

# WITW-Podcast-S1E4-The Green Menace Part 1\_mixdown

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## SUMMARY KEYWORDS

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## SPEAKERS

Christine Krebs, Jay Ferrell

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**J** Jay Ferrell 00:00

Hello, everyone, and welcome back to Working in the Weeds. My name is Jay Ferrell, and I'm the director of the UF/IFAS Center for Aquatic and Invasive Plants, and I'm really excited about this episode we're going to bring to you today. I'm a bit of a history nut. And we are going to be delving into the history of plant management in Florida, specifically the story of bringing water hyacinth into this state, and what has happened since then. So, I really got on this idea when Christine brought me an article recently, and I was just fascinated by it. So Christine, tell us about this article you found.

**C** Christine Krebs 00:34

Yeah, so I started my search on the history behind aquatic plant management, by just Googling water hyacinth and the St. Johns River, a lot of experts will tell you to start there, and out pop this article published in the Florida historical quarterly in 1982. So it was an older documents, I was very excited to find something like that. And it was titled: "Engineers versus Florida's Green Menace." And I was like, "What is this?" And so I was like green menace. And I said, it has something to do with water hyacinth, click on it. And it was written by this Jacksonville University history professor, Dr. George E. Buker. And in this article, he narrates the story of water hyacinth entering the waters of Florida and what managers had to do to fight this quote unquote, green menace. In this episode, we are going to intertwine excerpts from Buker's green menace story. So I want to give this author the correct credit for telling the story so well as Dr. Ferrell and I share the details and the intricacies in between this crazy story.

**J** Jay Ferrell 01:34

So with that, let's delve into the green menace.

C

Christine Krebs 01:49

In the late 1880s or early 1890s People living along the St. Johns River were enthralled by the addition of a beautiful floating water plant to the river's scenery. Above a luxuriant green base, towered a spike of purple flowers. Steamboat operators were pleased when tourists admired the drifting bouquets gliding by their vessels. Cattlemen even along the river were enthused at the prospect of a new cheap feed for their stock. They gathered bundles of the floating greenery to carry up river for propagation in their ponds and streams. The recipient of this attention was the water hyacinth, a freshwater free floating plant. The proliferation of the water hyacinth borders on the fantastic. It doubles every month of its growing season. And in Florida, it has no natural enemies. Water hyacinths were introduced in the United States at the cotton exposition in New Orleans in 1884. And by 1893, there were acres of hyacinths floating about until the Florida East Coast railroad bridge stopped the plant from moving further down river. For the first time, the wide St. Johns River was covered from bank to bank. The plant was no longer a picturesque floating garden. Now it was becoming a menace.

J

Jay Ferrell 03:03

Boy, this is a story of unintended consequences, isn't it? As you're reading this, and I'm seeing the issue develop, part of me is just kind of going, man, if only they knew back then what we knew. Now this is so preventable. But basically the story starts with the cotton Expo in New Orleans, there's this awesome new plant, it's going to be you know the talk of the town for all the water garden folks. It's this cool little floating plant from South America with this amazing purple flower. This is what all the cool people have and everybody's going to want. So they're giving these things away. That's one of the stories and it's the story we hear most commonly. So I think we're gonna just stick with that. But all of a sudden, they end up back in Florida, but within just a few weeks, their little water garden had been fully filled. And they were having to have they were having to pull the plants out and pull the plants out to get the effect they want. Well, before long they said, "well, we've got these overgrown plants, what harm could it ever cause we just put them into the river? Let's have other people enjoy them."

C

Christine Krebs 04:07

Yeah, so these people who went to the cotton exposition were garden enthusiast. They threw them in their water garden, the plant was almost doing so well that they're like, let's see what it looks like outside into the river by the docks. I mean.

J

Jay Ferrell 04:18

What's the worst thing that could possibly happen? Right? It's just a plant who's ever had problems with a plant? Well, we didn't realize what an invasive plant really was and what it could do. And very shortly thereafter, people love this thing in the St. Johns River. The river boat captains were going back and forth in their steamers and people every time they would get to a raft of plants, people would literally move from the cabins out to the rails and look at the plant they would "ooo" and "ahh." Cattle farmers up and down the St. John's were saying

this is the new miracle forage. It grows for free. All you got to do "everybody come collect some plants, take it back to your ranch, throw them in your ponds, throw them in your canals and streams, this is going to be the next big thing." But it didn't take very long for the tide to turn.

**C** Christine Krebs 05:07

And when you say not very long...20 years?

**J** Jay Ferrell 05:10

It was actually more like 10. Before we realized there was a serious and significant problem. What we didn't realize is this plant has a growth rate that is unexplainable. So you read here that it came in with no natural enemies. So this plant was just growing at Full Tilt. And now think about the nutrient rich waters of the St. Johns River. You've got that warm water, you've got this warm climate and you have a plant that grows and reproduces by two separate means. So first, the plant flowers, it then drops seed into the hydro soil. And as soon as the water recedes, and that soil dries up just a little bit, all of the seeds start to germinate. And you have all of these little hyacinth plants floating and moving. But the bigger issue is the plant reproduces asexually as well. So you'll have what they call a mother plant. And it just starts putting on stems, and boom, another plant, then another, another, another all growing in these chains. And in peak summertime, warm growing conditions, it'll put on another plant about every 12 to 14 days. So start thinking doubling right 64 becomes 128. 128 becomes 256. 500 becomes 1000. 5000 becomes 10,000. When you start doing the math before very long, this plant has totally taken over. Now, early on, it wasn't a huge deal when there were a few plants, because it is going down the St John's and this plant cannot tolerate saltwater at all. So it would flush through the St. John's, go out into the ocean, it would immediately die. The problem came as all of these plants that are connected together start forming these massive rafts. Now they're moving down in these huge rafts and they start getting hung, and as they get stuck, other plants are floating into them, and now you have miles of plants down the river. At one point, they said that Lake Harney to Green Cove Springs, Florida, which is over 100 miles, so it's over 100 miles from Lake Karn in green Cove springs, that entire distance, plants were within 25 to 200 feet wide through that entire distance. And when you sorry, when you say the plants were 20 to 100 feet wide, you're talking about those mats. Okay. Those mats, those huge rafts. Now, where we really started getting into a problem is when there would be any barrier in the river. Okay, so remember, they're using this river to-they're moving logs, so they'll cut trees, they'll put the logs into the river, and float them downstream. Well, sometimes those logs would sink and form what they call a snag. Well now you have that raft come down and catches on that snag, and then becomes this big barrier. Or even worse if there's a bridge. And by this time, they had already built some railroad bridges. In this area, it was called the East Coast bridge. And that is what was causing the big problem. Because the way it was built, there were some lateral bracing down low that kept those plants from passing under the pylons. So they were catching those big rafts, and really causing them to stack up. Now all of a sudden, the entire width of the St. Johns River is becoming full and becoming blocked in. And as these plants keep coming, remember, they're still flushing down the river, they start piling on top of each other forming these huge stacks of plants. So now the steamers are coming down and they're-this is commerce-this is transport.



**C** Christine Krebs 08:56

Yeah again. So for our listeners, remember, we're in the 1800s right now. So St. John's River was the primary highway system really of Florida.

**J** Jay Ferrell 09:04

It was the economic engine of this state. And you have these ship captains that are actually they recorded in their logs, they would get to this East Coast bridge, and then all of a sudden they're stopped and they are working. And one of the captains wrote that in three hours, they were able to move 100 feet. It was so bad. They were even sending crewmen to stand on the water hyacinth, which had now been stacked up two or three feet deep. And they had axes and saws and they were trying to saw their way out of this problem to break up these plants so their boats could keep moving again. This is extremely dangerous realize they're in several feet of water. And if they break through that mat, there's no way they're going to come back up. So ship traffic has completely stopped. Meanwhile, I mentioned a moment ago, you've got the snags these logs, the ship captains were really good at seeing as the current would move around the top of that log, they could see where those snags were and they would avoid them. Not when there's a two foot tall raft of plants jammed up against they can't see them. You now had boats being impaled on the snags in the river. Meanwhile, you've got the bridge that is holding these plants now starts being compromised. You've got thousands of tons of plants that are pushed up against this bridge, and an entire river pushing against those plants. Before long, it started to break the bridge, it actually knocked out an entire section of the bridge, totally destroying it. They had to come back in and rebuild it. In the meantime, all the farmers that had these plants, they were growing for cattle feed, they quickly realized the cows would hardly eat them. Yes, they're green, and yes to us, we think a cow would love them. Cows, they'll nibble on them, but they really won't eat them. There's a lot of problems with cows when they eat water hyacinth. Hyacinth has really high levels of calcium in the tissue. As that cow starts eating that tissue and eating all that calcium, their rumen, that stomach that starts breaking down all that plant material, it has to kind of act like a fermenter. But all of that calcium gets in there, the pH of the rumen starts to go up, and then it stops working. So it would quote "put a cow off its feet." So, the more hyacinth a cow eats, the less they can eat. Meanwhile, there's so much water in that plant, it's about 95% water by weight. They have to now osmoregulate, they got to get rid of that water through increased urine production. The amount of energy required to release that water, was more energy than they were getting from the plant. So basically, the more hyacinth they eat, the skinnier they got. So this salvation, this new forage for Florida turned out to be a curse. And the cows are smart enough to actually not eat it.

**C** Christine Krebs 12:08

Did water hyacinth have an impact on fisheries? I'm thinking - so we talked about above water. We talked about even water hyacinth leaving water and helping out cattle industry. What do we see with fishing?

**J** Jay Ferrell 12:19

So at first all anybody was focused on was we can't move trade. We can't move people in commerce down the river. We're having issues with bridges. That was what everyone was

commerce down the river. We're having issues with bridges. That was what everyone was focused on and it wasn't until a little bit later, they realized that the biology and the ecology of the river system was also really starting to become degraded. These beautiful sand bottom areas in the river are now starting to be filled with muck. A leaf on a water hyacinth plant only lasts about seven days. So it grows out, it goes as hard as it can photosynthesizing and turning sunlight into energy, but then seven days later, it throws it away, it sinks to the bottom, and it becomes that mucky, oozy, black stuff on the bottom. Well, all of the plants that are in the St. Johns River, they evolved to have nice sand bottoms and they don't tolerate that mucky deposition, so the plant start to suffer. Meanwhile, there was a pretty active shiner fishery or shad fishery industry in that area, they would catch them with cast nets. That industry almost ground to a halt. Because everywhere they needed to cast net, it was full of plants, so they could no longer access those fish. And not to mention, as those plants are there, they're dropping leaves, they're decaying, the dissolved oxygen in the water starts going down very, very quickly. So where you have these large mats of hyacinth, you don't have fish because they simply can't live there. So by 1897, the people that were really working and the most concerned with this problem, they realized that eradication was no longer even in the conversation. They knew this was going to be a problem we had to manage. And we're probably going to have to manage forever. So they really started to come to terms with the fact that in a very short amount of time and about 15 years, this manmade problem was going to have to have manmade solutions.

C

Christine Krebs 14:36

E. S. Crill leading banker at the time, felt the need to stress the urgency of the matter. No one can realize how fast this plant multiplies and spreads. When I say acres I mean acres and hundreds of acres are floating back and forth as wind or tide may carry them. Mr. Crill ended with a prophetic warning: "you could state the matter in such a way as to have the party who was in charge of approving the plans for the bridge. See that the however, was not periodically blocked, as it will cause thousands to remedy what can be done now with little or no extra expense. His plea for aid was the beginning of a project, which remains active to this day.

J

Jay Ferrell 15:11

So every once in a while in history, you run into somebody that you kind of see as a hero. And to me, Mr. Crill is definitely that guy. He saw very early on that this was not just a localized problem, this was a massive problem that was going to bring this state to its knees. And if it can happen in Florida, it can happen in other places, too. So his impassioned pleas to Congress really changed everything, and forced them to see the magnitude of the situation and start appropriating money to come in and fix it. So this is when the US Army Corps of Engineers become involved. So now up to this point, the Army Corps was very involved and they had basically jurisdiction over all navigable waters. But they had never done anything with plant management. There'd never been a need. It had been removing sandbars, and things like that help improve navigation. But the wisdom was, if the Army Corps can remove a sandbar, they can remove a plant. So again, why is it the Army Corps? They're not researchers, right? Wasn't it? Why wasn't it a nonprofit foundation or some philanthropic group or a university? Well, because those groups really didn't do this kind of work back then they were still very natural. Universities were very natural in the type of research they did, they were more observational, rather than biological and trying to find solutions. So the Army Corps was a solutions based group, and they were ready to come in it make things happen. So in 1897, the Sanford

Experiment Station in Sanford, Florida was established on the direction of assistant engineer John Warren Sackett. So John Warren Sackett was a pretty sharp guy. He didn't really have a background in plant management, he was an engineer, but he attacked this problem as an engineer would attack anything: what are my options? What are my solutions. And he immediately said, there are three solutions that are possible, there are natural solutions, which he was using his natural enemies, what we would call bio control today. There was a mechanical solution and there are chemical solutions. So that is where he really provided his focus to look at each of these individually, and potentially in combination. So where he really started was with the natural enemies thing. And he kind of immediately discounted that, he realized the river is blocked, we have to have a solution now. We need it immediately. So to go to Brazil, and try to find a natural enemy, bring it back, determine if it works, look at specificity is it going to eat fast enough? He knew that was going to take years. So he immediately discounted that. Additionally, people had come to him and said, "Oh, but don't worry about an insect, there's this fungus, this leaf spot fungus that we think's attacking the plant, maybe develop that." This is 1897, and understanding of how fungal pathogens grow, reproduce, how to store them, how to get them bulked up in a in the quantity that you would need. Again, he said that's just going to take too long. So he discounted the whole natural enemies or bio control angle completely. So he said, Okay, now we went from three to two. It's either mechanical, or chemical. So we started digging into the chemical side. This was really before Industrial Chemistry was a thing. Remember, DuPont didn't start that company until 1897. And in 1897, they weren't industrial chemistry. They were gunpowder. They didn't become a chemistry company for 20 or 30 years later. So there weren't good options out there. So he was using acids, and he was using boiling water and high pressure water. And he was trying to figure out how can you use these things to break the plants down? He looked at these things, 12 ways from Sunday, and he never found anything. He could injure the plants. But he would basically what we would call burn them down. He could knock the leaves off, but he never could injure that crown, right where it's in the water. So every time he would affect these plants, he'd say, "man, I think I got a solution." 10 days later, it would just leaf right back out. So it wasn't long until he was pretty well moving past that. But not before he tried gasoline and salts and everything else. He was literally trying to set the plants on fire. Setting a water plant that's 95% water by weight on fire...not that easy.

**C** Christine Krebs 19:58

So since we're speaking about trying things we spoke about it being cattle feed before, right? And then now he's playing around with all these different options. And so I've read in the article that there was arsenic, tried as well. What kind of consequences did that have?

**J** Jay Ferrell 20:12

So early on, he wasn't looking - like I said he was just looking to acids and top water and things like that. Well, there was this company, I believe in Louisiana, that said, we've got a chemical that I guarantee you will kill these plants. And they weren't real forthcoming with what it was. And he said, "No problem, send it here. I'll try it." Started working with it. Phenomenally effective. It was actually killing plants. And he thought he had a solution. But turns out it was an arsenic based material. And arsenic is just globally toxic, right. To make things worse, the way

that they had to manufacture that for it to work, and for it to be sprayable, they had to mix salt with it. So he's spraying it on these plants, and now you've got all this salt deposition on the plants. Well, what do cows love?

**C** Christine Krebs 20:12  
Salt.

**J** Jay Ferrell 20:46  
They love salt, and we put salt blocks out for him all the time, right? They were literally drawn to these plants, so plants that they previously wouldn't eat, they are now drawn to them because they're salty. So this was the problem is he is now attracting cows to this incredibly toxic substance. And it is - the results are clear and immediate. There are dead cows laying everywhere. And now the ranchers are furious for clear reason. They again, reach out to Congress and say you have got to stop this madness going on in Florida. They are doing things to manage these plants that are killing cattle. So Congress very swiftly steps in and totally puts a stop to all spraying for water hyacinth. They said, "if this is the best you can do, then you've got to figure out something else." So spraying stopped because of the arsenic issue and didn't start back for decades.

**C** Christine Krebs 22:11  
Francis Shunk, another researcher stated, "it does not appear possible to continue the method of killing the hyacinth and by spraying. It therefore seems necessary to fall back upon a mechanical method." So for the next three decades, managers combated the green menace by mechanical means only. During that time, the water hyacinth spread throughout the state. It was no longer a problem confined to the St. Johns River.

**J** Jay Ferrell 22:40  
So now here we are. We've realized that biological control at this point in time is a non starter. We've understood that chemical means of control is a non starter, we just don't have the technology for those. So we are now going to have to double if not triple down on mechanical harvesting. That's our solution. Now, the good thing is, is that this is the Army Corps of Engineers, and they love building bigger and better, more efficient machines. That's what they trained to do. That's what they go to bed thinking about and wake up thinking about. So this is where they really put their effort. And the amount of innovation here was phenomenal. They developed big draglines they developed grabbers, they developed elevators that would just go through and scoop the plants, and in one motion, put them on the bank. So things - the amount of innovation was just absolutely incredible. Now, but with this, they were realizing that this business system is not going to be really fast in this plant has already moved throughout the entire state, and even if we are able to manage them in this one area, we now have to move this thousand tonne piece of steel somewhere else. For this to be sustainable, they have to have recurring funding. So again, Congress stepped in acknowledging the need that is going on in Florida, and they appropriated recurring funds in 1899. Through the Rivers and Harbors Act,



and the appropriation was called "rag funds" or "reduction of aquatic growth." Believe it or not, those funds are still appropriated every year 120 years later, for water hyacinth control in the state of Florida. It's incredible that a federal program has lived that long, but the problem still remains and I think that's one of the things we need to keep in mind. But one of the more successful boats that they came up with or harvesters they came up with, wasn't a harvester at all, it's what we would call a shredder. It was designed by Charles Short of Clermont, Florida, and he designed what was called a saw boat. So picture a boat with basically a gang of saw blades on the front of it. So all of the saw blades were spaced about a half inch apart, and they would begin to rotate. And as they would lock in to that big raft of plants, they would start to shred the plant. So there was about a six foot Gang on the front, and two, two feet on each side. So they were able to shred and open up a 10 foot Swat. Now, where this is important is remember that East Coast bridge, that was that collection point for all these plants. The plants would go up there, hit that bridge, and stop. They knew if they could get those rafts broken up and let them pass under the bridge, they would go on out to sea, where they would be killed by saltwater. So they had to figure out how to break them up. And I mentioned earlier, they had people out literally sawing the plants apart with crosscut saws by hand, just not efficient. But Charles Short, he designed the shredder to get in there and cut 10 foot swaths. And what he would do is cut a swath, move over about 20 or 30 feet and cut another swath and then that piece that was cut free, would then pass through the bridge and out to the ocean. So for the first time, we actually have a way of keeping the St. John's flowing and keeping it open. But we knew that this was not a statewide solution. What do you - what happens in really narrow canals? Or shallow streams where this machine can't operate? Well, the Army Corps not really knowing what else to do in some of the specialty areas, they start employing people truly manpower, giving them rakes and having them physically rake these plants out on the bank. Now that worked reasonably well. But before long, these plants are still prolific in their reproduction, that you end up with not a lot of bank left, you have these huge piles, you still have plants, and now where do you pile them? So there were still big limitations. But at least with the technology we had, the water could flow. So this takes us until about 1940. So now come back and join us for part two, where we're going to talk about new innovation and new technology. Whatever happened to herbicides and cattle? And can we use this plant for good?



#### Christine Krebs 27:24

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