

Making Artificial Trees and Vines for Naturalistic Vivaria

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Disclaimer: This article details techniques that use heat, flammable materials and caustic chemicals. The reader uses these instructions at their own risk. The author assumes no responsibility for damage or injury resulting from following the instructions in this article.

Creating a naturalistic vivarium requires careful attention to hardscaping. Hardscaping is the arrangement of the non-living components of the vivarium. These components include substrate, tree trunks, branches, vines, and rocks. Collectively these create the “bones” of a vivarium and they determine not only aesthetics but also the arrangement of microhabitats that determine whether the vivarium will provide suitable environments for the plants and animals that will be inhabitants. Hardscaping has a dramatic impact on a vivarium and can transform a box of plants and animals into a vignette of nature that allows observers to transport themselves into another world.

History and Alternatives

Traditional hardscaping has been achieved by selecting naturally occurring materials such as rocks, tree stumps, branches and vines and arranging them into a pleasing and convincing display. Of course there are limitations to this method. The first is that diverse stocks of materials are not always available causing the vivarist to make do with shapes, colors, and textures that are less than desirable. Even if the vivarist is lucky enough to find the perfect piece of wood for their vivarium, the piece is doomed to decay if it is placed inside a moist, humid environment such as a tropical vivarium. For these reasons vivarists have sought methods of creating their own vivarium hardscaping that would be permanent and could be created to precisely fit the vivarium designer’s vision.

For over two decades professional zoo display designers have perfected methods of creating artificial rocks and trees that are



so realistic that it is difficult to distinguish them from the real thing even by touch. Unfortunately, the materials used in these processes are often quite expensive and the techniques used to obtain ultra-realism are not widely shared leaving these methods largely beyond the reach of most amateur vivarists.

The Dutch Flevopol method was a tremendous breakthrough in vivarium design because it provides a simple and inexpensive method of fashioning semi-permanent hardscaping that can be shaped precisely to meet the needs of the vivarium designer. But even though Flevopol can produce dramatic and pleasing effects, it still has its limitations. Briefly, the method entails creating an admixture of acrylic concrete fortifier (sold in the Netherlands as Flevopol but available in other countries under various trade names) and natural materials such as peat moss, coco fibers, and soil. This admixture is smeared over backgrounds and shaped pieces of PVC pipe or expanded urethane foam. The process can produce very nice backgrounds and formations but in my mind, it usually falls short for producing convincing trunks and branches. The problem is that the colors of the resulting pieces are too uniform and the texture is too fuzzy to accurately portray convincing wood tones and textures. A few skilled craftsmen such as [Ben Koper of the Netherlands](#) have produced some amazing results with Flevopol trees but I have no details about the techniques required.

For many years I have admired the realistic trees and vines seen in large zoo displays and scrutinized pieces for clues to their

construction. From my observations it appears that these large fixtures can be divided into two groups; cast or shaped. Cast fixtures are typically made of epoxy resins. Although cast trees and branches are the most realistic that I have seen, they are not particularly useful to the vivarist because first you need a mold of what you want to cast. 1) Most of us don't have molds of buttress roots from a tropical hardwood lying around. 2) Cast fixtures are still molded from nature which means that they are limited to the shapes that can be found. This limits the vivarist's ability to reshape and size a piece to precisely fit his or her vision. 3) The epoxy resins are not cheap which limits the ability to experiment without spending a lot of money. I personally prefer lower risk options which make shaped fixtures the perfect choice. Shaped fixtures are typically made with concrete which can be shaped and textured with trowels, brushes, knives and stamps. Coloring can be achieved by borrowing techniques from the model railroad hobby for making realistic landscapes. The result can be very realistic trees that while not perfect like the best cast products, are close enough that the observer has to look hard to know what they are seeing is not real. The remainder of this article will describe the materials and methods used to make a realistic looking buttress root tropical tree trunk. Although the process is somewhat time consuming, it does not require extraordinary artistic skills to achieve excellent results.

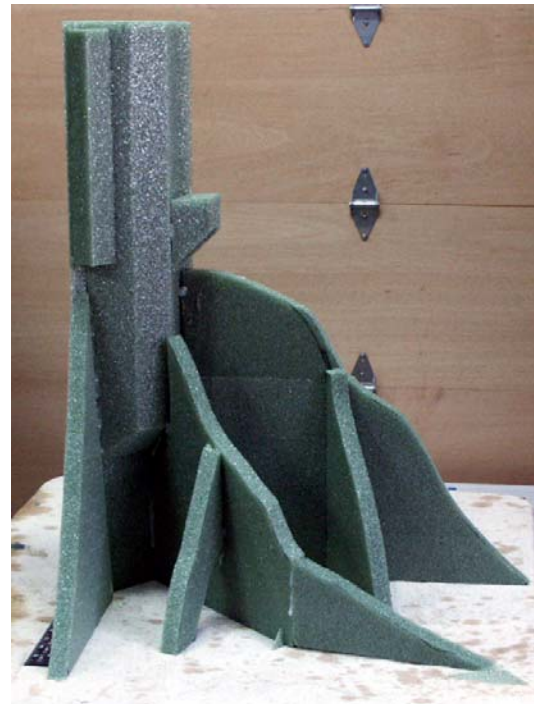
Step One – Homework

The first step in making a realistic tree is to know what you want. Think about the habitat you are creating. What part of the world is it in? What is the climate like? What kinds of trees live there? Also think about the plants and animals that will live in your vivarium. Do you need places for epiphytes to grow? Will the tree provide hide cover, basking or ambush sites for the animals? Do you need water-filled hollows for tadpoles? The answers to these questions may help decide what type of tree you want. For example, if you want epiphytes, you will want to design the piece with horizontal surfaces and crooks and crannies that would catch organic debris in nature and provide seedbeds for epiphytes

to get their start. Likewise if you need to include ground level water catchments, having two buttress roots that grow together could easily do the trick which would be more difficult to accomplish with a prop root design. Conversely, a prop root design may provide more appropriate hide cover for the animal inhabitants.

Once you have decided what type of tree you want to make, hit the Internet to find example images. You won't be trying to create an exact replica of the images you like but they can help guide decisions about the sizes, shapes and angles of roots and branches and about colors, textures, and patterns of the wood and lichens and mosses growing on it. Print one or more images out and keep them handy for reference as you work.

Step Two – Create the Frame



Sheets of Styrofoam cut and assembled to make the basic frame. If possible, cut sheets that will attach at angles at the correct bevel to provide a tight glue joint between sheets.

What you use for the frame depends on the type of tree you will make. In this example I used 1" (25 mm) and 2" (50 mm) thick Styrofoam sheets purchased at a local crafts

store to make a buttress root tree trunk. Prop root frames can be made by heating PVC pipe in an oven or barbecue and bending and shaping the pieces as desired.

The important thing is that the structure is strong enough to support the wet mortar that will be smeared over it later. In the example, I cut the Styrofoam pieces using a table saw and a hand held jigsaw but Styrofoam can easily be cut using a utility knife. A table saw just makes it easier to cut angles that allow the pieces to fit firmly together. The example tree was built to fit into the corner of the vivarium so the foam at the back is cut to form a 90° angle and only the front of the piece is finished with mortar. I used hot glue to stick the pieces together. Hot glue works well because it sets up rapidly allowing the work to progress quickly. At this point you are only trying to get the basic shape of the final structure so don't try to put too much detail in at this stage.



Expandable urethane foam is applied to bring the piece near the final shape. Foam can be used to create features like this bole in the upper trunk that collects water.

After the Styrofoam is glued together, put on a pair of rubber gloves and apply urethane foam. The foam does two things. First it strengthens the joints between pieces of Styrofoam so the structure becomes strong

enough to support the wet mortar. Second, it allows you to add basic texture and shape that will add realism later on. I used a combination of methods to apply the foam. The first was to spray down a blob of foam and then spread it out with a plastic spatula. This produces a sticky smear that doesn't look like much but it will start to expand creating texture and a surface for the mortar to bite into for a strong hold later. The other method is to lay down areas of foam to build up areas for effect. For example, I built up foam on the outer sides of the trunk to create a cleft where water will pool. Let the urethane cure for 24 hours before proceeding to step 3.

Step 3 – Applying the mortar

I used ready mixed standard thinsert mortar that is sold for laying tile. This type of mortar has additives that allow it to remain slightly elastic and strong even when applied in thin layers. You won't need a lot of mortar to cover a moderately sized tree. The example tree is about 32" (80 cm) tall and took less than 3 gallons of mortar. I added some additional Portland cement (equivalent to about 1/8 of the total volume of mix) to make the mix a little creamier and produce a smoother final finish. The addition of Portland is optional. It is also a good idea to add acrylic fortifier to the mix to increase final strength and water resistance. I didn't add fortifier to the mix on for the example tree and the results were not disastrous but I would recommend adding fortifier just to be safe. Mix the mortar slightly thinner than package recommendations to make it easier to spread. The mix should have the consistency of thick cake icing. The trade-off to a thin mix is that water weakens concrete and increases shrinkage which leads to cracking as it cures. Strength is not an issue if the tree is not expected to support anything but shrinkage adds more work later on. Shrinking and cracking can be reduced by using water reducer additive to the mortar mix. Water reducer is available at cement yards. I didn't use water reducer and only had minor cracking despite using a relatively wet mix. You want the mix thin enough to be able to spread but thick enough to stick to vertical surfaces without sliding off. A paint mixing attachment for a power drill insures even mixing and whips

air into the mix for a lighter and easier to spread mortar. After the mortar is thoroughly mixed with water, add concrete pigment. I used the darkest brown I could find at the local home improvement store. Just add the pigment while stirring until you get a nice even color that you like. Again, a power drill attachment is helpful here.

Now that the mortar is mixed it is time to apply. If you are using PVC for a frame, you may need to apply a coat of acrylic concrete bonder (usually the same product as concrete fortifier) to make the mortar stick to the smooth PVC. Follow directions on the bottle. You will want to have a trowel, a container of water, and cheap paint brushes of different sizes handy. Use cheap paint brushes since they will take a beating during the process. Also make sure you are wearing rubber gloves or else you will likely wind up with chemical burns on your hands. I used a tuck point trowel to transfer mortar from the bucket to the piece and do the rough spreading. If possible, lay the piece on its side and work with gravity to apply mortar to the up sides. Spread the mortar on the largest areas using the trowel, trying to get the mortar about $\frac{1}{4}$ " (5 mm) thick but don't get too concerned about this. Just try to get all of the surfaces covered.



Mortar partially applied. It helps to lay the piece on the side to let gravity work for you.

As you work, use a wet brush to smooth, blend and shape the mortar into its final form. Many of the brush strokes will show as subtle texture in the final product so pay attention to the direction of the strokes. Use long sweeping strokes along the contours that wood grain would naturally follow. Keep

working until all of the surfaces are covered with mortar. If you were able to lay the piece on its side, cover all of the horizontal surfaces and let the mortar stiffen a little before standing it up to cover the rest of the surfaces. Make sure you periodically stir the mortar in your bucket. Some nooks and crannies will require daubing the mortar in by hand and smoothing with a thumb or finger followed by final smoothing with a wet brush. As the mortar begins to stiffen, you have the option of adding texture by brushing the surface or stamping with rubberized texture stamps. See the article, *Making Latex Texture Molds* form information about making texture mold stamps. In the example trunk, I used stamps made from aspen trunks and the results were so subtle as to be almost lost in the finished piece. If you decide to use texture stamps, wait until the concrete is slightly stiff but can be depressed with light thumb pressure. Sprinkle the area to be stamped with a release agent to keep mortar from sticking to the stamp. Powdered pigment dye works well as a release agent but make sure you are prepared to contain the mess since the pigment will stain almost anything it touches. With the area to be stamped sprinkled with release agent, lay the stamp texture side down and lightly pat the stamp into the mortar to impress the texture onto the piece. Make sure the orientation of the texture stamp is correct. Lift the stamp and move to an adjacent area, placing the stamp so it overlaps slightly with the previous area. Try to vary the position of the stamp so you aren't creating straight lines of repeating patterns. When the texturing is finished, let the piece set up for at least 24 hours. While cement is setting up, it is best to keep it moist either by draping a sheet of plastic over the top or by misting with water every few hours.

Once the mortar has hardened there will probably be some cracks to fill. These can be easily filled by mixing up a little more mortar, smearing it into the cracks, and finishing with a brush just as before. Once the patches have hardened, it is a good idea to neutralize the lime in the mortar. Lime leaching from fresh cement products will raise the pH of soils and water features which can sometimes cause problems for vivarium inhabitants. The lime can be

neutralized by soaking or scrubbing the piece with vinegar, frequently flushing the piece with fresh water.



Mortar freshly applied. It is starting to look like a tree but very plastic looking.

Step 4 – Painting

This is the step that brings the tree to life. The method I used was taken from instructions posted by Dave Calkins on Frognet (<http://www.frognet.org>) which he modified from methods used by model railroaders to paint plaster scenery. [Dave's message](#) contains much more information than the techniques that I used and is recommended reading before beginning this step of the project. The materials I used for my project were non-toxic latex paint (almond) and several tubes of artist's acrylic paint (Mars Black, Burnt Umber, Yellow Ochre, and Permanent Green Light). The colors used will depend on the look you are going for. These colors worked well for producing a deep brown hard wood trunk with lichen highlights. If you want a grayer appearance, you might include titanium white and substitute the almond latex paint with a light gray.

Once you have the paints, have some cheap paint brushes of various sizes on hand, several pint sized containers and lids to use for mixing colors and as palettes, and a spray bottle filled with clean water. The first color I mixed was the shadow color. To

make this I mixed burnt umber with mars black until the color was more black than brown. Next add enough water to make the paint thin and watery. You aren't really painting the piece so much as staining it. You want the paints to be translucent so variations of shade and hue will bleed through in layers. Before applying paint to the piece, spray it down with water until it is wet to the point of dripping. This allows the applied paint to run and bleed creating a realistic appearance. The darkest color gets applied to places that would be in deep shadow such as in the crotches between roots at the base of the trunk and in clefts and crotches of the trunk itself. Not only does this accentuate the look of shadows, but in nature these areas tend to receive less sunlight and therefore do not bleach out as much as more exposed surfaces. As you apply the shadow color, experiment with spraying water lightly over the surface and at the edges of the paint to create intricate variations in shade. You can also apply shade color lightly to more exposed surfaces and mist them down to create a natural looking patina on the surface.

A large part of making the tree look real is to break up large areas of uniform color. It is really up to your eye to determine how much or how little shadow to apply. Once you are satisfied with the shadows, you might try adding a little more burnt umber or even some yellow ochre to your shadow color to create another hue to apply for color layering. By modifying an already mixed color, you avoid having unnatural color contrasts on the piece because each new color becomes a natural variation of the previous one. As you mix new colors, leave a bit of the original untouched in case you want to go back and reapply that color later. Also, don't clean your brush between colors to even further blend the transitions between shades and hues. Periodically step back and refer to the images you printed out in step one to get an idea of how the patterns of light and dark should be arranged. Typically you will be trying for a tree that has lighter, richer hues on the most exposed surfaces that grade to darker shadowy colors in the less exposed nooks and crannies. You will probably want at least three shades of color (shadow, base, and highlight) with all of the dirty blends in between. If you don't like the

way an area looks, simply spray it off with water and try again.

You should get to a point where you have a pretty realistic tree trunk but the trunk will be a little too clean. In nature few tree trunks are clean. Most are covered with life such as algae, lichens, and moss. Now is the time to get out the almond latex paint. Pour a little bit into a container and add some mars black and maybe a little yellow ochre to make kind of a muddy gray color. I learned that latex paint is much stronger than artist's acrylics so go easy on the latex so you don't go broke adding enough acrylic to tint it. Add enough water to this mix to make it just thin enough that it won't pile up when applied but a little thicker than the washes you used earlier. Apply this paint with a rough natural sponge by dipping the sponge in the paint and then just barely touching the surface of the piece with a sponge. As you dab the sponge, continuously twist and rotate the sponge to avoid creating repeating patterns on the piece. Again, it will help to refer back to the images to determine the correct places to apply the 'lichen'. These usually grow on the more exposed surfaces like the tops of the roots and up the exposed sides of the trunk. Often times lichen and moss will grow more prolifically on one side of the surfaces and not the other. The old saying that moss only grows on the north side of the tree is not exactly true but moss does tend to prefer either the more or less sunny surfaces depending on the local climate. Try to replicate this as you apply lichen to the tree. Again, experiment with light mists of water to bleed the lichen out a bit and create variations of texture. As with the wash, if you don't like the result, you can spray it off, reapply darker wash to the area to mute the lichen, or both. Don't overdo the lichen. There should be a subtle dappled texture in a predictable pattern over the tree with no abrupt lines where the lichens stop. Next add a little green to some of the lichen color to make a greenish muddy gray and apply using the same technique and the same dirty sponge. Something that worked well for me was to dip a different part of the sponge in each color with an area of overlap so the sponge had spots of muddy gray, greenish gray, and a blend. Then I could twist and rotate the sponge around to get an

infinite intermix of colors that looked like two or more species of lichen growing on the same surface. You will probably need to spray or over wash areas to tone down places that stand out too strongly. The key is for all the elements to blend in subtle patterns similar to what is typical in nature.

At this point you should have a stunning looking tree and you can clean up your tools as you let the piece dry which might take an hour or two.



The tree is painted and ready for sealing. Notice the pattern of dark colors in the deep recesses and lighter colors on exposed surfaces.

Step 5 - Sealing

When the piece is dry, you are ready to seal it but you may want to apply one more trick to give the tree a finishing touch. Take some dried green sheet moss and chop it up into fine pieces using a food processor or blender and place the ground moss into a plastic bag. If you buy sheet moss, make sure you get natural moss and not anything that has been dyed green. It is also a good idea to sterilize the moss in case it came from a location with chytrid fungus. Likewise if you collect your own moss to dry, make sure it comes from a chytrid free area.

With ground moss handy, you are ready to seal the piece. Either paint or spray acrylic cement fortifier and bonder onto the piece until it stops soaking the liquid up and is dripping. Make sure you get liberal amounts in all the crooks and crannies. Let it dry at least until it is tacky. The sealer will look like milk or Elmer's glue when you put it on but it will dry clear and leave a semi-gloss sheen that looks very much like tropical hardwood. When the first coat is dry, apply a second coat the same as before.



The tree has been coated with acrylic bonding adhesive. It is literally dripping with adhesive. Ground moss has been sprinkled over the left buttress root.

While the second coat of sealer is still wet, sprinkle some of the ground moss over the horizontal surfaces of the piece and on surface where it looks like moss would naturally grow. This may be in a similar pattern as the lichen but moss often grows thickest in shady pocket that retain moisture. A close look at trees in the wild often reveals little strands of moss peppered all over the surface but thick carpets of moss forming only in areas where conditions are best. Again, use your reference images for guidance. Moss sprinkled in this way will remain exposed to the vivarium environment and will likely decay with time. However, the dead moss will hopefully provide organic material and retain enough moisture that living moss begins to grow in its place. Now that the moss is applied, the tree is finished and should be left to dry overnight.



The tree is finished and ready to accessorize.

Step 6 – Vines and lianas

Tropical trees are typically festooned with epiphytes as well as vines and lianas. The reference image I used to make the example tree showed several of these draped over portions of the trunk so I decided to add some to my artificial tree as accessories.

Vines and lianas are simple to make using modifications of the Flevopol method. I made two sizes and types of liana. The first were small in diameter made using 1/4" (6 mm) vinyl micro tubing sold for drip and microspray irrigation systems. The second type was made using 3/8" (9 mm) PEX pipe sold for household plumbing. Any size of plastic pipe or tubing will work.

The first step is to heat the pipe or tubing to make it pliable enough to bend. Placing the pipe or tubing on a sheet of foil in an oven with the door slightly ajar works well. I found that about 5 minutes in a convection oven at 300°F (149°C) worked pretty well for heating the microtubing to a very pliable state. Keep an eye on it or you will melt it like I just did while typing this section. The microtubing stays pretty flexible when cold so you can just hang the tubing someplace where it can hang straight down or lay it out straight on a cool surface. You are mainly just trying to

take the curl out of the tubing and you should be able to bend it to shape latter. If you want the vine to follow a complex contour, you can go ahead and lay the tubing on your tree while it is hot. You can temporarily secure the tubing in place using rubber bands or any other suitable means. Make sure to wear oven mitts or gloves when handling the hot tubing. The PEX pipe is more rigid than the tubing so you need to bend the pipe to its final shape while it is hot and allow it to cool in that position. I found the PEX pipe required about 10 minutes at 450°F (232°) to make it pliable. With the pipe still hot, form it to the tree the way you want and fasten it the same as for the tubing until it is cool.

Again, refer to reference images to make a realistic configuration. Some vines hang straight down out of the canopy and others snake their way up trunks. Still others do a combination of hanging free but snaking along and attaching themselves to surfaces for a length and then hanging free again.



Plastic pipe and tubing is heated and formed to final shape.

Once the pipe or tubing is shaped and cooled, you are ready to turn them into vines. The first step is to mix up the material you will use to cover the plastic. I used a blend of peat moss, coconut fiber and a little of the ground up green sheet moss. Place

the dry mix on a sheet of plastic large enough to contain the mess of working the vines. Next coat the pipe or tubing with undiluted acrylic cement fortifier and bonder. When the plastic is coated, roll and press the plastic into the dry mix. Use firm pressure to press the mix into the adhesive. You will probably have to sprinkle fine particles of the mix over spots that are left bare. Try to get as complete of a coating as possible.

The next step is optional but I think improves the looks of the small vines considerably. Hold the wet, coated vine up by one end and run the flame of a propane torch up and down over the coating. Do this in a well ventilated area because it will smoke like – well – burnt coconut hulls. Scorch the coating enough that it burns off all the fuzzy coco fibers sticking out of the vine and to slightly blacken the surface of the coating. It will stink, but it will look good. This process also almost instantly dries the bonding adhesive. If you choose to leave the vine fuzzy, set it aside to let it dry. I left my larger diameter fuzzy which gives the illusion of having two different species of vine growing on the tree.

Once the vine is dry (either by flaming or air drying), put another coat of bonding adhesive on the vine and repeat the process. Adding two coats of adhesives and coating accomplishes two things. First, it provides complete coverage of the plastic so you don't have white spots showing through. Second, it traps your first layer of dry mix inside the acrylic which will help protect it from decay. When the second coat is complete, let the vine dry (again, either by flaming or air drying). When the vines are dry, you can attach them to the tree using either hot glue or silicone adhesive.



The vines are in place and the tree is ready to install.

The illusion can be taken a step farther by making fine root formations out of jute twine. Cut a length of jute about an inch (3 cm) longer than twice the length you want the roots to hang and soak the jute in water until it is saturated and limp. Unravel all but the middle inch (3 cm) of the jute which should expose about 6 individual strands when hanging from the middle. Next dip the jute in acrylic concrete bonding adhesive and then roll it in the dry coating mix. As with the plastic, firm pressure may be needed to make the coating stick. Flame off the fuzzy fibers while allowing the jute to hang from the unraveled middle section. The jute will dry in the position it is hanging so make sure it looks natural. Once the jute is flame dried, dip it in the acrylic bonding adhesive for another coat and repeat the process. This makes a realistic looking root mass that can be hot glued to a vine for a nice finishing touch. After the root mass is glued in place, you need to dab a little acrylic bonder around the glue joint and press in some more dry coating. Flame off the fibers and repeat.



Jute twine can be used to make realistic looking fine root masses. The vine on the left was flame finished and the larger vine on the right was not.

Step 7 – Installation

There is really not much too installing the piece in the vivarium. How it is installed depends on how it was designed. Some pieces may be simply set in place. For my corner installation I chose to seal off the spaces between the piece and the walls of the vivarium with expandable foam. Just make sure you aren't creating any death traps where an animal can squeeze in and not get out. If you aren't 100% sure that you can completely seal the spaces behind the tree, it is probably best not to even try so the animals can freely come and go behind the tree. Also remember that large volumes of expandable foam applied at once tend to shrink as they cure. Inspect the cured foam before adding animals and follow up with additional foam if need to keep the area off limits to the animals.



The tree can be shaped using expandable foam to form microhabitats like this cleft trunk containing a water-filled bole.



Even up close the illusion is complete.

Congratulations! You should now have an ultra realistic custom tree that will impress your friends and make your mother wonder where she went wrong.

Materials List

Frame

- Styrofoam sheets
- Hot glue and glue gun
- Cutting tools (table saw, jig saw, hand saw, or utility knife)
- Expanding urethane foam
- Plastic spatula
- Rubber gloves

Mortar

- Standard thinset mortar
- Acrylic concrete fortifier and bonder
- Brown concrete pigment
- Portland cement (optional)
- Electric drill and paint mixing attachment (recommended)
- 5 gallon bucket
- Tuck point trowel
- Paint brushes (2", 1", and ½ " sizes)
- Small container of water
- Rubber gloves
- Optional texturing tools
- Rubber texture molds (optional)

Painting

- Paint brushes (same as for mortar)
- Artist's acrylic paints (colors as needed – examples listed below)
 - Mars Black
 - Burnt Umber
 - Yellow Ochre
 - Permanent Green Light
- Non-toxic latex paint (Almond)
- Spray bottle of clean water
- Several containers and lids for mixing paint.

Sealing

- Acrylic concrete fortifier and bonder
- Paint brush or spray bottle
- Ground green sheet moss (optional)

Vines

- Plastic pipe or tubing
- Peat moss
- Coconut fiber
- Ground Green sheet moss (optional)
- Acrylic concrete fortifier and bonder
- Propane torch (optional)
- Jute twine
- Hot glue and glue gun