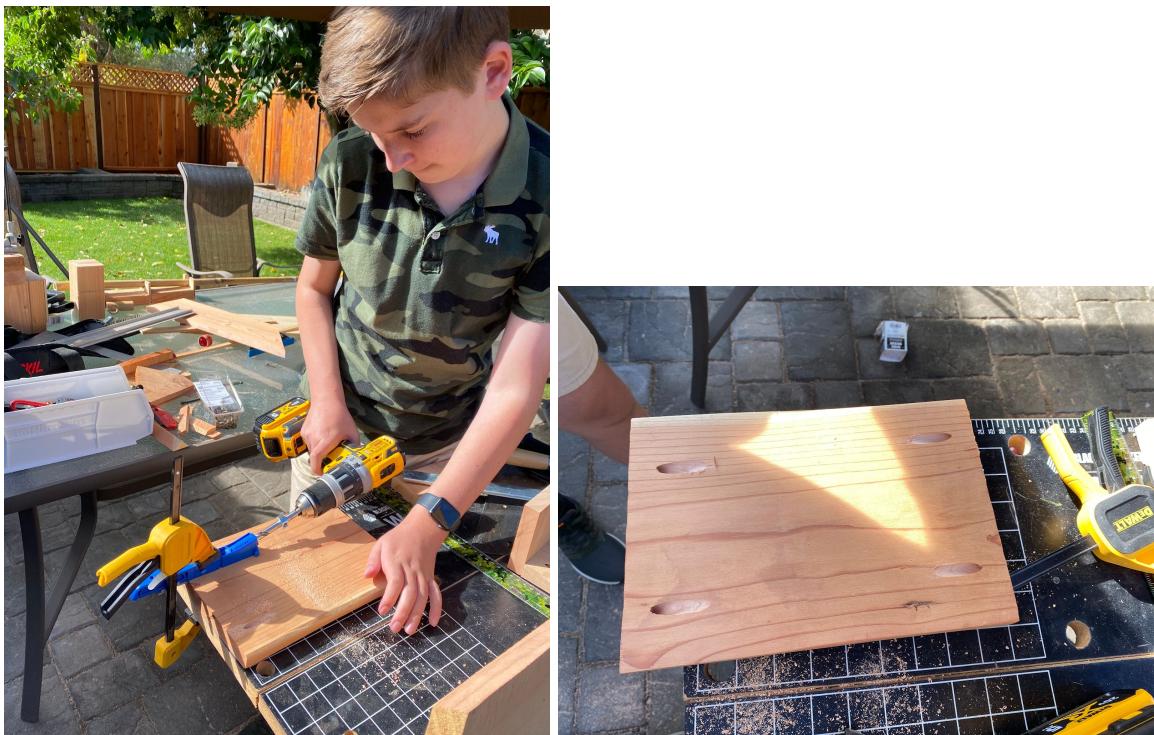
Step 6: Align the now drilled triangle six inches away from the backside of the roof, pocket holes facing to the backside.

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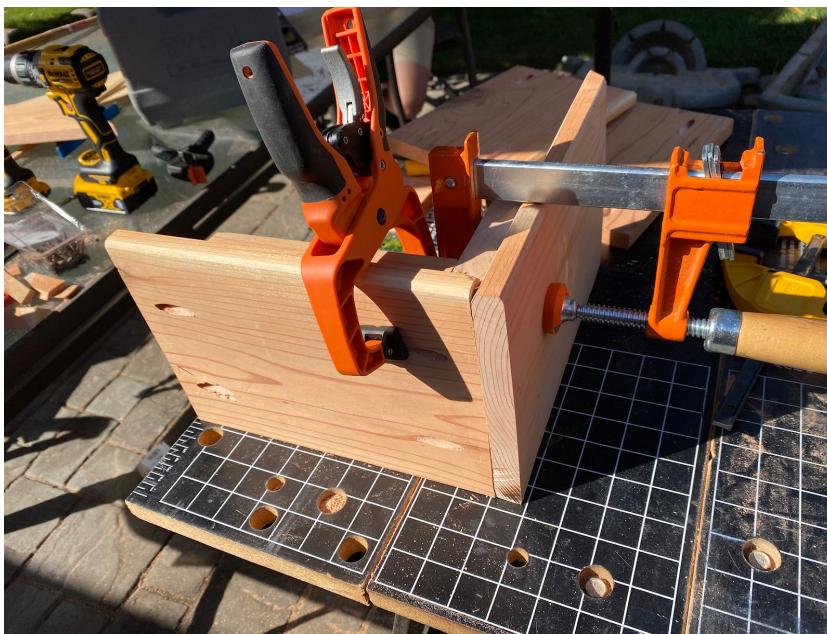
Step 7: Screw the triangle to the roof using the pocket holes and 1 1/4" screws.



Step 8: Place shelf upside-down on the bench (Ugly side up) and make 4 pocket holes in the upward facing side of all three shelves. The pocket holes should be facing outwards.



Step 9: after making holes in all three shelves, select one to be the bottom shelf. Attach this shelf to one of the walls using clamps using the corner "L" tool, then screw them together using the pocket holes and 1 ¼" screws. Make sure the front side with rounded corners is facing up for both sides.



Step 10: after attaching the bottom shelf to one side attach it to the other side with clamps before screwing them together.

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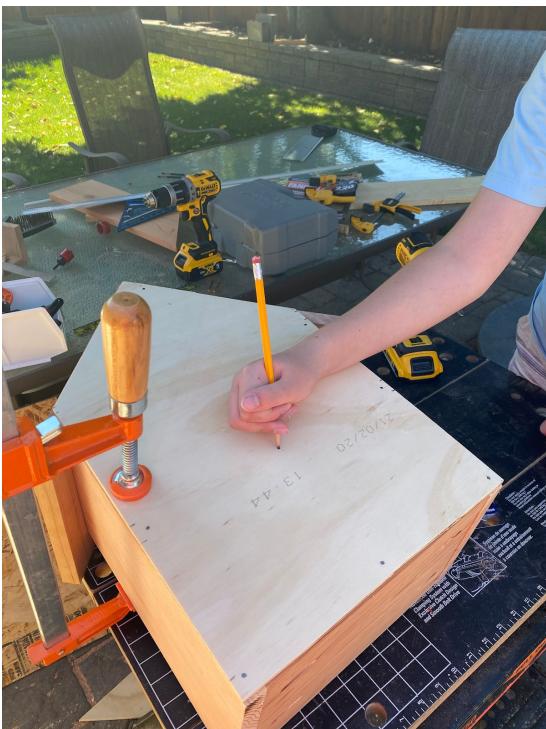
Step 11: After completing the last step, place another shelf which is now the top of the hotel just below where the roof would go. Again, make sure the rounded corner side is up. The pocket holes should be facing downward. After placing the top, place the roof onto the top. You will then carefully screw the longer screws ($1 \frac{1}{2}$ ") into the pocket holes while periodically checking that the top and roof are still straight. Your teammate holding the roof straight while you screw the screws in is recommended. These four screws will attach both the top shelf and the roof to the rest of the bee hotel.



Step 12: After you attach the roof and the top to the bee hotel, measure 4 $\frac{3}{4}$ inches from the top of the bottom shelf. This is where the bottom of the middle shelf will be. Then measure 5 inches from the bottom of the top shelf. This is where the top of the middle shelf will be. Mark the top and bottom of the middle shelf in pencil before aligning it with rounded corners up and screwing it in with the shorter black drill-bit. Similarly to the last step, periodically check that the top and bottom of the middle shelf are still straight. To ensure additional stability you can also clamp the middle shelf to the walls using the corner "L" tool.



Step 13: First hold the plywood backboard up to the back of the bee hotel and mark where the top and bottom of the middle shelf are on each side. Then screw 10 of the $\frac{3}{4}$ " screws into the following positions. 2 on the top of the roof on both of the two roof pieces. 2 just below the roof pieces on both sides of the top shelf. 3 on either side and the middle of the middle shelf. (use the markings you made at first to determine where the middle shelf is.) And lastly screw in 3 screws into the bottom shelf sides and middle. You don't need to make marking since you can estimate where it is based on the bottom of the bee hotel. Make sure to screw the screws into the middle of each shelf/ roof and not too far in either direction. You don't need to worry about the markings since the back of the bee hotel will be up against a fence.



Step 14: In this step you will attach the decorative brass bees to the front of the bee hotel. The holes in the wings are premade so you just have to nail them to the front using the tiny golden nails. However, since the nails are so small you must hold them with small pliers. After you know that the nail has entered the wood, you must release the nail from the tweezers and instead use the square drill-bit as a chisel to put the nail the rest of the way into the wood.



Step 15: In order to protect the open gap between the roof pieces from moisture, an aluminum edge is placed on top of the house. You need to cut a 9 inch piece of the edge strip with a hack saw. Smooth the cut edge with a file.

Drill 6 holes into the strip with a 1/16 drill bit, then nail the strip on the house using the $\frac{3}{4}$ " wire nails.



Step 16: In order to extend the life of the plywood back, it is recommended to cover it with wood protection stain. The rest of the house frame will last untreated, but you can stain it if so desired. The nesting blocks should not be treated as it harms and repels the bees.



Part 5: Bamboo Cutting

In this station you need to cut the bamboo rods into the correct length to be inserted into the bee hotel. These instructions use a self-made rig to hold and measure 7 inch bamboo pieces. You can also use an electric reciprocal saw to cut these pieces.

This station is fairly straightforward as you only need to align the bamboo rod between two of the slots and then cut the bamboo with a saw. The slots are all 7 inches apart so if you align the bamboo with the front of one slot you must cut at the front of the next slot. However, if there is a knot in the middle of the piece you are about to cut, you might have to cut a shorter piece off so

that the knot is not in the middle anymore.



Part 6: Inserting Straws and final assembly

In this station you will cut the straws and assemble the continents of the bee hotels. However, since some of the bamboo rods are different lengths, you first have to stick a straw into them to discover how much of the straw is sticking out. You must then cut the straw into the correct length using scissors. You must repeat the same process with the nesting blocks. (Note: after you have cut one end of the straws, turn it around before putting it in the bee hotel so that the better, uncut side is facing forward.

When inserting the nesting blocks, they might be a tight fit as boards are warped and block size varies. Try turning the 4x4 as sides often differ slightly in size. You can gently pound the blocks in place with a mallet, or sand them off to fit.



Thank you for helping the bees!

