

Grow Native Pond Guide - Don 5-6-2010

Southern Arizona

Atractive and comforting as they are, backyard ponds in the desert Southwest pose an environmental problem. They use precious water - up to 5000 gallons per year. More importantly, backyard ponds appear to be contributing to the growing problem of introducing non-native, invasive animals and plants to Arizona's rare remaining natural wetlands. Invasive American bullfrogs, plants such as common cattails and fountain grass, and even exotic fish such as mosquito fish can migrate from ponds during rainy periods and end up in natural, spring-fed pools in our national parks, national forests, and other preserves. Once established, the most invasive of these species displace natives.

Creating a natural backyard pond, one that more closely resembles native desert pools, is one potential solution...but can be challenging due to many biological and even political constraints. The purpose of this booklet is to help backyard pond owners who are committed to "going native" by providing background, guidance, and a variety of alternatives.

By converting your pond to a native species friendly habitat you can help reduce the spread of invasive species and help protect rare native plants and animals. Going native isn't easy - but in the long run backyard ponds containing native rather than non-native species of plants and animals have the potential for making a positive impact on our Arizona environment.

A Native Pond in the Wild

A native desert pond, such as would be found along an intermittent stream near Tucson, is surrounded by large rocks and gravel with dense clumps of deergrass growing along its banks. Moss-like algae grows from the bottom, with motionless leopard frog tadpoles silently lunching on its nutrient rich mass. Small Gila topminnow gather around the warm shallows, the dark males endlessly chasing the larger pregnant females in a turmoil of activity. As you approach the pond, three leopard frogs magically shoot out from in front of your toes, plunging into the still water and disappearing deep in the green algae. The abundant tracks in the mud indicate that a great blue heron frequents the pond, as well as a group of javelina and a lone mountain lion.

When the dry season reaches its most extreme point, this pool will be reduced to a mud puddle. The water is now murky with algae and mud, but the strongest of the fish and

tadpoles survive by gulping oxygen rich water near the surface of the pond. Most nearby pools in the stream have dried, so an abundance of water bugs have moved into this pool. So too have Sonoran mud turtles that are now feasting on the smorgasbord of easy prey. The leopard frogs sit nervously at the water's edge, ready to escape predators by diving into the opaque water or by leaping from the pond into the thick deergrass that is now a good 4 feet above the water itself.

The remains of a large frog are lying in the sand at the edge of the pool where a raccoon left it after feasting on the best parts. It is a nonnative bullfrog that had left the golf course pond nearly 5 miles away, following its unbelievably keen senses up a dry arroyo to seek out water. When it arrived at the pool, it was able to rehydrate and rapidly grow by eating some of the leopard frogs, a small turtle and the occasional bird or rodent that approached the pond to get a drink. But in the end the bullfrog was too large to hide from the predators that frequent the ever-shrinking pool.

If the aquatic species are lucky, the summer rains arrive before all the water in the pool disappears. When the rains do come, it is in the form of a violent thunderstorm bringing heavy rains and flash flooding. Within minutes, the drying streambed swells from a few scattered stagnant pools to a raging 9 foot deep muddy river.

The frogs, turtles and many of the insects will have left the pool for high ground at the first rumbles of thunder and heavy drops of rain. As the flash flooding wall of water hits the pool, fish and tadpoles are swept downstream. Most tadpoles die in the flood event but the strongest fish are able to make their way to the edges where they find slow eddies. They ride the rising water line regrouping with others of their species. In just a couple hours the water starts to retreat. The groups of fish work their way down with the retreating water line careful not to get stranded in the shallows.

But soon, the river of floodwater will become a slowly retreating stream of crystal clear water. The fish make their way through the shallow riffles to the deepest parts of the stream, instinctually knowing which pools will be the safest place to wait for the next rain. The frogs and turtles will seek out the pools with the most hiding places. The flood swept away the algae and left the pools clear as glass. They will rely on rock crevasses and deergrass to hide from their predators now.

The flooding and drying cycle will continue through the rest of the summer until the temperatures cool. As fall arrives, the nearby canyon hackberry and mesquite trees will go dormant and stop taking up water. With extra water from the trees and the cooler temperatures reducing the amount of evaporation, the stream now flows from pool to

pool and the fish become very active through the heat of the day as they make their way around searching out warm sunny shallows. The turtles have dug into deep rock crevasses to hibernate until the warmer months of spring.

Considerations for Native Ponds

(photo of desert pond)

Whether you are considering building a native pond or converting an existing pond, here is a list of things you should consider:

- How will I obtain permits to keep native plants and animals?
- Where can I obtain native plants and animals?
- How much water will a pond need and what will that add to my monthly water bill?
- How will I keep out nonnative species?
- Will my pond attract mosquitoes?
- What will become of my pond if I ever sell my house?

How will I obtain permits to keep native plants and animals?

Special permits are required for taking native plants and animals from the wild and keeping them in your pond. For example, the longfin dace, a native stream fish that does well in ponds with moving water, is protected by the state of Arizona. You will need to apply to the Arizona Game and Fish Department for a Wildlife Holding Permit without any guarantee that you will be granted one. With federally protected species like the Gila topminnow, it gets even more complicated in that you will also need to apply for a Safe Harbor Agreement without any guarantee that it will be granted. If your permits are granted, you will be required to file an annual report to document the status of the fish population and a state biologist will need to deliver the original fish to your pond and make periodic visits to add new fish and monitor habitat conditions. Each pond the state issues permits for, generates hours of workload obligations for their employees, its no wonder they don't like to issue these permits.

How much water will a pond need and what will that add to my monthly water bill?

Evaporation rates for Tucson are 100 inches per year. A typical 10 foot by 8 foot pond will roughly loose 5000 gallons per year to evaporation. At current 2009 Tucson water rates, that will add around \$40 per year to your water bill.

How will I keep out nonnative species?

If your pond is isolated enough, you might not ever get invaders but chances are there is a source population closer than you think. Make sure storm water does not flow into your pond. To protect your pond from invasive animals, build a barrier to keep them out. If the yards already walled in, retrofit all openings like gates and drainage holes with ¼ inch metal mesh. Walls will need to be at least 4 feet high and smooth textured. As a less expensive option, a fence can be erected out of ¼ inch hardware cloth, **(Figure)**

Even a pond with a tight barrier will need to be monitored regularly especially during the late Spring and mid Summer months. Bullfrogs can be identified by the males call, a deep “br-wum” and both sexes usually let out a “PEEP” when startled as they plunge into the pond. Set a spotlight at an open end of the pond at night. The frogs in your pond will gather around the light to eat the insects attracted to it and can be easily approached from behind the light allowing for close observation. Keep a watchful eye on the pond when using the spotlight since predators might also take advantage of the easy approach to the frogs.

Mosquito fish and crayfish can sneak in with pond plants. Take great care in transferring anything to your pond that might have been exposed to invasive pests. Keep a close watch on the fish in the pond watching for any individuals that might be of a different species and use a flashlight at night to look for night active crayfish along the edges.

Will my pond attract mosquitoes?

Mosquitoes are attracted to moisture and lush aquatic plants. Your pond will be a mosquito magnet and due to human health concerns it is necessary to incorporate mosquito control in all manmade aquatic habitats. Native fish are the preferred method with topminnow species (*Poeciliidae*) most efficient. The most available species in our area, the Gila topminnow (*Poeciliopsis occidentalis occidentalis*), is federally protected making it difficult to obtain. A good alternative is the less protected longfin dace (*Agosia chrysogaster*) but dace require moving water and are more susceptible to water quality issues. Under no circumstance should the nonnative mosquito fish (*Gambusia affinis*) be used. This invasive fish will eat frog eggs, will eliminate native fish and is a major threat to aquatic wildlife worldwide.

As an alternative to fish, “Bti”, (*Bacillus thuringienis* ssp. *israelensis*), are bacteria that infect and kill mosquito larvae. These bacteria are highly selective, killing only

mosquitoes and their close relatives like gnats and black flies. Formulations of Bti will only kill these types of insects and do not harm other kinds of insects, fish, birds, worms or any mammals. Bti is available locally in hardware stores and ranch supply stores in a doughnut shaped dunk or as granules.

What will become of my pond if I ever sell my house?

With such great potential for a native pond to get taken over by nonnative species, long term plans need to be considered. In the event that the pond is no longer cared for properly, it could quickly become a breeding habitat for problematic plants and animals. It is for this reason that you should consider filling in your pond if you end up vacating your property. The State wildlife biologists can help you relocate any protected organisms to new habitat or facilitate moving the plants and animals to your new property.

Never release wildlife or plants into the wild. Introductions of plants and animals have a terrible track record of unintended results. Captives are often exposed to diseases that could wipe out an entire wild population. For this reason the Arizona Game and Fish Department has developed a complex procedure of disease screening and environmental assessments for releasing wildlife into natural areas.

Building a Native Pond

A native wildlife pond can be as simple as a shallow rainwater catchment for rainy season toads or a full-blown lake with a flowing waterfall and stream. Due to the problems mentioned earlier about keeping unwanted invasive species out, we encourage people to think long and hard about building a new pond. Your pond might some day, perhaps under the control of a new owner, become a nuisance pond harboring invasive species that could harm local wildlife.

Perhaps a good compromise would be to keep your pond simple and small to make it easier to maintain and easier to disassemble in the event you decide to sell your house.

We've purposefully avoided going into details about materials and construction methods. There are many new products every year available locally and on the Internet and many different construction techniques. Do It Yourself books are readily available or hire a contractor. Instead we will supply you with basic guidelines for the design and habitat based structure of the pond.

Rainy Season Toad Pond (pond photo) (toad photos)

The simplest design is a shallow depression to facilitate toad breeding and to supply drinking water for wildlife. Our desert toads are not true frogs; they don't need permanent water to survive. They spend dry seasons under ground and when summer rains come, they have explosive breeding events at favored water holes where their eggs will hopefully have enough time to hatch and turn into baby toads before the pool dries up. If you live on the outskirts of town or near an urban wash, you will likely have a toad population nearby. Listen for the calling males on rainy nights. Some desert toads like the Great Plains toad, *Bufo cognatus*, are quite loud and could keep your family or your neighbors up at night. If you identify your neighborhood toads to be of the more quiet variety like the spadefoot's or the Sonoran Desert toad, you might consider building a toad pond.

Due to noise considerations, locate the toad pond well away from the sleeping areas of your home and your neighbors. A toad pond should be in a sunny location, about 2 to 3 feet deep and at least 5 feet in diameter with gently sloping sides to avoid trapping toads or other small animals that might end up in the water. Add 4 or 5 inches of rocks, gravel, sand and dirt to the bottom of the pond. If javelina or dogs will be visiting the pond, add extra rock to the shallows to protect the liner and to make it less attractive as a mud wallow.

The pond should be stagnant, without moving water. It should be temporary and let to dry during the winter months. This will avoid a buildup of aquatic predatory waterbugs that will feast on the toad tadpoles. A liner or concrete surface will help hold the water; you will need to keep water in the pond for most of the months of July and August to allow the tadpoles time to transform into baby toads. Plant a few clumps of deergrass, *Muhlenbergia rigens* around the perimeter of the pond to add some cover. If you want to avoid irrigating any plants, use stick piles and rock piles around the edges and in the shallows so tadpoles have protection from predators.

With the first strong summer rains, fill the pond, if it didn't fill on it's own. Add Bti mosquitoecide to the pond to keep mosquitoes from breeding. Be patient, it might take a couple years for the toads to find your pond but in the mean time it will surly become a great bird watching sight.

The Simple Frog Pond (photo)

The next simplest pond would be a permanent pond without moving water. Always locate ponds in open areas away from over hanging tree branches. This will help in maintenance when the trees drop leaves or bean pods that can dangerously alter the water quality of the pond. Make the pond deep enough to allow for a 6 inch layer of sand and dirt substrate in the bottom. This will give the plants something to root into and will allow for beneficial bacteria and microbes to help maintain water quality.

Without circulation, water quality and filtration is left to the plants and microbes.**(photo of submerged plants)** Your pond will need to be heavily planted with good oxygenating and filtering plants like Stonewort, *Chara* spp. and coon's tail, *Ceratophyllum demersum*. Avoid disturbing the bottom substrate as noxious gasses and chemicals that are a natural part of decomposition will be released into the water and could be harmful to fish. Goldfish and koi are not recommended for this kind of pond, when they grow large they will constantly stir up the bottom muck and uproot plants.

The Recirculating Pond (photo)(diagram of bio filter)

A recirculating pond is equipped with a pump that moves the water continuously. The moving water should be directed through some sort of a biological filter medium. The concept is simple; in nature a stream flows through rocks and gravel. The surface of the rocks and gravel is the medium for algae and microbes that can only grow in oxygen rich moving water. These plants and microbes feed on the nutrients in the water removing the harmful components. The plants in the pond are much more efficient at filtering the water when it's moving as well.

A good design for a recirculating pond is to pump the water from the pond into the head of a stream. This is often done incorporating a waterfall of some type. The water then moves down a small stream flowing into the pond to complete the cycle.

The pond should have deep places with some large rocks for the fish and frogs to escape predators and some sunny shallows for them to warm up during cold seasons. Position the water intake, where the water leaves the pond and enters the pump, along a steep shaded bank where the baby fish and tadpoles will spend less time and be less likely to be sucked into the pump. For native frogs, stack slabs of concrete or flagstone with 1 inch spacers along the shoreline that gets the most sun exposure. Angle the slabs slightly so the crevasses between the slabs have air pockets where the frogs can hide for extended periods of time. These pockets will protect sluggish frogs on cold winter nights when they are extra vulnerable.

If stream fish like longfin dace, *Agosia chrysogaster*, are to live in the pond, supply them with clean wash sand in the stream pools and where the stream flows into the pond. They will use these areas to lay their eggs. Each year it will be necessary to replace some of this sand with clean sand to encourage more breeding.

Converting an Existing Pond to a Native Pond

Perhaps you already have a pond that contains non-native species such as goldfish, bullfrogs, and non-native plants - but you want to "go native" and convert your pond to native species. Even if you can't get permits for native wildlife, there are ways you can make your pond more ecologically friendly.

Removing Invasive Species

The first step in converting a pond to native species is to eliminate the non-natives. The most drastic but effective measure is to consider drying the pond. May and June are our driest months and the best time to dry a pond. If any of the species in your pond are mobile, like bullfrogs, turtles and crayfish, you will need to set up a perimeter fence to contain them and make arrangements for their removal. Contact the Arizona Game and Fish Department, Invasive Species Coordinator at (623) 236-7600 or the University of Arizona, Department of Ecology & Evolutionary Biology (520) 621-3187 for help in placing these animals where they will not do any more harm. As the plants are drying, remove them and haul them off to the county landfill.

If individual species are your target, you might be able to try some less drastic alternatives to drying the entire pond.

Removing Nonnative Turtles

Turtles like red-eared sliders and painted turtles are commonly found in urban parts of the southwest and are frequently finding their way to our wetlands. Turtles can be easily attracted to traps with bait such as canned tuna. Turtle traps can be purchased online. If the pond is small, try lowering the water level and then you should be able to net the turtle with a dip net.

Removing Crayfish

Crayfish removal requires a thorough drying of the pond and surrounding soil. Dry the pond in early May and keep dry until the rains come in July. All plants in the pond should be removed. Crayfish will burrow into the soil around the perimeter of the pond so any

holes should be searched out and dug-up. Keep watch on the pond as the water is being removed. Gather any crawfish that try to leave the pond. Crayfish can be easily killed by freezing over night.

Removing Clams and Snails

Aquatic Snails can be beneficial to the native pond by consuming algae. Snails will hitchhike on the plants you acquire and are almost unavoidable. There are invasive species of snail like the New Zealand mud snail that are very difficult to tell apart from native snails and very little information on other common snail species. There are a number of introduced species of fresh water clams that are of major concern over their impacts on wildlife so it's best to avoid all clams and avoid distributing your snails unless you are positive they are native. Drying the pond is the only practical way to remove either mollusk.

Removing Bullfrogs

If the pond is not too large, bullfrogs can easily be removed, but their tadpoles present a challenge. The frogs will attract to a spotlight if the light is left on for several consecutive nights. Set up the light at the edge of the pond, aimed at the water, along an open shoreline where you can easily approach from behind the light. The blinding light will hinder the frogs ability to see you and you should be able to get close enough to net them. Some will get away and become wise to your technique so leave the light on for a few nights before you try again. Some pond owners in rural areas prefer to use a BBgun for bullfrog removal. BB's are nontoxic and unlikely to puncture a pond liner but injuring or killing the frogs is not for the faint at heart. If a captured bullfrog needs to be destroyed, the most humane way is to bag it and throw it into your freezer overnight.

Search the edges of the pond and plants for egg masses (**figure??**). When removing egg masses be aware that very small tadpoles might be emerging from some of the eggs. These helpless black "slugs" lie on the bottom of the pond under the eggs, unable to swim for the first few hours. These very small tadpoles can be easily gathered in a fine mesh aquarium net. The eggs will be quickly destroyed if allowed to dry in the sun. Any tadpoles that might emerge from the eggs as they dry will not be able to get to the water and will quickly succumb.

Free-swimming tadpoles in the pond are much more difficult to catch. Funnel shaped minnow traps can be purchased at sporting goods stores. These traps can be quite effective at catching tadpoles and fish without the use of any bait. Without drying the pond, it will be close to impossible to get all the tadpoles. Try lowering the water level to help in the removal effort. You can also try waiting a year or two for the tadpoles to

transform into young frogs and then revisit the spot light strategy.

Removing Fish

Fish are even more difficult than tadpoles to remove as they are much quicker and the tiny babies and eggs are almost undetectable to the human eye. However, in relatively small ponds, persistent efforts to net and trap out fish have proved successful. Employ the minnow traps mentioned in the tadpole section, retrofit the traps with window screen if the mesh is too large to contain the target fish species. Try baiting the traps with a few pieces of dry dog food. Along with the trapping, you will need to spend a lot of time stalking fish with a net around the edges of the pond. Lower the water level to isolate the fish from dense vegetation. Try using a headlamp or flashlight at night to see and net the fish. Just when you think you've gotten the last one, there will probably be very small babies hiding out so wait a couple weeks and do it again.

Fish also can be humanly dispatched by freezing or donated to a zoo or university.

Obtaining Native Species

The permit problem

After you have removed non-native, invasive species, the next step is to encourage natives to come to your pond. Because it is very difficult to obtain a permit to keep native wildlife, your best bet is to setup a native plant pond, keep it native species friendly in anticipation of someday being granted that permit, and hope that, with invasive predators at bay, native wildlife will find a safe haven at your pond. Expect birds like warblers and cooper's hawks to frequent the pond. Dragonflies and damselflies will quickly settle in. Native frogs and turtles have been known to find their way to backyard ponds. Species that arrive on their own do not require a State Wildlife Holding Permit.

Native plants can be acquired through local water garden clubs or ask your State Game and Fish department if they can put you in contact with someone who manages ponds with native plants. The plants need annual thinning so pond owners should be more than happy to share some of the excess.

As an alternative to fish for mosquito control, "Bti", (*Bacillus thuringiensis* ssp. *israelensis*), are bacteria that infect and kill mosquito larvae. These bacteria are highly selective, killing only mosquitoes and their close relatives like gnats and black flies.

Formulations of Bti will only kill these types of insects and do not harm other kinds of insects, fish, birds, worms or any mammals. Bti is available locally in hardware stores and ranch supply stores in a donut shaped dunk or as granules. Once the pond becomes established with predatory aquatic insects, mosquitoes will have a hard time in the pond and Bti will be less necessary.

Even if you apply Bti, your neighbors may have concerns that your pond could be a mosquito hazard. For this reason, you may need to introduce nonnative fish that do not require a state permit or maybe you just want to have fish in your pond. Do not under any circumstance introduce “mosquito fish” into your pond because they can be easily established in the wild, where they harm native fish.

Goldfish are very good at eating mosquitoes, inexpensive, can be easily observed and are less likely to survive in the wild if flushed out of your pond. Goldfish are also a little easier to get rid of than other species. The tiny “feeder” goldfish you buy at the pet store can grow to 9 or 10 inches in a few years. The larger fish are less adept at catching mosquito larva and spend most of their time foraging for food in the muck on the bottom of the pond and can be a nuisance as they uproot your plants. The constant disturbance of the muck will cause frequent algae blooms better known as “pea soup”. It’s best to get rid of the large fish and try to maintain a population of smaller ones.

Perhaps a safer alternative would be to use feeder guppies from your local pet store. Guppies will thrive in your pond all summer and are very effective at eating mosquitoes. The guppies will not survive cooler water temperatures so move a number of the fish to an indoor aquarium for the winter. In the spring as the pond warms, you can reintroduce the fish back into the pond if you desire.

Many exotic fish harbor diseases that could be harmful to native fish. Be sure to allow your pond to sit without fish for a season before introducing native fish to a pond that had formerly housed exotics.

Obtaining Native Plants

Most aquatic plants are aggressive growers. Avoid the most aggressive plants and never plant nonnative varieties. Aquatic plants at retail stores or from ponds with nonnative species will likely be harboring eggs or young of pest species that could take up residence in your pond.

Try to locate a local plant source for plants native to your area. These plants will be better

adapted to your pond. This is difficult since most wetlands are protected and state law protects all native plants. Contact the preserve manager and get permission to remove a set number of aquatic plant parts or seeds. Most aquatic plants can easily be grown from cuttings. By only removing a few pieces of the original plant, it should recover rapidly leaving little evidence of disturbance at the site.

Contact your Game and Fish Department or ask around at water garden club meetings to locate other ponds planted with native plants. Most established ponds are regularly thinned to prevent over growth, this can be an excellent source and requires no permit.

Edge plants like deergrass, *Muhlenbergia rigens* are readily available at local plant nurseries that specialize in native plants. Deergrass can be planted in the pond, at or above the water line or just outside of the pond. If planted outside of the pond give it supplemental water once or twice a week.

Native Plants to Avoid

- Here is a list of native riparian plants that have shown to be problematic in Southern Arizona ponds:
- Horsetail, *Equisetum* spp. (aggressive grower)
- Devils beggarticks, *Bidens frondosa* (abundant seeds clog filters and hook into nose and mouth parts of fish)
- Common cattail, *Typha* spp. (aggressive grower)
- Bulrush, *Scirpus* spp. (aggressive grower)
- Waterlily, *Nymphaea* spp. (aggressive grower)
- Duckweed, *Lemna* spp. (aggressive grower, clogs filters and pump, chokes out sunlight)

Recommended Plants

Here are a few riparian plants common to southern Arizona streams that have been successfully used in frog and fish ponds in Tucson:

- Spike rush, *Eleocharis* spp. (select the smallest species and plant along edges)
- Marshpennywort, *Hydrocotyle* spp. (forms floating mats in shallows)
- American speedwell, *Veronica* spp.
- Stonewort, *Chara* spp. (oxygenator, macrophytic algae, grows densely from bottom of pond, easy to thin out)
- Common monkey flower, *Mimulus* spp.
- Yerba mansa, *Anemopsis californica* (plant along shaded banks)

- Deergrass, *Muhlenbergia rigens* (plant along banks of pond for shade and cover and near pond with supplemental water)