

Pond / Watergarden Science

by **babair** on May 27, 2008

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Author: babair [author's website](#)

I'm trying to be all things to all people. :-)

Intro: Pond / Watergarden Science

Would you like to exert god-like control over an environment and its resources? Well, you should get a pond.

By adding even a small watergarden to your property, you can learn lots about the fragile balance of a vital ecosystem. To ensure a healthy biodiversity, you will need to monitor and manage many different variables.

Over time you will also develop positive personality traits like humility and patience, since nature works on its own timetable and to its own set of priorities.

Owning a pond can be a lot of work, but extremely rewarding.

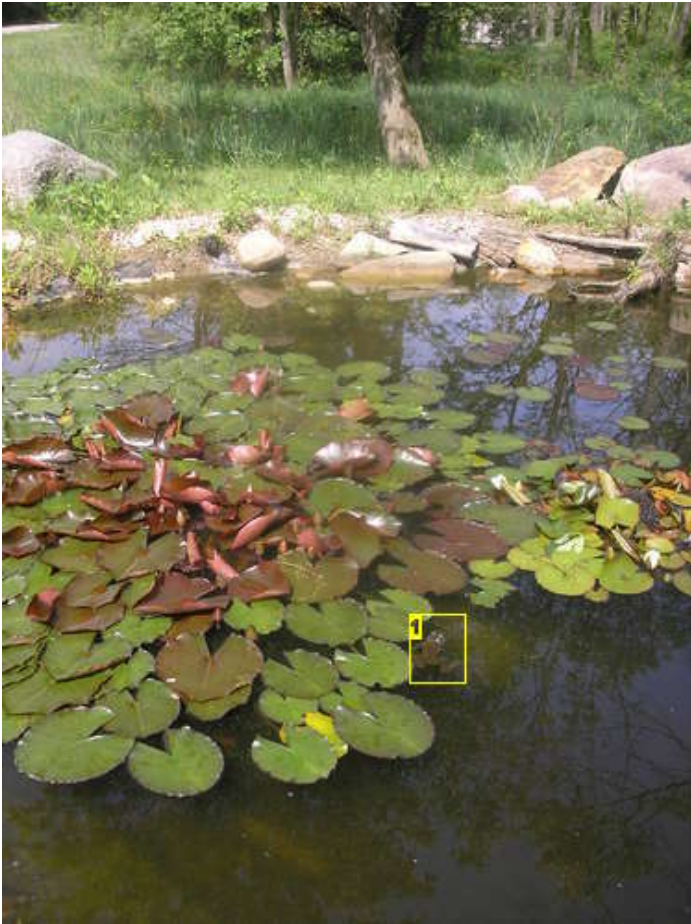


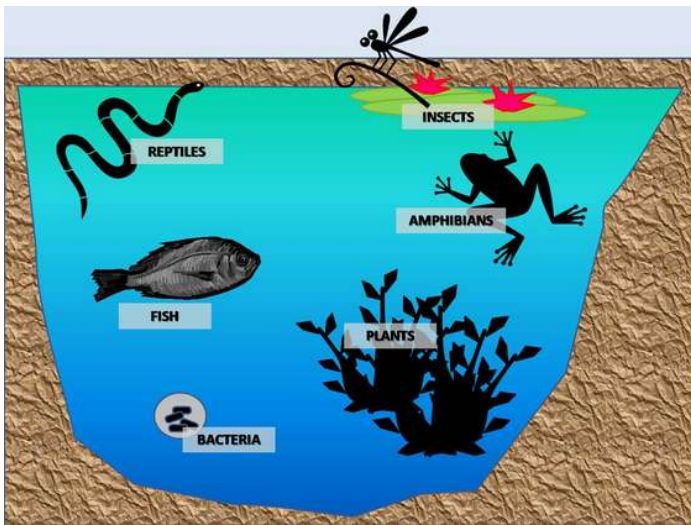
Image Notes

1. ribbit

Step 1: Lesson 1 - Biodiversity / Pond Residents

Once you add a pond or water feature to your property, you will be amazed at how quickly you become the popular neighborhood hot spot for critters. Everybody loves water.

However, with great gifts comes great responsibility. If you invite all of these creatures to your house, you'd better be ready to be a good host.



Step 2: Lesson 2 - Lifecycle / Spotlight on Fish

One pond resident that will take up the most of your attention is your fish.

For relatively small animals, they are needy, needy, needy. From day one, they demand your attention and care. Here are some considerations for the health and comfort of your fish.

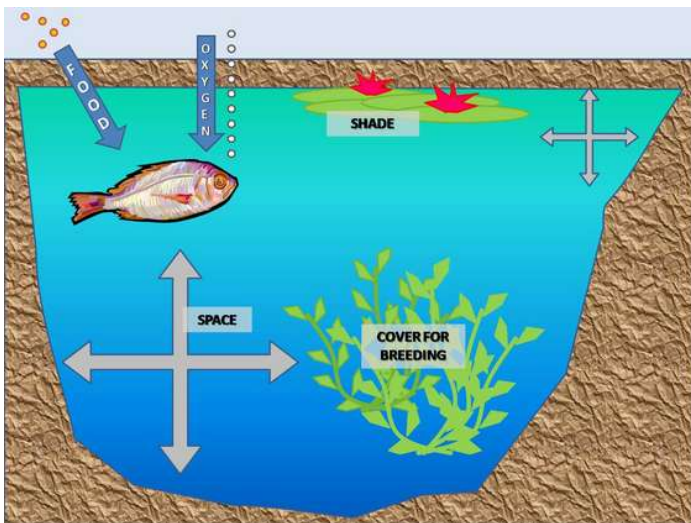
FOOD - Pond fish are luckier than their aquarium brethren. There are lots of interesting things to eat just floating around: algae, plants, insect larva, etc. But you probably want your fish to have a better quality of nutrition. Also, a well-fed and healthy fish will be more resistant to disease, temperature changes and other natural hazards.

OXYGEN - Fish get oxygen from two sources: the surface and vegetation. If your fish are always at the surface "sipping" air, you need to put in more plants.

SHELTER - On the one hand, outdoor fish are particularly vulnerable to predation. On the other hand, a natural environment makes them frisky so that they breed. You need to give your fish some shelter for both reasons. Floating plants will provide shade and concealment from birds and fish-eating mammals, like raccoons. Submerged plants will give the fish somewhere to spawn and also protect the fry from being eaten by other pond residents.

SPACE - Fish will regulate their body temperature by finding warm and cool spots in your pond. If your pond is deep enough they can go to the bottom to hibernate through winter (here in zone 5, that's about 30-36" deep).

Oh, and one more thing about spaces. Think about the margins of your pond. Wading birds, like heron and egrets, love nice gentle sloping shorelines. They will stand ankle-deep and spear your pretty white and gold fish and thank you for making dinner so easy.



Step 3: Lesson 3 - Chemistry / Circle of Life

Your pond is like a petri-dish full of chemicals and critters-- all wound together in a tight cycle of interdependency.

You start the process when you toss your fish some food pellets.

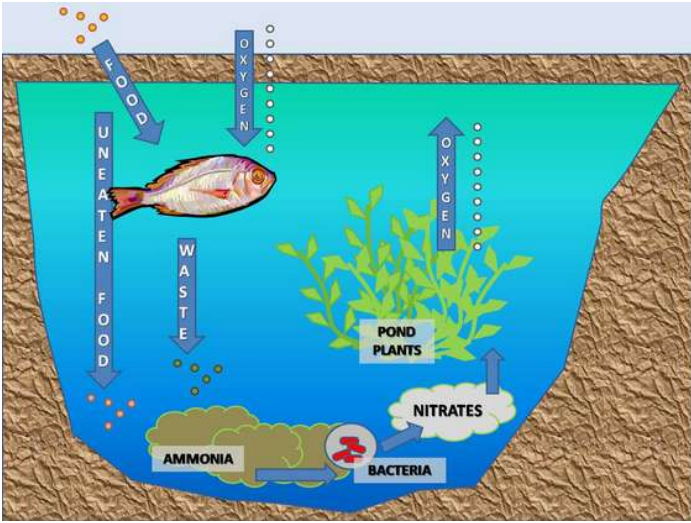
They eat nearly all but some pellets drop to the bottom of your pond. The fish add their own droppings. Leaves blow in, and they sink to the bottom. Pretty soon the bottom of your pond is an icky mess of brown slurry.

Well, it looks bad to you but anaerobic bacteria think its yummy. They start converting all of the waste to ammonia compounds.

Wait. Is that a good thing? Does anyone like ammonia? Yes, as a matter of fact, more (aerobic) bacteria come along and convert the ammonia to nitrites. And more bacteria convert the nitrites to nitrates.

Thank goodness for bacteria. Because now the plants can convert those nitrates to oxygen. Some of the oxygen is absorbed by the fish and some dissipates at the

surface.



Step 4: Experiment 1: Keep one Pond Resident alive for a year

Pick your favorite lifeform - animal or vegetable (minerals don't count for this one).

Pick an individual from your preferred species. This might be tough for frogs and fish since they move and grow. Biologists like to put tags on things for this reason. I've found that my fish don't enjoy being tagged, and furthermore, I try not to interfere with my study subjects. Look for some distinguishing marks, like peculiar spots or deformities.

Keep records on your pond environment and the appearance of your selected study subject.



Image Notes

1. Frog subject: Bud
2. Frog subject: Weis
3. Frog subject: Er

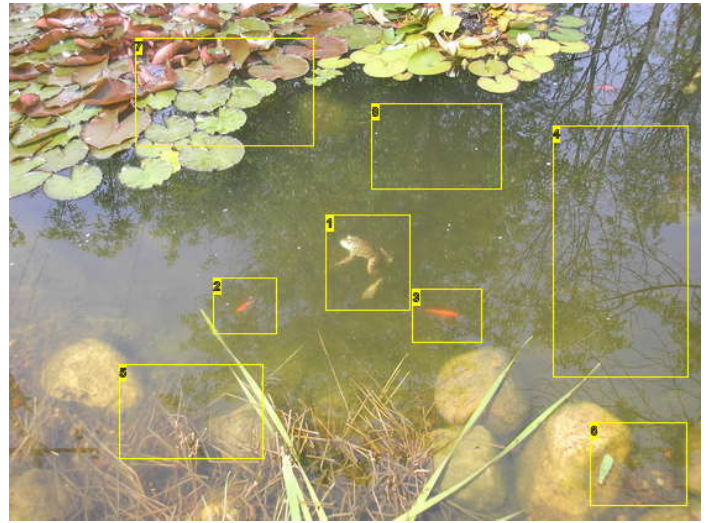


Image Notes

1. amphibian
2. fish subject: nemo
3. uncataloged fish
4. reflections of another world
5. tadpole nursery
6. bacteria grow here
7. shade and shelter from predators
8. hmmm.. why so green?

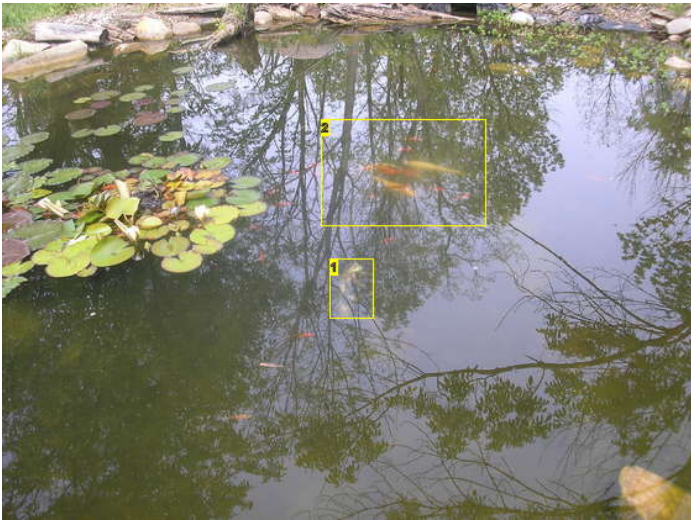


Image Notes

1. Bud
2. Main School: led by dominant Koi, Whitey. Other members of the group are Goldie and Spotty.

Step 5: Experiment 2: Breed another generation

One excellent indicator of the vitality of an ecosystem is whether it encourages reproduction of healthy offspring.

Frogs are fairly overt breeders and so make better study subjects for this activity. Here are some signs of breeding activity that you should be alert for.

BREEDING CALLS -- I always mark the start of spring from when I first hear the Peepers shrilly singing. A month later, the toads can be heard trilling. The bullfrogs are always the last to come to the party with their deep banjo-twanging and creaking.

VISIBLE MATING -- Like I said, overt. Toads will do it in broad daylight, and even let you take pictures and post them on the internet. Shameless.

EGGS -- Toad eggs come in strings, like in the picture. Frog eggs appear in masses.

TADPOLES -- Some shallow water is good for tadpoles, who like the warmth, the safety from swimming predators, and the availability of oxygen.

YOUNG -- One day all of the tadpoles disappear. They they don't call and they don't write. But if you look very carefully, you may notice very tiny creatures hopping around the margins of your pond. The ones in the picture are about the size of a housefly.



Image Notes

1. Hey baby, hey.

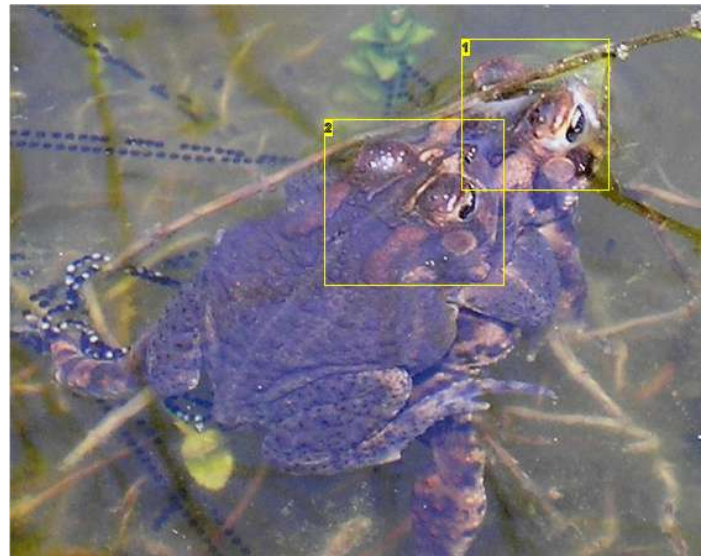


Image Notes

1. Pamela
2. Tommy Lee



Image Notes
1. Toad eggs



Image Notes
1. A few tadpoles



Image Notes
1. A lot of tadpoles



Image Notes
1. Swarms of tadpoles



Image Notes
1. baby toad

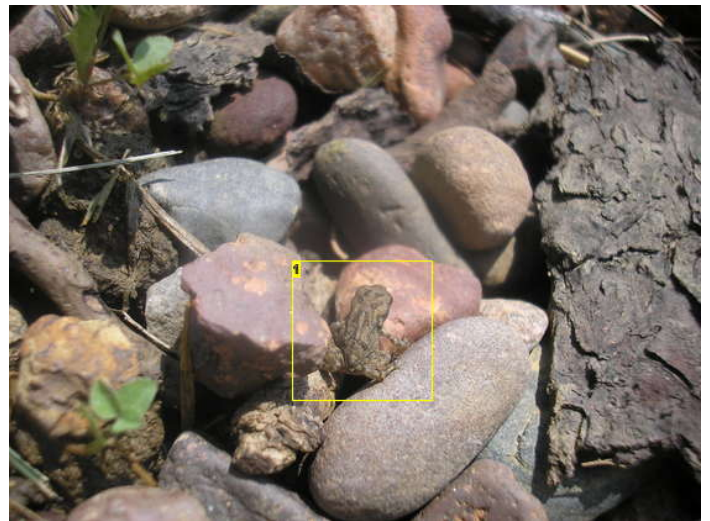


Image Notes
1. baby toad

Step 6: Experiment 3 - Get Certified

The National Wildlife Federation (nwf) will help you learn more about how to establish a sustainable ecosystem in your backyard by providing food, water, and shelter for animals.



Step 7: Experiment 4 - Save the World

It seems like a lot of people (and governments) have a hard time with sustaining the environment. Fertilizer run-off from farms contaminates streams, top predators are hunted to extinction and we put concrete and glass on the top of our most fertile real estate.

Think about how hard it is to keep one small pond in complete ecological balance all the time. Too many fish lead to too much waste and too much ammonia and your fish all die. Or maybe there's too much nitrates and you get an algae bloom that turns all of your water cloudy and green. Is cloudy water a problem for the fish or does it just offend your aesthetic nature? You fix one problem and it creates another problem.

What is your local government doing that is helping or harming the ecosystem that you live in? How does that affect other neighborhoods?

This instructible is part of my personal 'Knowledge is Power' campaign. You can help get this information to more people by COMMENTING, RATING and VOTING now :-)



Image Notes

1. Think globally here.
2. Act locally here.

Related Instructables



Recreate a Vanishing Ecosystem : The Eastern Vernal Pool by Tool Using Animal



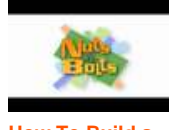
How to make a Garden Pond by andrewdpham3



Create a mini beast refuge in your garden. Logpile Habitat for International Day for Biological Diversity. by bosherston



Organic Hydroponics / Aquaponics by bhsx



How To Build a Frog Pond (video) by storyteller



Proper care of american toads (bufo americanus) by coolherps1

Comments

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WingsandFences says:

Great frog photos. :) We put a pond in last summer and the frogs alone are great entertainment. lol

Nov 8, 2010. 3:41 PM [REPLY](#)



nguoidanbadep says:

Oh my God, this is so interesting. You must be so proud. I am slowly building a pond myself, will definitely want to have something like this. Thanks for sharing this.

May 20, 2010. 3:30 PM [REPLY](#)



DragonX777 says:

We built a backyard pond before at Washington state, and suddenly we have frogs in our backyard pond. We even hear them croaking at night.

May 11, 2010. 7:23 PM [REPLY](#)



ladyfromthecoast says:

Hi again. With regards the ponds mentioned - the smaller one is only about 6 - 8 inches deep in places. In the summer it evaporates quickly (especially when we are not there although someone tops it up for us). We were thinking of building some sort of decking over the top of part of it which would shelter the fish and also (hopefully) stop some evaporation. Don't want to plant trees 'cos as Babair said, leaves will cause build up & we have enough of that now. This seemed the better option. Does anyone know if this will help?

Apr 7, 2010. 3:45 AM [REPLY](#)



ladyfromthecoast says:

Hi. Found this site and wanted to join as you guys seem to know your stuff. Bought a house in South West France and inherited 2 ponds (one converted from a huge round pool - must be about 6 feet deep). Frogs by the dozen (really noisy in spring) although great 'guard frogs'!! And fish.... can't stop them breeding. Must have around 300 last years babies in the big pond. I put some weed from the smaller pond into the bigger one - BIG mistake as it gave the babes somewhere to hide. I guess the pond will only sustain what it can. Does anyone know where I could re-home some fish though (near Cordes-sur-ciel SW France) Thanks.

Apr 7, 2010. 2:24 AM [REPLY](#)



Wasagi says:

AMAZING! Your pond is huge, to begin with. And did you have to add frogs, or did they just appear? Great instructable, five stars!

Nov 14, 2009. 8:57 PM [REPLY](#)



babair says:
THANKS.

The pond is approximately 20'x20' . I hired a fellow with a backhoe to excavate it. The deepest part is about 3' deep, and there are a couple of shallower shelves for marginal plants. The edges are designed to discourage herons and raccoons from fishing.

No, I didn't have to "add frogs". It was sort of amazing the way that they just showed up as soon as I put water in the hole. Before I put in rocks, or plants or fish, the frogs were there. The next closest body of water is a tiny creek about 200 feet away, so I guess that they migrated from there. But that seems like a pretty long (and dangerous) pilgrimage for a frog.

:-)

Nov 15, 2009. 6:11 AM [REPLY](#)



Wasagi says:

Hahah, that sounds like quite an adventure for a frog!

Thanks!

Dec 24, 2009. 7:21 AM [REPLY](#)



Khuwwa says:

Dec 18, 2009. 1:51 PM [REPLY](#)

This is an awesome instructable! I have wanted to make a backyard pond for several years now, but I'm waiting until I move to a more long-term dwelling.

Prospective pond-makers take note: you can help out your local environment even more by not putting in introduced goldfish. Fish-free ponds are much nicer for the native amphibian life, which is sadly dwindling in many areas!

I know most people prefer fish in their ponds, but consider one without fish, especially if there are endangered amphibian species near where you live. Your pond could be the only suitable breeding site for many kilometers around.



truemirror says:

Apr 12, 2009. 4:03 PM [REPLY](#)

so amazing, it reminds me of the time I spend at a beaver pond, it started as a tiny small creek/spring running through a mountainous forest, after the beaver stopped up the crick, than the ducks and storks brought in fish, turtle, frog eggs and pond weed in on their feathers, than all wild life start making paths to the pond where normally there wouldn't have been a body of water, than new types of plants start to grow where before it would have been too dry. I once made a small pond using a bucket, and before I knew it it became a wild life watering hole along with snakes, turtles frogs and of course I put in one small gold fish to eat the mosquito eggs. It still amazes me. after reading this article I think I will try something bigger.



A good name says:

Jun 19, 2009. 10:45 AM [REPLY](#)

I'm very interested in this bucket pond... I don't have the room to make a full pond to put in my backyard (well I DO, it's just much too close to everything else) and I'm considering trying something like that... Out of curiosity, what sort of bucket did you use, and how big? Did you ever need to feed your fish?



truemirror says:

Jun 19, 2009. 2:54 PM [REPLY](#)

The bucket pond I did, I got a deep black bucket from the automobile department at the store. I dug a hole deeper than the bucket, dropped the bucket in, filled it with water, placed heavy stones around the rim, some sticking over to hide the rim, and then one in the bucket so birds could stand on it, after letting nature take its course to condition the water, I added a few small gold fish, the ones that survives the animals and elements usually will live through the winter, or you can bring it inside, gold fish won't grow bigger than their environment. I let some leaves fall in and allowed it to go murky, soon though nature takes over and it clears up, it rains a lot so I didn't have to worry about refilling it too much, I fed the fish everyday in the beginning. or when there isn't a lot insects, and planted herbs around it. The deeper the bucket the better survivor rate for the fish from animals and winter. It's not too impressive but gave me a little corner in life to sit, watch and enjoy. not too good if you have children though, they may step in it. Or a if you have a huge dog he can drain it in one day.



A good name says:

Jun 20, 2009. 7:56 PM [REPLY](#)

Hmm... this is interesting. I wonder if I could go ask the elementary school I used to go to if they have any of those desk bins... If they do, I'm in luck :)



truemirror says:

Jun 24, 2009. 9:21 AM [REPLY](#)

Do an instructable on it, I'd love to see how your little pond turns out. :) (is a desk bin deep enough? maybe a food bucket from dunkin donuts lined with black plastic? though you would want it wider, or maybe one of those huge industrial mop buckets just a thought, check out the thrift stores) keep us informed.



A good name says:

Jun 25, 2009. 2:07 PM [REPLY](#)

Nah I figure a desk bin should be big enough for frogs... that's all I want it for, but since my dad's doing construction outside right now, I'm going to have to wait until it's all done.



clockworkdoorbell says:

Mar 21, 2009. 11:32 PM [REPLY](#)

Great Instructable. Can I ask about sun/shade balance? We've thought about putting a small pond in, but reckoned that it wouldn't get enough sunlight.



babair says:

Mar 22, 2009. 8:08 AM [REPLY](#)

Yeah, that can be tricky. Because too much light will encourage an algae bloom that will take over your pond. And if you have shade trees, the leaves will drop into your pond and create too much decaying matter that will change the biological balance. The usual rule of thumb is that you need about 6 hours of good light daily for shade-loving plant growth like hostas. If you have more hours of daylight than that, you can consider other types of flowering plants.



iya says:

Jun 10, 2008. 6:12 AM [REPLY](#)

you are clever and a joy to read...do you know if fish could survive the winter in Regina, Saskatchewan, Canada that is...Thanks so much!!!



NobodyInParticular says:

Mar 1, 2009. 11:56 AM [REPLY](#)

What if you located the pond over your sewer line? A hot shower and some dishwashing every day, in addition to heat from decomposition, might keep the pond warm enough.



babair says:

Jun 10, 2008. 7:18 AM [REPLY](#)

I am ashamed to admit that I had never even heard of Regina, SK until now. Looking at a map, I see that you're pretty far north. The important thing is to keep the water from freezing completely. The fish can live in very cold water, if it's liquid. You can achieve this by a) making the pond so deep that it can't freeze solid, and b) using a heater or bubbler to keep a portion of the surface ice-free.



iya says:
do you know what kind of fish, i don't want frogs because i run a daycare, thanks!

Jun 10, 2008. 2:59 PM [REPLY](#)



babair says:
I love the idea of little kids learning about nature from your pond. Be sure that you never let them near it unsupervised though, especially since it's going to be pretty deep to keep from freezing solid in the winter. It might be hard to keep frogs OUT of your pond. They tend to just show up wherever there's water. I don't know how they do it. It's sort of amazing. Anyway, you can buy any kind of cheap (comet) goldfish they sell. They cost \$.20-\$.60 a piece here in Ohio, depending on where you get them. If you manage to keep them alive for a whole year, you can invest a little more by getting shubunkins or sarasa (a fancier type of goldfish). If you keep those alive, you can try koi. Even small koi are \$15 here, so don't buy 'em unless you're pretty sure that you won't kill them. :-)

Jun 11, 2008. 7:49 AM [REPLY](#)



estuvam says:
where do you get your Koi? i live in columbus and a friend of mine has expressed and interest in getting some.

Apr 30, 2010. 4:00 PM [REPLY](#)



babair says:
There are lots of places around Columbus to get cheap and/or quality koi. I recommend Aquarium Adventure, because they have a nice selection in every price range.

Apr 30, 2010. 4:46 PM [REPLY](#)

But if you are northeast, try the Sunbury Garden Center. They even have tadpoles!



JOEDUPONT says:
I just bought some 12 cent comet goldfish from pet smart in Watchung, NJ and brought them up to PA. I have them in 5 gallon buckets with watercress in my greenhouse. I doubt the water will freeze inside. It would seem that the plants will love their fish buddies.

Jan 5, 2009. 5:13 PM [REPLY](#)



killarowa says:
whats the difference between regular frogs and "aquatic" frogs? do they not come out of the water at all or are all frogs considered "aquatic"? I must be missing something..... Did you dig out your pond by hand and shovel? How big is it? Do you use a pump or just keep close eye on vegetation/bacteria levels? Whats the max depth of your pond? Whats the dealio with the lily pads? transplanted them from another pond? And i think ive heard before, that if your water is too green/murky add some hay, im guessing so it can rot, sink to the bottom (or float around till you pick it up later) and produce oxygen.

Jun 17, 2008. 5:02 AM [REPLY](#)



DIYDragon says:
Those 'aquatic' frogs; if they're the pet store variety I think you mean don't come out of the water. They're pretty cool little critters though - And grow large if you have a big space. I bought some for my Dad's pond, and they are quite impressive specimens now when you see them! It's hard to catch a glimpse sometimes though, because they're very good at hiding. :)

Dec 16, 2008. 2:21 PM [REPLY](#)



babair says:
That's a lot of questions! Aquatic frogs... I dunno. The ones in the pet store don't seem to need a place to sit and breath air. My current pond is 20'x20' by 3 feet deep. There were too many rocks for us to get very far with a shovel. So I had a fellow with a back hoe dig it. Then my husband I and I shaped it, and put in the rocks and plants. I have a pump and a waterfall that keeps the water circulating (and sounds pretty). There's a mesh mat that keeps leaves and algae out of my pump. But most of the water conditioning comes from the biological balance. Got the lilies from a watergarden store. It was late in the season, and they were on sale. What you see in the photos is the result of being in the same location for three years. You can add barley 'straw' to your water and it does help some. It's supposed to float though, not sink. Basically it introduces desirable bacteria to your pond and gives them a habitat. Only barley straw works though. Don't use hay. :-)

Jun 17, 2008. 1:18 PM [REPLY](#)



goodfishfive says:
When barley straw decomposes it releases small amounts of hydrogen peroxide into the water. This small amount of hydrogen peroxide helps to keep algae levels down. Don't add too much or you'll potentially kill your beneficial organisms and bacteria. (Nice looking pond by the way.)

Jun 25, 2008. 6:12 AM [REPLY](#)



brabantia says:
Super cool instructable. I didn't know I wanted a pond before reading your article, now I've decided I'm going to get started on one this coming weekend!

Oct 22, 2008. 3:15 PM [REPLY](#)



babair says:
THIS weekend? Really? Do you live somewhere really warm?

Oct 23, 2008. 5:48 AM [REPLY](#)



brabantia says:
well not REALLY warm, but pleasant: south of France

Oct 23, 2008. 11:17 AM [REPLY](#)



babair says:
Well, according to my map, the south of France is still a bit north in the US. Although I don't know... I've never been south of Paris. Anyway, I'd recommend starting your pond in the spring, when the earth is softer and your plants and fish have time to get established before the first frost (which we had this week). :-)

Oct 23, 2008. 3:55 PM [REPLY](#)



bedeboop says:

Sep 6, 2008. 1:33 PM [REPLY](#)

I love this! How deep would you have to dig for Zone four, or is it feasible for Zone four?



babair says:

Oct 23, 2008. 5:48 AM [REPLY](#)

Sorry that it took me so long to respond. I had to search for this map. Click this link and look at page two of this document to find a frost depth map of the US. <http://www.usace.army.mil/publications/eng-manuals/em1110-1-1905/c-2.pdf#search=frost%20depth>

You need to make part of your pond at least this deep so that the fish don't freeze solid in the winter.

:-)



ronniedd says:

Aug 25, 2008. 1:28 PM [REPLY](#)

HELP!! I got the kids a paddling pool to discover it was full of tadpoles one day plus 2 other form of life. Reckon there are about 500 plus, have just let them be for the last couple of weeks. What should i do??



babair says:

Aug 26, 2008. 8:44 AM [REPLY](#)

Ronnie -- If you are absolutely sure that the creatures are tadpoles and not some sort of parasitic worm, they should die off on their own pretty soon. I mean, I doubt that you have all of the necessary ingredients for animal life in a paddling pool. How long have you let that thing sit anyway? :-)



ronniedd says:

Aug 28, 2008. 4:26 AM [REPLY](#)

im sure they are tadpoles,there does seem to be a worm like creature at the bottom and a lot of other more round ball shape creatures swimming about. It may have been lying a week or two unused but had very heavy rain on numerous occasions.



babair says:

Aug 28, 2008. 2:56 PM [REPLY](#)

Ohhhh Ronnie. I think that you have some nasty stuff cooking in there. If you love them, don't let your kids swim in that pool. But this might be a good 'teaching moment', if you can get a microscope. :-)



Aedh says:

Aug 15, 2008. 7:20 AM [REPLY](#)

Made a pond with fish, no filter or air pump similar to yours. But frozen ice-sheet is bad for fish here. Put clear plastic sheet over top of pond in winter, rocks ect. have to keep sheet super tight over top of pond. Never freezes below air is great insulator plants live and fish living over 3 years in central ny weather.



jacksteal4 says:

Aug 8, 2008. 1:29 PM [REPLY](#)

this is really cool



babair says:

Jun 15, 2008. 6:36 AM [REPLY](#)

I photographed a couple of this generation's baby toads this week, and posted the pics on step five. They are really, really tiny... about the size of a housefly. :-)



AndyGadget says:

May 27, 2008. 1:13 PM [REPLY](#)

I grew up with ponds but still haven't built one where I'm living now, even though conditions are ideal. You can spend hours upon hours by (and poking about in) a pond. I used to have names for the regular frogs and toads, and once spent the best part of a sunny summer's day watching a dragonfly nymph climb a reed stem, slowly break free from it's larval case, expand and dry its wings and fly away. Not time wasted at all - mind you I was a student at the time. Too many other pressures now (sigh).

BTW, you can embed links directly in text, like in my recent 'ible [here](#). Just click on the 'link' button.



babair says:

May 27, 2008. 2:07 PM [REPLY](#)

Yeah, its pretty fascinating, and there's something new every day. Two years ago I tried to raise some of the tadpoles in an aquarium in the house. It did not work very well at all. I could not maintain the proper balance of temperature, food and water quality for all of the stages of frog development. It was a great lesson in humility and the dynamics of a 'natural' ecosystem. Never saw a dragonfly being born tho. :-) p.s. I fixed the link, but I had to do it manually. The 'link' button doesn't work on my browser.



AndyGadget says:

Jun 1, 2008. 1:50 PM [REPLY](#)

I've never seen it happen, but I've read that if (common frog) tadpoles start to run short of food they change from vegetarians to carnivores and start to devour their siblings. Good sense survival-wise (for the winners), but a bit gruesome. Higher temperatures will drastically speed up development. I've seen this in a local pond which was drying up. The tadpoles there raced ahead of other permanent ponds in the area and were full froglets by the time the pond turned to mud.



babair says:

Jun 2, 2008. 8:04 AM [REPLY](#)

Yeah, that's what happened with my tank. I had pulled a lot of algae from the pond, but I don't think that it was the right vegetation at the right time. By the time I realized that I was having a problem, it was too late to fix. And then my fixes started creating other problems. Ultimately, I did get a couple tiny little toads, about the size of a pencil eraser. But of course I didn't have anything to feed them either. Exasperating. I finally put everything (rocks, water, plants, critters) back in the pond. Where they all promptly disappeared. I choose to believe that they all found happy homes.



gordokury says:
excellent, thanks for posting

May 31, 2008. 3:34 PM [REPLY](#)



SamuraiGoose says:

May 29, 2008. 11:10 AM [REPLY](#)

Great pond!! I've read a lot about it, and I've tried to make one also but the instructions I got from elestanque.com did not advise you to water the land before start using concrete and the pond broke. Question; I'm an advanced aquarist and also all the plans I found advise to use some filtrarion or aireation sistem. Like a waterfall from water pum. So? Oh you can get some nice pond advise from the tetra website also. Bye



babair says:

May 29, 2008. 2:14 PM [REPLY](#)

Sorry to hear about your pond. I have never used concrete -- only PVC (polyvinyl chloride) liners. They're very flexible and tough. I've never had a tear or leak.

A filter with a pump is a good idea for water circulation and aeration. Some filtration systems have special pads or media that encourage beneficial bacteria growth.

This site gives a good overview of pond building.

<http://www.lowes.com/lowes/lkn?action=noNavProcessor&p=LawnGarden/waterGarden.html>

Good luck.



SamuraiGoose says:

May 29, 2008. 5:01 PM [REPLY](#)

Yeah? the I suppose i'll make one from pvc also. You use a special pvc uv resistant for ponds?? I'm from Argentina and I can only get common pvc but nice and thick. I have some aquariums, but a koi pond is my true dream. IÁ´m running out of yard so I could make a little one for carassius, but I'll certainly make one.

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