

Seneca Lake Pure Waters Association: Okay, I'm admitting everyone.

Seneca Lake Pure Waters Association: Alright, see if your share works.

Seneca Lake Pure Waters Association: Sorry for the delay, everyone, we were just dealing with some technical issues, apparently, the more things change, the more they stay the same.

KJS: Alright, are you seeing the slides, then?

Seneca Lake Pure Waters Association: Yes, we have it.

KJS: Oui.

Seneca Lake Pure Waters Association: We finally figured it out, just in time.

KJS: I don't know what was going on. Gave me a headache, though, that was fun.

Seneca Lake Pure Waters Association: Yeah, always, always fun to come in at the wire.

KJS: I am so sorry about that, but, let's see.

KJS: And I should be able to... it doesn't matter if the camera plays now, I can just get rid of Cameo.

KJS: Thanks.

Seneca Lake Pure Waters Association: Okay.

Seneca Lake Pure Waters Association: Alright, we're gonna give it a few more minutes so that anyone who's, was thrown out or doesn't understand what's going on can get back in.

Seneca Lake Pure Waters Association: Again, I apologize to everyone for the delay.

Seneca Lake Pure Waters Association: We spent a good almost half an hour trying to figure that out.

KJS: I've been have... actually, I'm not surprised, I've been having so many technical difficulties lately, it's ridiculous.

Seneca Lake Pure Waters Association: Gotcha.

Seneca Lake Pure Waters Association: Alright, so...

Seneca Lake Pure Waters Association: We will give it another 2 minutes, and then we will get started.

KJS: M?

Seneca Lake Pure Waters Association: And again, apologies.

Seneca Lake Pure Waters Association: Phew.

KJS: I did upload it to Board of Directors, so you do have a copy of the presentation.

Seneca Lake Pure Waters Association: Perfect, thank you.

Seneca Lake Pure Waters Association: I assume. We were.

KJS: There's a recording based on what I'm seeing of the other deep dives.

Seneca Lake Pure Waters Association: Alright, just one more minute, and then we'll get going.

Seneca Lake Pure Waters Association: Okay.

Seneca Lake Pure Waters Association: So let me start off by, introducing our latest Deep Dive participant, Professor Kelly Smith, courtesy of, Elmira College. She is,

Seneca Lake Pure Waters Association: incredibly experienced in terms of environmental research and water resource issues. She's doing a presentation tonight on the power of plants.

Seneca Lake Pure Waters Association: And I would, encourage everyone to keep their mics on mute, and then if you have any questions at the end of the presentation, we will have some time for that. You can just enter it directly into the chat.

Seneca Lake Pure Waters Association: And, I will let, Kelly take it away.

KJS: All right, I'm still seeing the icon in some of these for this,

KJS: camera view I was set up, so just ignore it. I'm gonna... Switch this to, slideshow.

KJS: And let's hope everything works. Alright.

KJS: Okay, so I'm gonna be talking about the power of plants, and I'm hoping the camera is working right. And so, I've done a lot of work with wetlands, and you know, a lot of my more recent work has been

KJS: more coastal, but I've also done some freshwater work, and I'm just very excited about aquatic systems and looking at human impacts on aquatic systems.

KJS: And so, I'm sort of kicking this off with just a few images that are local in nature, so...

KJS: One of the photos is of a forest ephemeral stream, very pretty. This is the type of stream we would like to see in a natural system, where in reasonable flow levels, you see the water percolating through plants.

KJS: There's going to be a lot of processing of materials before it reaches the water body that it's headed to.

KJS: The second image is of Catherine Creek.

KJS: Not at a high flow time, but all of that turbidity you see. By turbidity, I mean the cloudiness of the water, is due to culvert work, and so you can see just how different the water is where there's a lot of disturbance

KJS: versus Catherine Creek, which is very clear at that time.

KJS: And then, many of you may be familiar with the very high flow event that happened on March 31st, and this is showing a culvert

KJS: That is emptying into our wetlands, and instead of that water then just pouring directly into a creek, it's being forced across marsh grasses, which are going to help capture material and reduce the loading.

KJS: So, we're all interested in the nutrient sources for Seneca Lake, and I think you've heard about a lot of the sources. I'm going to talk about it from kind of a more big picture

KJS: View.

KJS: So, many systems, many lake systems have cycled nutrients within them, and so much of the nutrient transformations are autophonous, meaning the nutrients are cycled within the system.

KJS: And so that internal cycling, allows reuse of nitrogen, phosphorus, and other materials, although eventually they may sink to the sediments. And for a lake like Seneca Lake, autoconous

KJS: input should be fairly low. This is because it's a deep, narrow lake, there's a lot of shading from the sides, and typically, nutrient input is low, and so we don't see a lot of internal sources for nutrients.

KJS: That would be very different if you had a shallow pond

KJS: That had a lot of submerged vegetation.

KJS: Much of the problem we have is what's called allocthenous, aloe for outside, and so this is input from other sources. You can have some input from direct precipitation, you can have some runoff from the shoreline of the lakes, but a lot of it is going to be

KJS: Coming from the watershed, entering tributaries, and then from there, moving into our lake system.

KJS: So, let's focus on this input from runoff. And again, just to use a few key terms, a watershed is a land area that water moves from entering a particular region, such as a stream or lake.

KJS: So what I'm showing you is a big picture image of land use in New York State, because

KJS: Land use practices fundamentally alter the runoff that is going to come from a watershed. And so you can see, for example, that the Adirondacks... can you see my cursor?

KJS: Can people see cursors?

Seneca Lake Pure Waters Association: Yes, we can see the cursor.

KJS: So, the Adirondacks, nice green, all forested, and so that's going to be the main land use. But what happens when we move into the Finger Lakes? We see a lot of yellow. If you look at the legend for the map, yellow is agriculture.

KJS: And so we've got a lot of agriculture. Now, we're gonna zoom in...

KJS: to an image of Finger Lakes land use, and this is from Halfman. I think it was posted on, originally at Hobart William Smith.

KJS: And so, here again, we're seeing all of that agricultural land use, with some areas that are forested, okay? So, we have a major source of,

KJS: runoff that is going to come from agriculture. So, if the primary land use is natural forests, which we can see some forests here, the runoff is

KJS: A lot of the water is, first of all, going to infiltrate quickly. The soils are going to capture it, plants are going to capture the nutrients, and much of what enters into streams and tributaries is what we call coarse particulate organic matter, or, sea palm, which is like leaves and twigs, things like that, which are processed in the stream.

KJS: And we'll look at the role stream complexity can play, but it can either be retained within the stream or exported into the waterways.

KJS: Agriculture, on the other hand, we're going to have a lot of depleted soils, we're going to have a lot less coarse particulate organic matter coming in. The soils are going to come in, because the soils are depleted, those soils.

KJS: Farmers are probably going to be adding fertilizers, things like that, and those fertilizers and pesticides are going to travel through the soils, making them their way into, field runnels, and ultimately into tributaries.

KJS: Now, I mentioned stream complexity, because stream complexity can play a role in, Capturing nutrients, and...

KJS: especially coarse particulate organic matter. So I've tried, for those of you who are interested, to put the whole citation for some of the articles that I'm going to talk about in the slide. And so what we're looking at here is a Boulder Creek watershed, and so this is not our region, but it is a mountainous watershed where we have fast-moving streams.

KJS: And so, many regions simplify their stream structure to... in an effort to prevent floods. If you remove all of the debris and everything, water doesn't back up. But it's actually that debris in plants that capture materials

KJS: And can prevent them from being exported into waterways. And so, you see here some different options for having retentive features that might be present in the stream. And then what we look at is proportion of accumulation of

KJS: Horse particulate organic material.

KJS: And so we see that factors that retain them, these are the different categories here. Coarse grains can play a role. Look at the role that live vegetation plays.

KJS: Other factors, but large and especially twigs and woody sea palm

KJS: gather up, and I've actually witnessed this in the streams that we have. They're captured by larger material, and then they form these boluses that can retain more material, and then that allows that material to be broken down in the stream, utilized by a lot of organisms, and so a lot of times you have less export.

KJS: into local waterways.

KJS: Okay? So, I do want to emphasize that stream complexity is a very important topic when we're looking at export of materials into a waterway, like a lake.

KJS: So we want our tributaries to have a lot of complexity that's going to capture any coarse organic matter and allow it to be processed within the stream.

KJS: Now, just to give sort of an overview, previous, deep dives have talked a lot about runoff

KJS: and the severe impact of strong runoff events, so when we have storms. And so I'm just going to use a couple of classic teaching materials that I use when I talk about this process

KJS: for students.

KJS: And so, when we have high discharge, that means that our watershed is receiving either very prolonged rains or very severe rains. And...

KJS: How long that water takes to reach a water body, and how high the water levels ramp up depends upon the type of land use that is prevalent in that region.

KJS: I've done a lot of work in urban areas. And so, in an urban area, what we see is very rapid ramp up. And if you look at discharge, you'll notice that the peak is higher. This is hypothetical, but again, there's a lot of data to support this. The peak is higher, ramps up rapidly, high peak.

KJS: and then rushes out. Versus agriculture, which has a slightly delayed peak, but again, notice that we've still got that higher peak.

KJS: than we see in a forest. So, when you have forested systems, your discharge rates are slower.

KJS: it makes sense. There's being a lot of... there's a lot of capture of that discharge. So when we have these high ramp-ups, these very high discharges, we're going to have greater erosive force. So that means that the actual substrate

KJS: of the watershed, the surrounding lands, and the stream itself are now being transported into other water bodies. This is also going to lead to higher nutrient transport, and again, I want

to emphasize that that impact varies greatly with land use, and so we really need to understand the land use.

KJS: And again, this is why people are very interested in this storm runoff

KJS: for Seneca Lake. We need to know, of course, what these tributaries are doing. Now, there's being a lot of data being collected for Seneca Lake, but again, this is taken from Water on the Web, which is a fantastic site for learning about freshwater systems.

KJS: And these are just some generalities from 1980. What we're looking at for phosphorus is

KJS: high, very high export of phosphorus under high water, and we see it drops down with lower water flow, and then as our, our discharge decreases, it drops even more. Compare...

KJS: urban and agricultural to forest, and to direct input from precipitation. So we're really seeing a lot more phosphorus coming in, and I want to emphasize the units here. It's a rate.

KJS: It's kilograms per kilometer squared per year. So, I hope you all see the magnitude here. So, what do we have along Seneca Lake?

KJS: We have a lot of agriculture. We have some urban, but not a lot, and then we have some forested areas, but they're very patchy. So what we're looking at is a signature of runoff from agriculture. So we're seeing the potential for these higher discharge events that are carrying more phosphorus. And by the way, if you have questions.

KJS: Please pipe in and let me know if you have anything you want me to answer. I really... I'm used to students interrupting me all the time.

KJS: All right, so we've talked about storm runoff then. We know

KJS: that, runoff happens. We know that that runoff is more severe when we have land uses other than forest. And so, as we have converted much of this region into agriculture, we're seeing those higher loads of nutrients. And

KJS: Oftentimes we emphasize phosphorus. This has been talked about in previous discussions, but phosphorus in freshwater systems is what we call a key limiting nutrient, meaning that you add more, you will always get more growth.

KJS: Now, more growth is fantastic if you're trying to grow your garden.

KJS: It is not fantastic if that growth is coming from algae in the lake. So if these nutrients are making their way into a lake.

KJS: The organisms that are very quick at capturing those nutrients are algal species, and some, like cyanobacteria, can be extremely competitive for phosphorus. And by the way, cyanobacteria, this is blue-green algae.

KJS: These are our freshwater, harmful algal bloom-forming species.

KJS: So, what I'd like to talk about today is using plants to reduce runoff.

KJS: So, there are a lot of artificial ways we can reduce nutrients, binding them with various chemicals, but I'm very interested in natural systems and their role. And I can't really look at the chat, by the way, now, so if any... if someone can bring the chat to my attention, if there's a question, just let me know.

KJS: So, we're going to talk about using plants for runoff, and there are a number of opportunities. I have highlighted the two that I'm going to focus on today, but I don't want to say that the others are not important.

KJS: So we have riparian buffers and field buffers, so this is doing something at the edge of the landscape to reduce water from coming into the waterways. Then, if we are

KJS: at the edge of the water, we're either looking at improving our wetlands, or even in still waters, creating floating wetlands. Now, other factors that take up nutrients.

KJS: SAV stands for submerged Aquatic vegetation. There are some submerged forms that we like, there are some we don't. The problem with relying on submerged aquatic vegetation that's rooted is it's not really helping you a lot for the water column.

KJS: So really, we would be looking at macrophytes that are rootless or growing in open water that can take that up. And in severe systems, we can rely on just floating macrophytes

KJS: like duckweed and other forms that get all of their nutrients from the water cup. Now, this is not going to happen in Seneca Lake.

KJS: But we do know that there are a number of smaller ponds, which retain waters for periods of time, and then ultimately the outflow makes its way to Seneca Lake. And so those are things we can think about. Now, of course, cover crops, methods like that of farming.

KJS: are incredibly important in terms of reducing runoff. I'm not going to address that, because that's not really where my expertise is, but I certainly want to emphasize the fact that certain farming processes can greatly reduce the amount of nutrients that enter the runoff.

KJS: So let's, talk about riparian buffers.

KJS: So riparian means riverine or stream zone, and it's... so it's looking at the edge of moving waters. I am not a good graphic artist, so I borrow from people who are, and so this comes from Sophia Boss from,

KJS: World Wildlife Fund in Canada, and I really like this image because it's incredibly informative, but you have to think about it for a while.

KJS: So...

KJS: When we have a thriving riparian buffer, as indicated on the right, we have a broad edge with complex vegetation growing along here, and so any field outflow, that sort of material.

KJS: is going to be, in part, taken up by this rich, diverse network of plants.

KJS: The wonderful thing about a healthy riparian zone is it is habitat for a lot of different organisms. It is going to sequester carbon. Now, if you're not familiar with carbon sequestration.

KJS: Why are we interested in it? Because we have challenges relating to elevated carbon dioxide levels in the atmosphere, and so the more carbon we can sequester in our biomass, in our sediments, the better off our climate is. So that's another broad topic, but I do want to mention

KJS: that... That rich riparian buffers facilitate that

KJS: holding of a lot of carbon, which is good. And so, what's the result of a healthy riparian zone? We have cleaner waters coming out.

KJS: providing lower nutrients, and those nutrients are... the majority of those nutrients are actually being processed by these plants along the edge. Now, the other fantastic thing about a really rich

KJS: diverse riparian buffer is all of that plant material helps to reduce erosion. So the plant roots are holding the soils in place. So you're getting less sediment export.

KJS: Now, here's our degraded... right, whoops.

KJS: Waste.

KJS: a little crazy here with my scrolling tab here. Alright, so...

KJS: Here's a degraded one. So maybe this farmer didn't feel like leaving a lot of trees up next to the stream. And so, we're having direct erosion and nutrient export directly into the stream water. This is going to lead to increased algal blooms, and it's going to be leading into

KJS: reduced water quality, okay? So, think of thriving riparian buffers as those vegetated zones alongside streams that capture those nutrients.

KJS: Now...

KJS: What I want to talk about next are the plants we use for a riparian zone, because not all plants have the same power. They're not all able to capture those nutrients. And so, this is a nice graphic from another organization, Watersheds, that is showing you

KJS: If you can see it, it's a little blurred, but what we're looking at is, here's the surface of our soil, and then here are root networks.

KJS: Here is mowed grass. So, if you like your bright green grass on your lawn, your grass is pretty craptastic for picking up nutrients. Why? Because the roots are maybe 4 inches long.

KJS: So anything that goes below that level, they cannot access, which is why many homeowners with bright green lawns are applying fertilizers, because their grass is not good at capturing nutrients. So short.

KJS: Fibrous roots are poor nutrient collectors.

KJS: Now, if we move to long, complex roots, now they're moving down into the soils further, and they're better able to acquire those nutrients. So they're allowing less of the nutrients to escape.

KJS: And...

KJS: That's also more carbon in the soils. And then, if we get woody roots, we've got long-term storage of carbon. So, we're kind of moving from lousy

KJS: Plants for riparian zones to these better plants for riparian zones with extensive root systems.

KJS: that can capture nutrients at greater depths. So if we're taking more nutrients out of the soil, they are not moving through subsurface flow to waterways, where they are then entering into our lakes.

KJS: Okay? So, plant type is really important.

KJS: So... Let's think about practices in our riparian zones.

KJS: So, riparian zones... One of the challenges we face with many of our streams is we have

KJS: a sort of a conflict between capturing nutrients and controlling floods. There is a lot of concern with many engineers about vegetation holding up water flow, vegetation being swept into the waterway, and increasing flooding.

KJS: I think some of those concerns are a little overdone, but it's very hard to argue the case. Now, one of the good bits of news, though, is DEC, for their flood zones.

KJS: Does require, for the areas they maintain, deep-rooted grasses, so they're not going to be using those small turf grasses with very short

KJS: root systems. Some of their grasses include bluestem, indi grass, and switchgrass, and so one of my students is standing here

KJS: This is a... if you were to pull this grass out, first of all, it would not be easy to pull out, and secondly, its roots go pretty far in.

KJS: And so.

KJS: It is being swept around, moved around by this water, it's still holding soils, and it's going to be capturing those nutrients. One of the challenges we have, though, is eventually growth can...

KJS: can cease, so these are seasonal plants, and so they're uptake seasons. Now, hopefully, nutrient inputs are also reducing at that time. In other words, we're not having late season fertilization or anything that would contribute those nutrients.

KJS: No.

KJS: One of my comments is, do private landowners follow these guidelines? And that is a big question.

KJS: So, this is Havana Creek. This is one of our creeks that we know has nutrient runoff from farm land use, and so my student is capturing this water. We later tested it. I can't do whole phosphorus, but I can do

KJS: phosphate, and we did find high levels of phosphate. You'll note that high water level, turbid appearance, this is a high water flow day. So this is a day when we're going to have a lot of nutrients being exported.

KJS: And just for your information, Havana Creek feeds into Catherine Creek, which feeds into Southern Seneca Lake, ultimately. So this is moving nutrients into the lake.

KJS: All right, so I want to tell a story in pictures. I have always loved wetlands, and we had an amazing opportunity to buy a little hobby farm when we moved up here. And so we purchased it in January 2023, and it was a farm where sheep

KJS: were allowed to graze along the edge of the creek, they were allowed to walk through the creek, they were basically allowed to trample everything. And so this is a culvert

KJS: Creek passing along here, but you'll notice it's denuded of all vegetation. Yes, this is the winter, but there's just nothing left there. And I don't have a good photo of this, I didn't think to take it, but there was very little vegetation

KJS: along the creek stem, the Lahamadu Creek itself.

KJS: So, we purchased it. We do have plans to get grazing animals, but we will not be allowing them to approach the creek. We will protect a broad riparian area. This is after

KJS: just a little over a year of our ownership, and this is looking at a small culvert inflow, and then Lahamadou Creek. I hope you can see the stunning difference. So we've got massive quantities of plants.

KJS: And... geez, I just got this thing popping up in front of me. That was not fun.

KJS: It was a poll.

KJS: So we've got all these plants growing here. Now, a lot of these are invasive weeds, we're working on that, we're trying to get more natives, but even these invasives are taking up nutrients. So we're gonna see, even in this high water event, we're seeing less, whoops, less export of nutrients and less erosion.

KJS: Now, I mentioned the very high water event March 31st, so this was a freaking disaster. We still had a lot of frozen ground.

KJS: And then we had a lot of rainfall combined with snowmelt. And this was a catastrophe.

KJS: What I want to show you here is... Look at this...

KJS: wetland vegetation resisting. It is resisting the movement, and then there's some deadfall in here. So it is... it is basically depulsing the movement. It's slowing it down.

KJS: A lot of the sediment gets deposited into this vegetation, so even though the vegetation isn't actively growing, this wetland vegetation is doing its job.

KJS: It's slowing the water down, it's capturing a lot of that energy, and it is reducing the erosion.

KJS: So, a lot of people get rid of their cattails, they consider them unsightly along creeks, but cattails can do a lot of work, and they can help

KJS: to slow that water movement. And any material that is exported is coarse and typically relatively low in nutrients. So I hope...

KJS: These photos have told a story about just a small example of what changes in land use can do.

KJS: If you prevent grazer impact, if you prevent erosion and trampling right next to your creeks, if you preserve that riparian zone, you are really going to benefit the creek system a lot. And remember, these small creeks coalesce into larger creeks, which enter, then.

KJS: the Seneca Lake.

KJS: All right, so now I'm going to tell a story about an area that I used to work in, but some of the challenges are going to be really similar to the challenges that we have.

KJS: So, I've done a lot of, there we go. Days... there we go.

KJS: I've done a lot of work in Florida, and Florida has pretty crappy requirements for riparian zones. They have fewer restrictions for the type of vegetation used, and homeowners can pretty much do whatever they want.

KJS: And they do have flood control areas. They have made abundant opportunities for surface waters to be captured, but they're not all that careful about what

KJS: the vegetation is along this. And so here is a drainage ditch. This is not my photo, but you can see that there's short St. Augustine grass, some weeds, but not a lot of vegetation here.

KJS: Okay? So there's not a lot of nutrient uptake here. These are fairly, saturated soils, and so, again, this is a more urban area I'm working in.

KJS: We could think not necessarily of some of the smaller towns, but maybe, like, Elmira, New York, as a more urban area, and some of the streams that come from there.

KJS: So we've done some research in the past about using these riparian zones, modifying them, and improving uptake of nutrients. So I'm going to talk about a 2010 study. This is published.

KJS: The title and the authorship is huge, so I've just got the link down below that you can access the original paper.

KJS: And so what we did...

KJS: This is for St. John's River, St. John River in northern Florida. It is a very different river than the ones we have around here. It's slow moving, but I still think some of the lessons we learned from this can apply to our systems.

KJS: So we took areas that just had, sort of mowed lawn, areas like that, and then we took other areas that we restored with native plants.

KJS: And so we used a variety of different native species with complex root systems. And so these are some of the areas that we worked in, and so what we were looking at are these upper tributaries. So.

KJS: Upper tributaries are not spectacular. They're tiny. They're like that ephemeral stream. Upper tributaries for urban areas are basically runnels, swales along roadways. In farms, they're those small

KJS: streams running off of the farmland and joining larger streams. But...

KJS: This is where the main interaction between soils and water happens.

KJS: So the big picture of nutrient influx happens in the upper watershed, where there are these very small streams. So that's really where we want to focus a lot of our energy, if we want to reduce nutrient transport.

KJS: And so, I'm only going to present some of our results. Oh, man. So, that box migrated. That box on pH was supposed to be over nitrogen. Ignore pH, it is not useful.

KJS: Look, instead, follow the cursor, not the box.

KJS: Nitrate-nitrogen. We've got our garden sites, where we put in our native vegetation, and we have our non-garden sites, where we didn't. Let's focus our eyes here. And so nitrate-nitrogen was significantly reduced.

KJS: by gardens, and this was an early-stage garden. They had not completed their grow-out by the time we published.

KJS: the news, I think, would be a lot better now. We do see some impacts on phosphorus, but phosphorus is very confusing, and so we actually think that phosphorus was higher

KJS: just by chance in the soils there, and this early phase didn't capture it enough. So we think there would be better phosphorus results. So, what's the big picture here? Just by adding natural gardens, we saw soil nutrients reduce.

KJS: Okay, so what's the picture of water? Well, if you did large enough areas, remember, where's the water coming from for the stream? It's coming from the soil. It's either on the surface or doing

KJS: just below surface transport in a sheet-like movement from higher elevation to lower elevation. So it's making its way into these water bodies. The more of those nutrients we can capture, the better it is.

KJS: Alright, so that's our tributary work. I also got very interested in retention ponds in Florida.

KJS: And so, Florida, as you know, used to have a lot of wetlands, and people love to live in Florida. I'm glad to be out of it, but I know many of you may visit Florida for its lovely warmth.

KJS: To build houses in Florida, you have to alter wetlands. It's happening less frequently, but we still have altered wetlands.

KJS: But, These areas are still low-lying, and they have a lot of water. So instead of having wetlands.

KJS: they create what are called retention ponds, and sadly, the state of Florida actually counts retention ponds as wetlands. So an acre of retention pond is considered an acre of wetlands, but they do not function like wetlands.

KJS: And this is an example of a residential

KJS: Retention pond. Do you see what's surrounding it? Nice mowed grass, all the way to the edge.

KJS: So you can imagine that very few of the nutrients that move along that surface are going to be captured by that grass. And here is the big challenge, and...

KJS: all the scientists agree on this.

KJS: But it's hard to get this across to the public. This water is moving in a sheet-like form, relatively untransformed into local waterways, meaning there's very little nutrient transformation happening, and so any nutrients in this pond are just making their way to the tributaries and the river.

KJS: And that's a problem.

KJS: A lot of people don't want their ponds to grow a lot of algae, and this has both green algae and blue-green algae. Algae does take up the nutrients. It reduces the transport of those nutrients into the waterways.

KJS: But it has a relatively unpleasant aroma, and it doesn't have the appearance people.

KJS: So what can we do with these systems?

KJS: Well... One tactic I used was floating wetlands in the ponds. This was a...

KJS: Basically, a concept attempt to see how well they work.

KJS: You float these wetlands, you use attractive plants. The ones I used weren't attractive, but use attractive plants. They take up the nutrients into the biomass.

KJS: You harvest them, and you export those nutrients out of the system. The other thing we can do is use vegetative buffers. Stop mowing to the edge.

KJS: And use different types of plants as your plants along the edge.

KJS: And so, for example, the university I was at, University of North Florida, stopped mowing to the edge. They started planting bunch grasses like sawgrass along the edge.

KJS: And not only did that capture more of the nutrients, but when you've got big bunch grasses, all the garbage coming off from the roads and the sidewalks.

KJS: Collects in the grass, and you can pick it up.

KJS: Otherwise, all that plastic waste ends up in the waterway.

KJS: Alright, so let's take a look at what happened.

KJS: My original project, I do a lot of salt marsh restoration, so the plants I used were *Spartina alterniflora*, which is the salt marsh poured grass.

KJS: it will grow in fresh water, as long as there's enough nutrients. You do have to acclimate them back into salt to put them back out in the marsh. So I said, let's take

KJS: *Spartina* from a donor marsh. We're going to pull it without a lot of root biomass, so we're going to reduce the damage to the marsh by pulling the plants with low biomass, reducing the peat loss, and then we're going to grow them out in the lab.

KJS: Now, the sources of water we used were from retention ponds.

KJS: I think that the Golf Learning Center pond, this was a pond that was used to irrigate the golf course.

KJS: And initially, that pond was filled with spring water, which was a big no-no for Florida. You're not supposed to use aquifer water for irrigation of golf courses. So eventually, what they did

KJS: Was they started pumping reclaimed water directly into the pond.

KJS: And reclaimed water is water that has received preliminary processing, but still has high nutrient levels. And so, you can imagine what happened to that pond pretty quickly. We had algal blooms, we had noxious smell, even with aeration.

KJS: And so this looks at the nutrient levels of those ponds

KJS: This is one that the Lot 18 just received runoff from turf grass and, asphalt. You still see a signature of phosphate, a signature of nitrate.

KJS: But take a look at the levels for that reclaimed water pond. I think this is a model for some of the ponds that capture manure and runoff around... around farms.

KJS: high nutrient loading, and that water is sitting there, and it is just loads of nutrients. So we use these nutrient-laden waters as a source for growing out plants in the lab.

KJS: This was a student project, and I think she did an elegant job. So we just used dark Lowe's buckets that wouldn't let light in, and you can see that the top of each of these buckets is covered, and we've even used foil to block any light from entering the bucket.

KJS: Why? Because any microbes in the bucket, such as algae, could take up nutrients if they grow, so we wanted to prevent all algal growth. A good experiment has controls, and so we had buckets that had everything but the plant in them, and we looked at nutrient uptake there.

KJS: So we had this replicated project in the greenhouse. Again, this is a low-cost project. We plant... we put these plants in, and we look at root development. And this just shows you the stunning root development that can happen from a plant that is just floating in water. So with those high nutrient levels, these plants are growing vigorously.

KJS: Whoops, and so here we see the high nutrient pond water. These are plants that are ready to go out in the field for a restoration. Now, I was doing a salt marsh restoration. Do we need to restore our freshwater wetlands around here? Yes, there are plants we might want to cultivate.

KJS: Can we cultivate them in high-nutrient fresh water? Yes, we can. And we end up with a great root mass that's ready to go out in the field, and it's already enriched with microbes that are going to help.

KJS: This is what grows when you don't use nutrients. We just had to see what tap water would do. It did nothing.

KJS: So, we see that this nutrient-rich water can grow plants.

KJS: Now, this is my student's graph.

KJS: And these are just two short trials. We did not see a big impact on phosphate. We did see an impact with nitrate. And so control are the diamonds, these are those buckets with no plants.

KJS: The circles are with plants. What we see is that a very steep slope here

KJS: for the ones with plants, a less steep slope, so we're seeing nitrate... I think some of the nitrate could be transformed or reduced to ammonia, but we're seeing that decrease in nitrate

KJS: In the planted ones, without as much production of ammonia.

KJS: We see it in the second trial.

KJS: steeper slope, so more nitrate being removed, and do you notice the unit? This is ours.

KJS: So this is over hours that these plants are taking up these nutrients. So, this is really getting at the fact that if you float these plants in nutrient-rich water, they will take up those nutrients.

KJS: So the next thing we did was floating wetlands. My design is ugly, but it allowed us to pull out individual plants and examine them.

KJS: Normally, if you're gonna do a floating wetland for a waterway that people look at, you're going to go with a commercial company that can produce you some really nice planting mats. Everything can look a lot better. But this was our technique.

KJS: for each one is an individual plant. We can't see a measurable effect on the pond. Our system is too slow. What we're looking at is how successful these plants are in situ, so in the pond.

KJS: And this is where things get messy.

KJS: So, hurricanes. This is Florida. We have hurricanes.

KJS: Our wetlands actually washed up on shore.

KJS: I don't know that we could create a floating wetland that would withstand hurricanes, but in New York, we don't have hurricanes, so that's good news.

KJS: We had a problem with birds.

KJS: Canada geese like to sit on our wetlands.

KJS: And...

KJS: that's not so good for the wetlands. They push the plants under, so you actually have to think about roosting deterrents for your wetlands. And then, for the very high nutrient-laden ones, we actually started getting root grazing, and so I think that means that

KJS: It's gonna impair the ability of the plants to be re-established. However, we're still getting the uptake of the nutrients, we think, but we had some things to resolve.

KJS: So one of our solutions is better anchorage, goose deflectors, and more rapid harvest of the plants that we have out there.

KJS: For high nutrient loading.

KJS: Don't use Spartina. This was a practice plant. There's much better species you can use that will take up nutrients. So I'm going to turn... I'm sorry for how long I'm taking. I'm going to turn to the published literature. This is a fairly recent paper.

KJS: In water research, looking at nutrient uptake by floating wetland plants.

KJS: Alright, so let's walk through this. This is nitrogen. This is phosphorus. HY stands for high nutrient treatment. LY stands for low nutrient treatment. J stands for junkus.

KJS: P stands for pontideria. These are freshwater plants. What do we see? Look at that nutrient sequestration. Where is the nutrients going? Again, these are in water. Only... the only nutrients they're getting are from the water. It's going into shoots.

KJS: So...

KJS: What can you do to get rid of your nutrients? You harvest the above water biomass, and all of those nutrients are snatched out of the water, okay? So...

KJS: They both work, but if I were to pick one, I think you can tell which one does better, Pontaderia.

KJS: And so if you had a floating wetland with pontideria, you can extract a lot of nutrients out of that water into the chute, and then remove that chute, and thus be able to ultimately

KJS: get rid of those nutrients. Now.

KJS: What could we do with those shoots? Can they be silage? Food for cattle? Who knows? There's lots of options. But again, it's an opportunity to get nutrients out of an enclosed water body and out of that system.

KJS: So, to summarize, riparian plants play a critical role in reducing eutrophication. A healthy riparian zone is going to provide many benefits that a,

KJS: damaged... riparian zone is not. We're going to get much better water quality.

KJS: Maintaining healthy wetlands around those systems are the best. And so, if you can make sure your tributaries, instead of going around wetlands, are passing right through them, that's really gonna help you.

KJS: And floating wetlands may be effective in smaller water bodies. We're not going to go... first of all, Seneca Lake isn't that bad. There aren't the nutrient levels to grow them. But can we look at some of these source water bodies and, use them

KJS: In those source water bodies to reduce their input.

KJS: And that is that, and I'm ready for questions.

Seneca Lake Pure Waters Association: Thank you so much, and I just want to say, we're actually lucky enough that, Kelly is, part of our most recent slate of board members, so she sits on the board of Seneca Lake Pure Waters Association, so...

Seneca Lake Pure Waters Association: That is, something that we're incredibly happy about. As you can see, she's, she's a great get for us. Our first question is from Amara Dunnsilver.

Seneca Lake Pure Waters Association: How do discharge rates compare from something like a home lawn relative to urban areas and agricultural land? I'm thinking about lakefront residences along Seneca Lake.

KJS: Your home lawn is going to have the same discharge rate as an agricultural field. What goes into that discharge depends on what you put on it.

KJS: So, if you're adding fertilizers, it's gonna go into the lake. If you're not adding any fertilizer, there's no change in discharge. Your grass, again, it's what you put on your grass that's important, okay? Because it's gonna... there's gonna be... it's gonna be pervious, but there's not much blocking the movement of water.

KJS: So...

KJS: you know, as long as you're not fertilizing, it's not going to be bad. Urban areas, what we're looking at is impervious surface. So, impervious surface is a fancy word for pavement. It's surfaces where water can't penetrate.

KJS: And so it just runs off the surface, okay? So...

KJS: Here's the thing as a lakefront owner.

KJS: Don't pave your driveway. Use gravel.

KJS: Okay? That's a quick response.

KJS: That reduces runoff. Avoid pavement wherever possible.

KJS: Minimize the amount of unvegetated area. Mulch doesn't serve the same purpose as vegetation.

KJS: So those would be helpful hints for a homeowner to reduce their impact.

Seneca Lake Pure Waters Association: Gotcha. Great. Next question. Is there research comparing lake residential shorescaping compared with hardscaping, such as retaining walls, brake walls, and riprap?

KJS: there's not enough. That's where I want to come in.

KJS: So that's the stuff I'm excited about, is I hate hard surfaces. I hate breakwaters. I hate solid walls. Why? Because when waves hit him, boom, back. And so all that energy is carried back, it's not dissipated.

KJS: The... you don't want that straight wall.

KJS: And so, what we developed were methods of more pervious surfaces, so the energy is dissipated. It's captured.

KJS: And so less of it's reflected. That's gonna reduce the overall impact on nearshore erosion.

KJS: Okay? Your wall is gonna stop you from losing your land, but what's gonna happen, all that reflection is gonna scour out underneath, and your wall's gonna collapse eventually.

KJS: That's what happens very quickly in coastlines, that sort of thing.

Seneca Lake Pure Waters Association: Gotcha. Another question,

Seneca Lake Pure Waters Association: Some of our neighbors create culverts for flood control and fill them with broken rocks. Can deep-root grasses help?

KJS: Yeah!

KJS: Yeah!

KJS: Now, here's the thing.

KJS: You have to be sensible. Many people are very panicked about backup and flooding.

KJS: And rocks will allow water to move through, but they're still blocking water. I would love to see rocks replaced by other type of debris. Honestly, what are we doing? Where are we getting a lot of our rocks from? Mines.

KJS: or using rubble that's not from this area, you can use woody debris. Woody debris works well. I love this one area along Catherine Creek, right by where Royal Treat is in Millport. Do you know what I'm talking about? There's a bend in the creek.

KJS: They just put upturned root masses along the edge there, and it captures the energy, and it's natural, and it's not wasteful. It's a great way to reduce erosion in a high-energy area, and

KJS: I guess it doesn't look good, I think it looks cool. So, that's an opportunity other than rocks.

Seneca Lake Pure Waters Association: Another question. Do you know if different wild species differ in their root depth, or differences are minimal versus deep-rooted grasses or sedges?

KJS: So, yeah!

KJS: A tree's gonna have deeper roots.

KJS: A shrub is going to have deeper roots.

KJS: So, grasses, you want those long root grasses, and so you're going to ask... DEC can help you, Cornell Cooperative Extension can help you select the appropriate grasses you want.

KJS: I recommend shrubs, things like that, but for some people, that can be upsetting because of wildlife, things like that. That doesn't upset me, but again, for a homeowner, I think the bigger the roots, the better. Again, I want to make that point that

KJS: Every tree root is storing carbon.

KJS: And that's really important in the big picture.

Seneca Lake Pure Waters Association: Another question. I live on the west side of the lake with a stream at my north border. Most of the time, the flow is minimal, but with heavy rain in the stream, it's a roaring torrent and floods the wide, border that is weed-covered. Is there a source that I can use to advise on what could be planted on the 4-foot dry border?

KJS: Yeah, I think Cooperative Extension, again, many of these, DEC has recommendations. I could probably help you.

KJS: you... the plant... the grasses that DEC uses work pretty well. Again, I'm a little frustrated that they don't incorporate any trees at all. I think they're a little overly nervous about tree fall.

KJS: I think, you know, as long as you use the right species wisely, trees do a better job of capturing nutrients and getting way down there to hold the... to get the nutrients, but long-stem grasses, I just... just avoid

KJS: any of the grass that Lowe's sells, that sort of stuff. It's just terrible.

Seneca Lake Pure Waters Association: Okay.

Seneca Lake Pure Waters Association: That, brings us to the end of tonight's deep dive. We went just a touch over... just about an hour, actually, because we got a little bit of a late start due to the technical difficulties, so I want to say thank you to all for bearing with us and making sure that you got in. I also want to say,

Seneca Lake Pure Waters Association: thank you so much for your support and your time and your energy. If you guys are members, I would very much hope that you're staying up to date with your membership, and if you have any other questions.

Seneca Lake Pure Waters Association: Please feel free to reach out to me directly. You can get in touch with me through the email address that's in the chat, and you can also check out our website, SenecaLake.org.

Seneca Lake Pure Waters Association: Our next, deep dive coming up next month will be our president, Bill Rogge, who will be talking about, data centers and all the fun that that entails.

KJS: Hmm.

KJS: Thank you, bye!

Seneca Lake Pure Waters Association: Thank you, everyone.