

Bioactive/Naturalistic Guide for *Python regius* (royal/ball python)

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I'll be pulling information from my personal experience and from several of the groups I am in for this guide. I'll provide links at the bottom for the groups I mention as well as several online retailers you can buy products at for both the US and UK. This guide is not the only way to do bio but we get so many questions about it I figured we could use a group resource.



What is “bioactive”?

_____ The term “bioactive” refers to an enclosure that not only houses the main animal but also includes small invertebrates, microorganisms, and other little decomposers (referred to as custodians or the clean up crew “CuC”) to help break down waste and maintain healthy soil. You can have soil substrate and not be bioactive. You can have live plants and not be bioactive. It merely refers to the CuC being present.

Why go bioactive, and why not to?

Using a bioactive enclosure is purely owner preference. You can have an incredibly enriching and great enclosure without being bioactive, and you can have a really poorly set up bioactive tank. Bioactive DOES NOT imply the highest tier of keeping, it is merely one of the ways you can house your animals. I prefer naturalistic setups though and bioactive is just one more step, so it was more of a “why not?” for me. If you try it out, realize it's not for you and you switch back, there is no shame in that. You can be a new keeper and do bioactive right off the bat or you can start if you've been keeping reptiles for 50 years! All it takes is a little research.

There are a few reasons you should steer away from bio though:

- You don't want to deal with insects
- You have seriously ill animals or recovering animals
- You haven't researched it thoroughly first
- You are unable or unsure of how to provide proper husbandry (in regards to heat especially)

- You do not have a large enough enclosure (even for juveniles, I would not start in less than a 36x18x18". For adults/snakes over 3ft, you want at LEAST a 4x2x2ft enclosure.)

Naturalistic vs Bioactive?

_____ Naturalistic is having live plants and/or soil, etc. just NOT the CuC. There is debate, depending on who you ask, how many boxes you have to check to be naturalistic. If it's just live plants, just soil, both, if special lighting needs to be added (well, lighting should always be provided, but that's a different story!) so whatever combination you choose is up to you. You can follow this entire guide and just not add the CuC and have a fantastic naturalistic setup! You can just have soil substrate and no plants. If you have a potted plant buried in your cypress mulch, that's ok too! It is up to you how far you want to go. Naturalistic is where we can get more enrichment when compared to minimalist rack/tub/tank/etc setups. Deep soil substrates, fake/real plants to provide dense ground cover as well as canopies, branches for climbing, etc. are all naturalistic and will benefit your reptile.

What exactly is "CuC?"

_____ As discussed above, CuC is the clean up crew/custodians that make it bioactive. You have a ton of options for CuC. I recommend having at the minimum one species of isopod and one species of springtail, but as with all, variety is the spice of life! Different species have different niches and preferences. I also recommend to always keep a culture of your isos and springs outside of your enclosure as backup in case the viv fails, you want to add more, or if you start a new enclosure. Cultures are easy to maintain and it might even become a second hobby! Personally I use *A. vulgare* + *A. maculatum* + *P. laevis* isopods, an unknown gray springtail species, dubia roaches, and super/morio worms and beetles.

In the final section of this article I discuss how to feed your basic CuC, you do want to supplement their diet to keep them healthy! Please research the unique species you choose to ensure you can properly care for them.



Below is a list of just a few suitable species:

- Isopods (also known as roly pollies or woodlice)
 - *Armadillidium maculatum/vulgare/nasatum*, *P. laevis*, giant canyon, powder blue, dwarf purple, dwarf tropical white, and many others. I would be cautious of using *Porcellio scaber* as they love protein and might prey on your other CuC, but if you feed them well you should be fine. There is a fantastic facebook group simply called "Isopods" with lots of information on all these species and breeders, link will be at the bottom.
- Springtails
 - Temperate gray, tropical white, and tropical pink springtails are the 3 most commonly used. Any will work, a mix of two or more species is ideal.

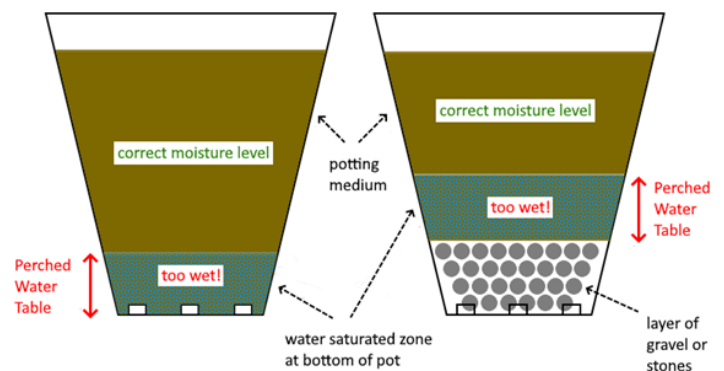
- Roaches
 - Dubia, orange head, lobster, domino, and question marks are commonly used. Check your local laws on what roaches you can buy, some states outlaw certain species. I would recommend avoiding red runners.
- Beetles
 - Morio (from the superworm), harlequin flower beetle, and sun beetle (not legal everywhere) for a few.
- Worms
 - Superworms (turn into Morio beetles), and earthworms.
- Other
 - Millipedes are often added by enthusiasts, they don't contribute much to the actual work of an enclosure but do make beautiful additions. Bumblebee and african giants are popular. I would avoid centipedes when possible as they can have nasty bites and like to snack on typical CuC species.

What do you need to go bioactive?

There's several parts to a typical bioactive enclosure: drainage layer, barrier, substrate, litter, CuC, plants, and lights. You also need to take into consideration your enclosure. If you're using a wooden viv you'll need to take care to seal the wood with waterproofer (like drylok, epoxy, pond liner, etc) and the joints and seams of both with silicone.

***New addition to this article: I have been researching ways to improve this guide, and my own husbandry, since this was written. I have been experimenting with my own enclosures and through this and research I've found and been shown, I would like to discuss the idea that drainage layers may not be necessary or very beneficial in most setups. I do not use drainage layers for my two BPs, or most of my herps. I do not use drainage layers in my (many) houseplants or outdoor plants. I will attach links to a few sources that go into detail about how water moves through soil, perched water tables, etc. and do a very TLDR version here. For extreme overwaterers or extremely soggy enclosures--which ours should not be--a drainage layer with an actual drain may be beneficial. Otherwise, having a drainage layer reduces the depth of available soil for roots and raises the perched water table which may increase sogginess higher up in the soil depth. A drainage layer isn't necessarily going to ruin your enclosure, but I do think after reading up on this information we are basically wasting our money and time on it, and potentially harming our plants. [Link one.](#) [link two.](#) [link three.](#)

The Effect on the Perched Water Tabel in Pots When Using Gravel Underneath



This is from NeHerpetoculture.com and shows what the different layers might look like.

Drainage layers can be made of lava rock, pebbles, crushed stone, hydroballs, light diffuser, etc. The barrier is typically just weed screen. Topsoil needs to be pesticide and fertilizer free, Scott's makes a good brand that has peat, moss, and wood mixed in and Timberline is good too for a more plain dirt (both US companies, they are locally sourced so not all bags will be the same. Screen them to ensure no trash or debris is included.). Some good choices for mix-ins are coco fiber, cypress mulch, orchid bark, sand, leaf litter, decaying wood, and sphagnum moss; this stuff gets mixed into the substrate to help aerate/lighten it and provides nutrition for CuC and good bacteria. If you don't want a huge variety use at least some sand and mulch mixed into the soil with leaf litter on top. Cork bark makes excellent hides for snakes and homes/food/breeding places for your CuC as well. Leaf litter is typically done with oak, maple, and magnolia but many types can be used, just avoid pines, cedars, and other aromatic type soft woods. Some companies make kits and mixes; these kits work but they are much more expensive than doing it yourself.

An important note is that bio tends to be more successful in "larger" vivs, for balls I would use no less than a 4x2x2ft to give you plenty of room for deep substrate, branches, plants, and overhead heat. If you have a particularly active or large snake, go larger. Not only will it be beneficial for your snake, but your plants will have a better chance at surviving too! Younger snakes can be started in smaller vivs but they can also be put directly into an adult sized viv as long as you have plenty of snug hides and clutter. Space is not the enemy!

Heating is also done differently in bioactives. First thing, the whole "royals need belly heat" thing is a myth and under tank heaters are often not sufficient in heating non-bio vivs either. They will not be able to penetrate the soil well enough to heat and tend to overheat the CuC and plant roots, and you run the risk of excess heat build up and cracked glass. Overhead heat is always preferred and can be accomplished a few different ways: halogens, ceramic heat emitters, and radiant heat panels being the main 3. Red, blue, or other colored heat bulbs should not be used. All heat sources need thermostats and all heat in slightly different ways. Halogens work excellent for day heat with radiant panels and CHes being great for backup/nighttime heat. (If you would like more information on the differences between heaters, please [see this playlist](#). Not all heat is created equal!)

Taking from the wild?

This is absolutely doable for both CuC and decor. I recommend checking online in your area and see what wild diseases, fungal infections, etc. are local to you. You always want to sterilize what you can, avoid picking up items that cannot be cleaned somehow. Wild-caught CuC should be bred in a quarantine tub to ensure they have no health issues. Check under logs, bricks, and in leaf litter for them. DO NOT gather leaf litter/wood that has been sprayed

with pesticides/fertilizer/other chemicals. Both my armadillidium and nasatum cultures are from WC stock, I typically breed for a few generations or 3-6mo to ensure everything is going as it should be. Keeping a tub of isopods is good practice for going bio anyway, and they're quite fun to watch as they zip around.

Some groups are adamant that you should not sterilize, but this is far riskier than they like to mention. In my wild gathered materials I have picked up ticks, venomous spiders, centipedes, ants, and harmless spiders that are still pests, prey on my CuC, and weave webs everywhere. I am still battling a spider infestation from the time I thought not sterilizing was the best option! Please, for the health of your animals, sterilize your materials. This includes anything you order online or pick up from pet stores or expos.

For sterilizing you can bake, boil, scrub with bleach, soak with F10, or whatever other cleaning methods you like. Some methods may be more effective than others. DO NOT boil/bake rocks unless you want the chance of them exploding! You can soak or scrub them with bleach or F10 for a safer way of cleaning.

Plants and Lighting

We want to avoid plants with toxic sap but we have less worries with royals than we would with reptiles that eat plants or for amphibians. You also should be careful of where you buy your plants, reptile-specific online retailers may have safe plants (aka no pesticides) but Lowes, Wal-Mart, Aldi, and your local nursery might not. These plants are still fine to use but you'll need to rinse down the plant very well (leaves and roots) and repot them for a few weeks or more (you can use your own substrate mix as it shouldn't have pesticides or fertilizer) to give them a chance to cycle out dangerous compounds for our CuC. Frankly I prefer to purge all my plants no matter where I bought them from, reptile vendor or not.

Quarantining your plants is also good to avoid pests! The last thing you want is to have to tear apart and trash your enclosure because you got a bad case of spider mites (they won't harm your snake but will kill your plants.) Usually a few weeks is sufficient to see if anything has hitched a ride. For plants that are commonly afflicted with disease or pests, like ivy, I often pre-treat with diluted cold pressed neem oil just to get ahead of any potential nasties.



Make sure you look up each plant's care needs (for example some ferns don't want to dry out but the sansevieria don't need much water at all) to help it thrive. Plants also need particular lighting to help them thrive. Aim for lighting around 6500k. Jungle Dawn LED and LED bar, T5 bulbs, and CFL bulbs are just a few types. Avoid the pink plant grow bulbs, we want bright white light. Each has pros/cons and different price points, choose what works best for

you. I would avoid CFL inside an enclosed viv though, they're not always humidity-proof. I prefer LEDs and T5s personally, and the new Jungle Dawn LED bars are very good. You don't need a very large one of those, they are quite powerful. (This is all very simplified, but we aren't growing anything very needy.)

Here is a list of good plants, I'll include some varieties of each and ** for easier plants:

- **Pothos (neon, majula, marble queen, golden, jade, pearls n jade, n'joy)
- **Scindapsus pictus (also called silver pothos)
- Sanseveria (black coral, moonshine, fernwood, trifasciata)
- Ferns (rabbits foot, birds nest, lemon button, kimberly queen)
- Schefflera (elegantissima, arboricola)
- Ground orchids
- Croton
- Ficus pumila
- Fittonia (also called nerve plant)
- **Dracaena (marginata, janet craig, many types)
- Maranta (also called prayer plants)
- Vinca vine
- Anthurium
- Pilea
- Peperomia
- **Transcendentia
- **Ivy (prone to spider mites, be careful!)
- **Bromeliad (cryptanthus is a small one that's bright pink in good lighting)
- Air plants (don't get planted in soil, need to be misted/soaked for hydration)
- **Spider plants
- **Philodendron (both ground and vining varieties)
- Dragon's Tongue

FINALLY....How To Build!

How-To without Plants.

Red is optional, please see higher up where this is discussed.

Item list:

- Drainage layer (optional)
- Barrier (only need if you have a drainage layer)
- Soil and mix-ins (if your soil is soaked dry it out a bit first)
- Leaf litter
- CuC

- Basic snake decor (clutter, hides, branches, etc)

Ok, so you've got your stuff. Steps:

1. If using certain drainage layers, rinse it in buckets, outside, in the shower, wherever. Lava rocks, pebbles, stone, etc. will all need to be rinsed. Hydroballs, light diffuser, and similar ones will not need that.
2. Put the drainage layer in, you want about a 2" layer of it.
3. Measure and cut the barrier layer. You want about 2" extra on each side. You can tuck the ends down into the drainage or leave them curled up to cradle the substrate, your choice. Don't worry if its not perfect, royal's aren't huge diggers and wont mess with this area.
4. Mix and add your substrate! There is no exact recipe for this. For royals you want about 60-70% top soil with the rest being a mix of what other parts you choose: sand, mulch, moss, coco-fiber, etc. Mix it and see how you like it, it's not an exact science. You want a minimum of 4 inches of substrate for a non-planted bio, but more is good too.
5. Add leaf litter and any extra organic matter you choose. I keep a light scattering of leaf litter and moss throughout and pile it deeper along the edges, near hides, and under the water bowl. It will slowly decompose and be eaten over time so it's good to always have some on hand for top ups. Leaf litter is very important for the health of your CuC, so don't forget it!
6. Add your CuC! Just toss them in, yes you can dump the charcoal and springtails all together.
7. Add hides, branches, water bowl, clutter, and your snake.
8. When not using plants, I would do partial soil changes once or twice a year.

Super/Morio beetles and isopods chowing down on a carrot as supplemental food.

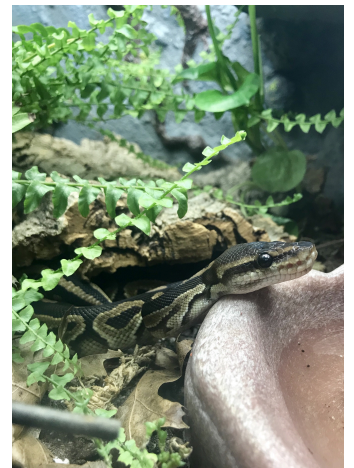


How-To with Plants

Soil depth will need to be increased in areas that are planted. Plants will have a better chance at thriving if given a few weeks to root and settle before adding your reptile, but it can be done immediately. **Again, remember that drainage layers are not completely necessary. Please see higher up for more information.**

Item list:

- Drainage layer
- Barrier
- Soil and mix-ins (if soil is soaked dry it out a bit first)
- Leaf litter
- CuC



- Plants and plant light
- Basic snake decor (clutter, branches, hides, etc)

Steps:

1. If using certain drainage layers, rinse it in buckets, outside, in the shower, wherever. Lava rocks, pebbles, stone, etc. will all need to be rinsed. Hydroballs, light diffuser, and similar ones will not need that.
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4. Mix and add your substrate! There is no exact recipe for this. For royals you want about 60-70% top soil with the rest being a mix of what other parts you choose: sand, mulch, moss, coco-fiber, etc. Mix it and see how you like it, it's not an exact science. You want a minimum of about 6 inches of substrate, but more is great and can be piled around hides and deeper in the back/corners for your plants.
5. Plant your plants. Gently pat down the substrate around them and give them a light watering if your soil is dry, if your soil is already wet then no need to water immediately. Most noobs kill plants by overwatering, remember that!
6. Add leaf litter and any extra organic matter you choose. I keep a light scattering throughout and pile it deeper along the edges, near hides, and under the water bowl. It will slowly decompose and be eaten over time so it's good to always have some on hand for top ups. Leaf litter is very important for the health of your CuC, so don't forget it!
7. Add your CuC! Just toss them in, yes you can dump the charcoal and springtails all together.
8. Add hides, branches, water bowl, and your snake (unless you're letting the plants settle and grow for a while first, which again, is recommended.)

I've got it finished...now what?

_____ Bioactive doesn't mean you can go completely hands off, especially while your CuC is still getting established. You will need to spot clean poops (remove entirely or bury a small bit for your CuC to work on, yes I promise this is safe for your snake) for a while as your CuC population grows. I recommend leaving at least some of the sheds in. CuC love snake shed! Watering plants, lightly churning soil occasionally, topping up with fresh soil and organic matter, feeding the CuC supplemental foods, etc. will all need to be done. If you choose not to add plants I would recommend a 30-50% soil removal every 6 months or so, this will help keep down levels of compounds plants would slowly recycle. Less maintenance will be needed as the cycle establishes itself and your CuC populations boom. For me waste is almost entirely gone within a day or so and sheds don't last more than a couple days either. There is also zero smell even immediately after a bowel movement.

If your tank starts to smell sour, you get compacted soil, and sheds/waste don't appear munched on you might have a failed or stalled bio. In these cases it's usually a good idea to replace 50% of the soil, make sure you have plenty of mix-ins to prevent compaction and anaerobic spots, and refresh your CuC population (this is why it's good to have a tub of isopods and springtails that you breed!). Make sure you give it at least a month or so to set up at first before you get too worried though, especially if you don't start with a ton of CuC.

CuC *technically* can survive just on a minimal diet of what you have in your viv but they will also benefit from occasional extras like cucumber, carrots, squash, bell pepper, fish flakes, Repashy morning wood, Arcadia InsectFuel, frozen/dried bloodworms, or other similar products. This can keep their numbers higher than would otherwise be possible which means sheds and waste gets taken care of quicker, and it ensures they stay healthy. I would also keep a bit of calcium in the enclosure for them to munch on. I feed my CuC enough food to last them a day or two once or twice a week, I skip the snacks if I know a bowel movement or shed is coming up.

If you don't have enough cover with your real plants, please don't be afraid to add in artificial ones! I typically have both to provide sufficient cover, as plants don't always cooperate in your growing plans. You also want to ensure you have plenty of branches and elevated areas for your snake in addition to the typical floor hides. Not only will this enrich their lives and build muscle, it will help your plants stay alive!

If you notice pests on your plants, remove them immediately for sterilization/trashing or treatment. Spider mites, aphids, and mealybugs are the most common pests. Gnats are ugly, but not really that damaging. Just dry your top layer out to kill them off. If your snake contracts snake mites, you will need to remove them from the enclosure for treatment or use predatory mites. Either way, a sterilization and refresher is not a bad idea. This is why quarantining your animals and plants, and sterilizing everything you can, is so important.



Final Words

This is simply a brief guide I created to help people based on my research and personal experiences, it is not necessarily the only way to create a bioactive or naturalistic enclosure. Please do plenty of your own research before starting this process to make sure you're prepared. Some bioactive groups will do things differently, some might scoff at something I choose and others might praise it. I'd recommend reading as much info on bioactive as you can from different groups and don't rush the process. Take your time researching products, growing out plants and CuC populations, looking at various builds and suggestions, and be patient with the process. I hope this helps, thanks for reading!



Links:

- Former NJAPR Admin's guide on bioactive. u/NoCold
 - https://www.reddit.com/r/ballpython/comments/9lnedp/getting_started_with_bioactive_husbandry/
- Not Just a Pet Rock (NJAPR, Royal python specific)
 - <https://www.facebook.com/groups/142173286457639/>
- Advancing Herpetological Husbandry (AHH)
 - <https://www.facebook.com/groups/454242811428496/>
- Bioactive Vivaria Worldwide
 - <https://www.facebook.com/groups/BioactiveVivs>
- Isopods
 - <https://www.facebook.com/groups/isopods/>
- NEHERP
 - <http://www.neherpetoculture.com/>
- Josh's Frogs
 - <https://www.joshsfrogs.com/>
- Northampton Reptile Center (UK)
 - <https://www.reptilecentre.com/blog/>
- Bioactive Herps (UK)
 - <https://bioactiveherps.co.uk/>

