Growing Mushrooms on Logs and Stumps

Why would I do this?

- You like mushrooms!
- You want to build soil!
- You have logs you don't want to dispose of and/or tree stumps you don't want to dig out!

How would I do this (at a high level)?

1. Insert wooden dowels that contain a decomposer fungus into a log (or stump).
2. Protect the insertion sites with a wax sealant or some other cover.
3. Store the log somewhere protected from fungi competitors and dehydration.
4. Occasionally water the log while patiently waiting 6-36 months for mushrooms.

Sounds simple enough. What do I need to know?

You must pair your tree and fungus species correctly. Fungi vary in which types of wood they prefer. Some are picky eaters, while others can feed on a wide variety of trees. There are huge numbers of tree and fungus species, but here are a few examples of good pairings:

	Alders	Ashes	Chestnuts	Elms	Eucalypts	Maples	Oaks	Sweetgums
Blue Oyster	+		+	+		+	+	
Elm Oyster	+			+		+	+	
Maitake	+		+	+		+	+	
Lion's Mane	+		+	+	+	+	+	
Shiitake	+	+	+		+	+	+	+
Turkey Tail	+	+	+	+	+	+	+	+

The knowledge base for which trees and fungi pair well is constantly growing. If you are unsure which fungi will pair with a particular tree type, or which trees will pair with a particular fungal type, a quick online search will often result in a reputable-grower's recommendation, a research article, or a forum posting.

Mushrooms grown on different tree species can have different flavors/nutrients/characteristics. Before you attempt an uncommon fungus/tree pairing, you should first research how the pairing could affect any mushrooms that might be produced.

You shouldn't try growing mushrooms on cedar, cypress, juniper, mulberry, Osage orange, sequoia, or yew. These trees are exceptionally resistant to fungi.

Some fungi have preferred growing locations on trees. Most fungi have a specific pathway into trees (through roots, wounds on a tree's trunk, foliage, etc.) and specific locations where the fungi prefer to grow. Fungi such as maitake and reishi, for example, prefer to grow close to where a tree's trunk and roots meet. Fungi like oysters, lion's manes, and shiitakes will grow most places where there is dead wood to eat, including high-up on branches. If your fungus has a preferred growing location, you should try to accommodate it.

There is an optimal window for introducing fungi into cut wood. Living wood contains anti-fungal compounds. It can take a few days to a few weeks for these compounds to dissipate from wood after it's cut— but the longer you wait, the more competition your fungus will have from organisms in the environment. In general, the optimal window is 1 week to 2 months.

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Protecting the fungus gives it a better chance of out-competing other decomposers. Keeping the log's bark intact, protecting inoculation sites with wax or another cover, and storing the log off of soil will limit competition while your fungus colonizes the log. Also, the more dowels you use, the faster colonization will occur.

You need some light. Your mushrooms need light to fruit. During the colonization phase, you can store your log someplace entirely dark, but you will need to later move it to someplace with at least a bit of light if you want fruiting to occur.

You must be patient. Depending on the tree type, fungus species, and growing conditions, it can take 6-36 months (and sometimes longer) before you'll see the first mushrooms. Dense hardwoods (oak, elm, ironwood, etc.) take longer to start producing, but produce mushrooms for many more years than softer woods do.

What do I need (besides the logs)?

- Inoculated dowels
- A drill
- A ¼" drill bit (brad point recommended)
- A rubber or wooden mallet
- Hot wax (bee or soy)
- A brush for applying wax
- Eye protection and a dust mask

Ok, I have all those things. What are the steps?

1. Make sure the log is in a secure position. Depending on wood type, drilling can require a lot of force, and you don't want the log to suddenly move while you're using the drill.
2. Locate the tree's sapwood (vascular tissue) between the tree's heartwood and bark. Heartwood is the dense, central part of the tree, and is often darker than sapwood. Most colonizing fungi will be able to spread through the channels of the sapwood easier than through the heartwood. Nutrients for your fungus are more available in the sapwood, too.
3. In the sapwood, drill a circle of holes around the heartwood. Holes should be spaced 1-2" apart, and be at least 1.25" deep. If the wood is very dense, the overall log diameter is large, and/or the ratio of sapwood to heartwood is high, you should drill multiple concentric circles.
4. Along the length of the log, drill a line of holes at least 1.25" deep. The holes can be spaced 4-6" apart. If you want to speed up colonization, drill the holes closer together. If you are using a super-tough and voracious fungus species (I'm looking at you, turkey tail), you can drill the holes further apart. If the bark is thicker than 1.25", drill through the bark and into the underlying wood.
5. Rotate the log 4-6", and then drill another line of holes. Repeat the process until you're back at the initial line of drilled holes. You can stagger every other line to create a diamond pattern on the log.
6. Partially insert dowels into the drilled holes.
7. Using the mallet, gently tap each dowel until it's flush with the log surface. The dowels might be softened by the fungus and can splinter/shred if you're not careful. Because you drilled holes at least 1.25" deep, you've created a small pocket (to help the fungus grow) behind the 1" dowel.
8. Optional (but recommended): In a container of water, entirely submerge the log for 12-24 hours. This will give the fungus better conditions early on for colonization. The pockets created behind the dowels will fill with water, which will help keep moisture levels higher.
9. After the surface of the log has dried, brush melted wax over the dowels at the end of the log. You can cover the dowels along the side of the log, but it isn't as important as covering the face.

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Now I have an inoculated log. What's next?

With careful consideration for location, occasional watering, and a good amount of patience, you should have mushroom production over a number of years.

Location:

- You should not store your log indoors. Indoor humidity is not conducive to colonization, and if you were to attempt to maintain the correct humidity, it would likely result in mold problems for the indoor space.
- If your fungus prefers growing low on a tree (maitake and reishi, for example), you should (eventually) bury the log in the ground or in a container of moist dirt or sand. You can wait for the log to colonize before burying it, but the log should eventually be buried to promote fruiting.

  The log should be oriented horizontally, with at least two-thirds of the log buried. You can bury the entire log, but if you do so, it should be just below the surface of the ground. If you use a container, make sure that it can drain through the bottom; pooling water would suffocate the fungus, and allow anaerobic bacteria to grow. Anaerobic bacteria produce bad smells, and will cause a variety of problems for your log.

- For fungus that is less particular about its growing location on a tree, logs should be left somewhere moist and shady (less than ¼ of the day in direct sun). Sun and wind can dry out the wood, which will slow colonization and can cause bark to crack open, potentially letting in more competitors. Dirt harbors competitors, so you can provide a bit more protection by placing the log on cardboard, rather than bare dirt.

Water:

- Stumps and buried logs need less attention, overall, than logs above ground do. They draw water from the soil, so are not as prone to drying out.
- Above-ground logs will need some protection from heat, wind, and sunlight, and will also need occasional watering. Watering is dependent on conditions— at the height of summer, you might want to water logs every couple of days. In spring or fall, maybe once a week or every other week. If early on, you get a good feel for the weight of the log, you'll later be able to pick up the log and tell if it's become dry.

Sharing your log:

Because your log is being stored outside, you'll be sharing it with nature. Cut wood can draw decomposers from the natural environment, such as bark beetles, termites, and other boring insects. Bark beetles are tiny and feed predominately on the inner bark of dead and dying trees. They lightly score the wood underneath the bark, but do not affect the volume of wood in any substantial way. Termites and other boring insects can eat away at the wood, but should not have a large effect on your fungus. If you're concerned about termites, a protective barrier between the log and the ground can prevent subterranean termites.

Triggering a flush of mushrooms

To fruit, fungi usually need certain environmental triggers (usually related to water and temperature). Fruiting parameters for most commercially grown mushrooms are available online or in books, though new varietals (with different growing parameters) are being developed all the time.

Months after inoculation, when the log is fully colonized by the fungus, you can sometimes hurry mushroom-fruiting along by soaking the colonized log in cold water for 12-24 hours. Don't soak for longer than 24 hours though, as this can injure/kill the fungus.

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Important Dos and Don’ts

Before you consume any mushrooms that grow from your log, make absolutely sure that they’re the variety you’re expecting. Logs and stumps can (and often do) support multiple species of fungus. Regardless of your attempt at monoculture, there will be other fungi in the environment, which can mean different types of mushrooms growing side-by-side on your log.

Be careful about what you introduce to your environment! Some online vendors sell highly parasitic fungus species like honey mushrooms (Armillaria species) and the bioluminescent “ghost fungus” (Omphalotus nidiformis). These types of mushrooms infect and kill healthy trees, and would likely spread to other trees in your area. Ghost fungus is especially problematic because it's toxic and looks similar to edible oyster mushrooms. Buying your fungi from a trusted local source reduces the likelihood that you'll introduce something negative to your environment.

Don't use logs from far-away places! There are many threats to our local forests— emerald ash borer, laurel wilt, and oak wilt, to name a few —and transporting logs across distances can introduce disease and pests into new areas. Make sure you grow your mushrooms on logs from local sources to avoid introducing new threats to our forests.

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