

[Music] Hello everybody, uh, Don here. In this episode of "The Naturalist," I'm coming to you from Wright States Woods on the campus of Wright State University. Um, today's episode is not so much about a place; I will come back to these Woods in a few weeks to talk about, uh, fall colors with you. But today is going to be about a tree, the Pawpaw. This is a very interesting and popular tree these days, so I'd like to introduce you to Pawpaw, tell you everything I can think of about them, and, uh, hope that you learn to appreciate these things like a lot of other people do. So, let's take our journey. Here we go.

So, let's take a look at our local Pawpaw patch. All right, so Pawpaws are the trees that you see to my left with these large, uh, large glossy green leaves. And, um, Pawpaw, again, is a member of a family of plants called the Annonaceae. The scientific name for Pawpaw is *Asimina triloba*, but it's the only temperate member of its family. Um, but you can really see the tropical nature of its relatives when you look at this plant. Uh, it looks like the kind of plant that you'd grow in a greenhouse here in the temperate zone or in the atrium of a mall or something like that. But when you glance at this tree, it does give you a very tropical feel to it. You can imagine yourself in an understory of a tropical rainforest under these big glossy green leaves.

So, Pawpaw is a pretty adaptable tree. It can grow from the wide-open, completely exposed sunny areas to the forest understory. It will exhibit slightly different growth forms under those different conditions, and I'll point that out throughout the day today. But our local Pawpaw is very abundant in Wright States Woods and in Ohio in general. Um, and we have a very large patch of it right here with some very large trees as well. So, let's just take a look around at this Pawpaw Patch and see what we see.

Now, this patch did not fruit well this year or at all. And, um, so later in the episode, I'll show you Pawpaw fruits and talk about them extensively. But our local patch here did not fruit very well at all, and reasons for that are that, um, Pawpaw flowers very early in the spring. So sometimes, even if its flowers get successfully pollinated and fertilized, they're subject to freezing at that time of year with some late frosts that did happen around here. And I think a lot of local Pawpaw patches don't have many fruits this year because they got frozen. Now they have a very low fruit set in general. All right, they produce a very dark maroon fruit that smells like rotting meat and it's pollinated by small flies and beetles. But they're not that successful at it, okay? So, Pawpaw, by its very nature, doesn't set a lot of fruit every year. All right, so you have good years, you have bad years. This local patch, it's been a bad year in this local patch. But nonetheless, this is a really vigorously growing patch of trees in terms of just the vegetative growth of the trees. So, let's look around at them a little bit closer.

All of the trees with the light gray bark that you can see in front of me are Pawpaws, of course. It's interspersed with a few larger canopy trees like sugar maples and black cherries and things like that. But, uh, we have a lot of large trees here in Wright State's Pawpaw patch. Here's one right in front of me. Keep in mind that the national champion Pawpaw tree, there are national and state champion trees that can be entered into competitions. The national champion Pawpaw tree is about 30 feet tall and about 10 inches in diameter, 10 inches or so. And so, I'll show you some trees in this patch that aren't that big, but they are—you could envision them getting there in another decade or so. So, um, this is a very abundant Pawpaw Patch. Here's one of those tip-up mounds, by the way, that I pointed out in my walk in Davy Woods—an old fallen tree that

tips up soil and roots, okay? But as we walk around here, here's another large Pawpaw, okay? It's a big one. And then back in this direction, I think our largest, here's another large one, all right? Nice large, solid, probably on the order of 25 to 30 feet tall easily. So, these are nearing the height of the national champion. This tree, I think, is our largest diameter Pawpaw right here, okay? It's somewhere in the order of seven or eight inches in diameter. And, um, the one problem with this tree is although it is still alive, the top broke off of it, okay? And so, it's, uh, it is alive. It is growing. It'll probably grow a lot slower now that it had its top blown off. So, a little bit of an issue there, but it's alive. And one thing I noticed as I was walking around here earlier is that this log you see in front of me here is the top of this Pawpaw tree. And, uh, it's full of the holes of a bird called a sapsucker, okay? And so, a sapsucker makes these linear holes in the bark of trees, and it's called a sapsucker because sap will exude out of those holes, and the bird will eat that sap. And there's some idea that it might also eat insects that visit this sap, okay, to take a drink or feed on it. And so, um, those are sapsucker holes. Sometimes you can see trees that are just completely riddled by sapsucker holes. It's really interesting to see that on a smaller scale like this. That it's not real damaging to a tree. They can usually recover from that kind of thing. But sometimes, trees can be extensively damaged by sapsuckers. That's not what made this thing fall off. I think the wind blew this over.

So, Pawpaw—you see how densely growing these things are with these large, long leaves that Pawpaw has. They shade the understory quite a bit. And so, Pawpaw can come to dominate large areas of the understory because of that dense shading that they produce. So, these trees don't reach the canopy like a large sugar maple you see in front of me there or other trees in the area. They're kind of a mid-canopy tree, you know, reaching 30 feet or so in height. But they produce this densely shading understory layer that makes it hard for things to grow under Pawpaws, okay? You can see there's not a whole lot happening on the forest floor here under these Pawpaws. Again, that's partly because of the dense shading that they produce. But there's also an idea that they might chemically inhibit other plants through a process called allelopathy. I'll describe that in more detail in another episode. But there's also an idea that they might chemically inhibit other plants, um, through a process called allelopathy. I'll describe that in more detail in another episode. But, um, that is, they might produce some compounds in their roots or bark or leaves that have negative chemical impacts on neighbors, making it hard for, for neighbors to grow. So, nonetheless, they can occupy large patches and sort of dominate an area. But again, they are a native tree and, um, so we tolerate that in this case. But once again, when invasives do that, it's a different story because, uh, they have a net kind of usually a net negative impact on the ecology of an area.

Okay, uh, pawpaws are the host tree for a really beautiful spring and summer butterfly called the zebra swallowtail. I, obviously, they're done flying for the year, um, but they are a white and black butterfly with stripes, therefore zebra swallowtail. And their larvae, the caterpillars, feed on the leaves of, um, pawpaw.

Okay, later in the episode, I'll talk a bit about the chemistry of these leaves that make it hard for things to eat it, but that caterpillar, that species can tolerate it and, therefore, they have access to this host plant that other insects and, uh, things are unable to eat. Okay, because they're toxic.

All right, in terms of reproduction, um, pawpaws reproduce in a couple of different ways. Uh, one is that, of course, the fruits that they produce have seeds. Okay, and those seeds will germinate, uh, and grow into new pawpaw trees. Uh, seeds of pawpaws require something called stratification, which is, you know, the fruits are produced this time of year, they hit the ground, those seeds hit the ground, and, um, if they're not eaten or damaged in some way, they sit on the ground and under leaf litter and maybe a little bit into the soil over the winter, and then they will germinate in the spring. So, they actually require a cold period being exposed to a cold period before they will germinate. Okay, they won't germinate if you just took them home, kept them on a shelf in your house, and never expose them to cold because they need to know that they've been through winter before they will germinate. They need that signal, that environmental signal that they've been through winter before they'll germinate. So that's called a seed stratification requirement, and there are a lot of plants in the temperate zone that have this requirement. Makes a lot of sense. There's no sense for most species to germinate right now when they hit the ground because cold weather's coming. They'll freeze. There won't be water available. It'll be too cold to grow. So, there are a lot of species that have this seed stratification requirement, and pawpaw is one of them. But you can collect the seeds and expose them to winter artificially in your house. All you really need to do is put them in a Ziploc bag with a moist paper towel and stick them in your fridge for about two months. And after you do that, you can take them out, pot them up in potting soil in pots, and they'll germinate and grow. You'll have new pawpaw trees.

Okay, and pawpaws are pretty easy to grow from the seedlings or saplings once you take them outside. But, um, the other feature of, uh, pawpaw reproduction is that all these little pawps you see on the ground in front of me, these are primarily not seedlings, believe it or not. Most of these are what we call root suckers. And so, these are shoots that will pop up off of the root of a parent plant. So, I'm pulling pretty hard on this root sucker here, and I can tell it is attached to a larger root of a parent pawpaw somewhere in this area. Okay, and so these root suckers, they'll come up prolifically around the parent plant, and even if you plant one pawpaw in your yard, you'll have many pawpaws within a few years because of this tendency that they have. Um, now the thing about pawpaws is, if you're trying to grow a pawpaw or get pawpaw fruit in your backyard, you need at least two trees to cross-pollinate each other to get successful fruit production. Okay, they need to be of different genotypes, different genetic makeups, in order to get successful fertilization of their flowers and successful fruit set. So, um, now all of these root suckers, let's say all these root suckers in front of me here are attached in some way to this um, this parent tree right here. Now they're going to be clones of the parent. They're going to be genetically identical clones of the parent. So, I presume that this parent tree will, um, will flower in most years. These trees are too small to flower, but if they got large enough to flower and started to flower, they could not cross-pollinate each other because they're all the same genetic makeup. They're clones of each other. So, you have to have different individuals, different genotypes near each other to get successful uh, pollination.

All right, so while these plants are prolific and abundant, uh, they're all just the same as mom, okay? They're all the same. Now I see in this particular line right here, you can really see the nature of uh, them being root suckers because they're all kind of in a line right along here, meaning they're probably coming off of the same root from one of these parent trees in the area. Okay, they're all connected to the same root. Now over time, they will lose their connections to the parent as the parent root maybe degrades, but of course, they'll have their own root system by

then. They have their own roots now, but they're still attached. And you can tell that, again, by just pulling on them. They won't give. Okay, so um, so pawpaw, one other thing about pawpaw that makes them unique, as I mentioned, I believe, is that they produce the largest fruit in North America native to North America of any tree. And um, in the state of Ohio, this is our state fruit. Okay, it's not our state tree. Our state tree is the Ohio buckeye. And uh, but, uh, this is our state fruit. And again, pawpaws are receiving lots of attention these days by people interested in hobby farming and ecological restoration and, um, you know, homesteading and things like that because you can eat from these trees. They are a native tree, but they also are, uh, you know, native to the Appalachian regions. And the idea that perhaps, you know, farming pawpaws can provide some economic benefits to people throughout Appalachia and so forth. So, pawpaws are very popular right now. And um, there's a pawpaw festival held outside of Athens, Ohio every year, every year in September. And so, um, you know, that's a lot of fun. You can go learn about the different varieties of pawpaw, um, pawpaw breeding, about grafting pawpaws, recipes about ways to use pawpaw, uh, and uh, folklore regarding pawpaw. There have been songs written that include pawpaw in it, so it's a lot of fun. I'd recommend a visit to that area, uh, to that festival if you ever had the chance. Okay, so now this episode is about pawpaw, but while I was wandering around this little spot, there is a notable tree I'd like to point out to you.

First of all, Wright States Woods is filled with notable trees. Okay, these woods are, um, part of these woods are considered old-growth woods, but there's a special tree over here I'm going to point out, and again, it's one I pointed out the species in another episode. But there's an exceptional individual here, and that's the tree you see in front of me. Here, this is a remarkable blue ash tree.

Okay, I feel like I'm going through the jungle and found a discovery here. Okay, this tree is, um, about 15 ft in circumference. Again, blue ash, and it is in good health. It's kind of hard to tell the canopy way up there, and of course, this time of year, trees are losing their leaves, but it's in good health. I cannot see that it's been attacked by emerald ash borer. And that's part of the story here that this species is, um, persisting and surviving in the face of the devastating emerald ash borer that kills most of our ash trees.

So here's a view of its canopy, just a remarkable tree, uh, and I've been all over these woods in the past, and this is one that has escaped me until today as I was scouting this area earlier. So, uh, it's just a tremendous blue ash tree. I'm certain that's the largest blue ash we have in our forest here at Wright State. All right, so back to pawpaws, um.

The one thing about these root suckers I was going to add is that it is difficult to dig these up and get successful transplantation to another site 'cause usually when they're attached to the parent root, they are, they know, parts of their root system break and, uh, they're just kind of hard to get out of the ground intact. So, um, the best way to plant pawpaws is to grow them from seed, grow them from seed from a diverse mix of sources so that you're sure that you have different genotypes and, uh, grow them in pots for a while, for a year or so, and then transplant them to a, you know, an area, um, suitable for them, um, after they've grown for a year or two. Okay, one thing about pawpaws as well, which you always have to be concerned about if you're interested in planting trees.

Fortunately, deer don't really eat pawpaws very much. Okay, these woods are full of deer, for example. Um, I see very little sign of deer browsing on these trees. In fact, you can see by looking at the leaves that the leaves just generally aren't eaten much at all. But I'm not seeing characteristic deer browsing on these trees at all. You occasionally will get bucks that rub their antlers on the tree during, you know, the season where they're removing the velvet from their antlers and marking territories and that kind of thing.

But, uh, you don't have to worry too much about deer eating pawpaw. And that relates to the chemistry of the leaves and bark of this tree, which I will talk about shortly. Okay, but, uh, that's a nice thing in terms of restoration because with a lot of trees you try to plant, an oak, maples, you have to be concerned about this sort of thing because deer, if they're anywhere near your area, they will find young tree saplings and eat the leaves, nip off the buds and, uh, be a real bane to your effort if you don't protect your trees from deer.

One thing I was noticing as well as I was walking around here is how the different stages of leaf senescence or leaf color development in this patch. So we're here on October 8th, 2023, and, um, where I've been walking, the trees here are still very green. They pretty much look like what they look like all throughout the summer, okay, dark green leaves still full of chlorophyll. But out here in the open, you see the trees in front of me, you can see that they are a lot paler. They're losing their green color quite a bit, and again, these trees, as you can see, turn a real bright yellow in the fall. That's another feature that's nice about pawpaws.

And you also notice that those that are turning are tending to be out here in the open. But there is a patch back here that's also turning yellow. That's kind of an indicator that, um, that patch, you know, a big patch, it's all turning yellow at the same time, suggests that they're all very similar genetically related. And that kind of indicates that's one big clonal patch of pawpaw, probably very closely related to each other, that basically has the same developmental timing.

Okay, you can see in front of me here a patch that's all turning yellow before the majority of the trees are. Okay, of course, the process of leaf color change is something I, uh, that we can talk about, and I will address in a subsequent episode. But, um, that is an indicator of the relatedness of trees, you know, one big patch all turning at the same time. It is also some indicator of the environmental conditions. Generally, what you have with trees is leaves that grow in the shade, lower down in the canopy. They'll have higher chlorophyll concentrations in their leaves, okay, because it's shadier. They need more chlorophyll in those leaves to capture the limited light that's available.

Um, the process of color change is the loss of chlorophyll, essentially. That's the start of it. And so it just takes longer, okay, for them to go through that process and degrade the chlorophyll that they have in their leaves and recover nutrients. You know, these trees out in more open areas have lower chlorophyll concentrations just because it's brighter. They don't need to have as high a chlorophyll concentration to get the light they need to grow. So they will change colors more quickly usually, and you could see this in most trees, most open-grown trees. Leaf change will occur from the top down, from the top leaves toward the bottom of the tree, and it does relate a lot to the chlorophyll concentration of the leaves.

Okay, so I think that's, uh, what I have to say about our local pawpaw patch here at Wright States Woods, and I'll catch you in the next segment.

All right, I'm visiting this spot just to show you what a pawpaw tree looks like when it's grown in the open. The tree in front of me, you can see how densely it has leafed out. It's relatively short, and its branches are relatively short and very leafy. And so that illustrates one of the differences you can expect between a forest-grown tree and a tree grown in the open is that they won't be as tall for a given age, and that is because they don't need to be. There's plenty of light out here; they don't have to grow as tall to reach for the light or stretch for the light in around competitors.

So, um, this is true for many trees when they're grown in full sun in the open. They'll be not as tall as they would be in a forested situation. Um, they'll often have a bushier appearance; that's simply because they don't need to grow tall and with long branches to get the light that they need to survive. So this is just a little grove of pawpaw trees, and, uh, you can see they are all exhibiting this same kind of phenotype. We would call that growth form. Um, this one's a little different; this one has multiple stems coming from the base. All right, so it's naturally going to be in a sort of a shrub formation, but these others are more strongly with a central trunk and branches coming from it.

Now, these are all growing very well; I don't see that they have made fruit this year, though. So we will, um, visit another spot and talk more specifically about fruit production and all about the fruits of pawpaw.

Okay, I'm now here in my backyard pawpaw patch, and I came here specifically. Now, this is the third kind of growing condition I've shown you. Now I've shown you a natural patch of pawpaws in the forest. I've shown you some open-grown trees out in a basically open lawn area. And then this is a kind of a more naturalistic setting but still in a yard. Okay, so there's a nice big oak tree over here helping to shade these pawpaws.

Nonetheless, this is still a backyard pawpaw setting. And, uh, the reason I came here in particular, though, is that we still have fruit on these trees. So we can now talk a little bit more about the fruit. So, uh, right in front of me is a set of pawpaw fruit. Okay, these fruit are ripe. Okay, you can tell just basically by squeezing them, okay, and they're softening. Um, unripe Pawpaws are bright green, and they're also pretty hard, okay? So, they're not good to eat at that point, okay? These are ripe, and if I were to shake this tree, these fruits would fall quite easily, right now. I could, I'm sure of that, okay? I'm not going to do that, though. I'll pick these later, so that they don't fall and get bruised and so forth. Um, but those are Pawpaw fruits. They'll either be in a cluster of two or three or sometimes singly. Our trees this year in this particular little patch made a fair number of fruits, but we did lose fruit this year to, um, flowers at basically the stage of flowering and fruit set to a late frost, okay?

So, we still have a number. Here's a few more. This also illustrates a little bit about the diversity in size that you can expect. Uh, that's a single small Pawpaw, and then again, sometimes they just show up on the ground. Um, I don't see any on the ground at the moment, okay? But if they do hit the ground, you often have to compete with animals for them, okay? So, um, this is our Pawpaw patch. Pawpaw trees underneath a nice oak tree. A couple more traits that you can use

to identify a Pawpaw include, of course, the leaves, which I've already talked about—these large, smooth, glossy leaves, dark green on top, a little lighter green underneath. They also have an interesting bud. It has sort of a flattened, duck-bill shape to it, and it's sort of very soft, finely, uh, furry, okay? So, it has very characteristic buds.

And then finally, you know, there's all kinds of things you use to identify plants—the look of their flowers, the number of petals, look of their leaves above and below, the look of their bark, and so forth. But the smell can help you as well, okay? Okay, so um, and the taste in some cases, but the smell, in particular, of Pawpaw has been described as a smell of green bell peppers. So if you were to take these leaves and crush them or cut them, they give off the aroma of green bell peppers. So that's something that, uh, you can use to identify them. To me, it's kind of a displeasing odor. It's not the greatest smell in the world, but it does resemble green bell peppers.

All right, so let's take a look at this Pawpaw fruit that I just collected from our trees next to the house. And, uh, again, this fruit fell naturally from the tree. That's a sign that it's ripe. And as I look at this Pawpaw fruit, I can see there are a few teeth marks in it from little rodents, probably, that try to take a bite or sample this fruit and decided not to eat it. But you often will get things like opossums and raccoons and so forth eating any Pawpaws they find on the ground, but they'll also climb trees and just raid an entire tree of its ripe fruit. Uh, one year, we lost probably 20 or 30 Pawpaws to a troop of possums, okay, that attacked our trees and then took our Pawpaws.

So in any case, um, locally, we had a pretty good year for Pawpaw fruit set. Pawpaw fruit set is not usually that high. The flowers do not get pollinated very well. Um, in nature, they are pollinated by small beetles and flies, excuse me, and they're just not that successful at it in nature. But you can get big crops in some years. Uh, this year's crop suffered from a late frost that basically froze the flowers of a lot of trees right at the point where either they were about to be fertilized and pollinated or just after, okay? So, we did lose a lot of Pawpaws from our trees because of that, but we enough of them got through that we have a pretty good crop.

All right, let's take a look at what the inside of a Pawpaw fruit looks like now. All right, so the outside has a, at this point, it's a fairly soft skin. Um, when Pawpaws are not ripe, they're very hard, okay? They're sort of like an unripe pear, okay? Very hard. But then they soften up considerably once they are ripe, and so what I'll do is just sort of slice into this Pawpaw, okay? And so that's what the inside looks like, okay? You have, at this point in a ripe Pawpaw, a very soft flesh that is very tasty. Okay, I'll take a little bite of that now. Okay, when I eat Pawpaw, I get the sensation of a very ripe banana with a little bit of mango mixed in it. And I think a lot of people get those general tastes from a Pawpaw. I think they're absolutely delicious. There are certain people who don't like Pawpaws, but I'm a fan, okay? So I'm one of those that does.

All right, so when you eat this flesh, you can eat either just the soft yellow flesh that you can see here, but also the seeds. They have these large, dark brown or black seeds, okay? And each of these seeds is sort of in a little envelope, like kind of a pillowcase, if you will. And that material is also edible, okay? Very sugary sweet. But here's a Pawpaw seed, then, all right? Each fruit will have, you know, eight or ten seeds perhaps, okay, depending on the size of the fruit. And these seeds are, these Pawpaws are easy to grow from seed. So you could actually take these seeds out of this fruit, basically rinse them quickly, dry them, and then you can grow new trees from these

seeds. They require a procedure called stratification, all right? So these seeds have to think that they've been through winter before they'll germinate. So what you can do is fool the seeds into thinking they've been through winter by putting them, basically, in a plastic bag with a moist paper towel and stick it in the fridge. You can stick it in the fridge for about two months, bring them out of the fridge, plant them in soil in pots, and you'll have seeds germinate relatively soon thereafter. And you can grow new trees back from these seeds that you collect.

So, um, people make all kinds of things from Pawpaw fruits. I'm a fan of just eating them fresh, but I'm also a fan of eating them in things like Pawpaw bread. If you imagine banana bread, basically just substitute Pawpaw for banana. Uh, you can make pies out of them. People make ice cream out of them. You can ferment them and make, uh, you know, beer out of Pawpaws. Anything you would do with some soft fruit, you could put them in smoothies; you know, they'd be perfect for that. But just eating them fresh is simple enough, okay? And they're delicious. You can even use a spoon to eat them. People call this custard custard apple because the flesh can get really soft like custard, and I just eat it with a spoon.

Now, with all this sort of, uh, talk of how delicious Pawpaws are and what you can do with them and how easy they are to grow, uh, it needs to be discussed that there is some toxicity associated with Pawpaws, both the leaves and the bark, but also the fruit, okay? And this has been well studied. This is well documented, um, but Pawpaws contain some potent neurotoxins and some toxic alkaloids—things that can be inhibitory to cell growth and so forth. And so, um, if you look at a Pawpaw tree and its leaves, you see that Pawpaws are not eaten very much by herbivores, okay? Their leaves have relatively little feeding damage from insects or what have you that would normally eat the leaves. And that's partly because they do contain these toxins, these toxic alkaloids, for example, that will inhibit insect feeding or inhibit the growth and survival of things that do try to eat it. But it also has these neurotoxic effects as well. It shows toxicity towards nerve cells, essentially, and it's been, uh, the chronic consumption of Pawpaw or relatives, okay, the tropical relatives, has been associated with things like, um, what's called atypical Parkinson's disease, um, that is a disease Parkinson's-like disease caused by chronic ingestion of these neurotoxins.

All right, now the average person, the average Pawpaw enthusiast who has a few of these maybe for a few weeks each year or a few times throughout the year has nothing to worry about. What we're talking about here is chronic consumption. If you eat Pawpaws like every day, for example, or, you know, every week your whole life, which some people do, right? If they grow up on a Pawpaw farm or it's just a common part of their diet, you know, they can reach levels of consumption that can be damaging to your health. All right, so that's just something that needs to be discussed a little bit when you talk about Pawpaws because it's there.

So that concludes our episode on Pawpaws. I hope you enjoyed it, and I encourage you all to go out and try to identify this tree on your own, get yourself in a Pawpaw patch and see what that's like, uh, try to find a fruit and taste it, see what you think. I'm a fan; maybe you'll become a fan and learn to appreciate Pawpaws like I do. All right, take care."

[Music]