

EPISODE
CLOSED CAPTION
SCRIPT



SEARCHING FOR SUSTAINABILITY
FARMING PRACTICES
AND SUSTAINABILITY

Prof. Doug Reinmann - This whole idea that we're coming to the limits of the resources of the planet the ability the planet to support us is very much in people's thinking.

Michael Finney - It's amazing to hear scientists say that, without us, meeting the challenge of sustainability in this century we may not even make it through the century and we're 15 years into that century.

Margaret Krome - I want humans who can use that which they need but no more. I want to see humans able to be responsible and thereby and protect the resources so that the world around them is a strong and healthy world that can endure into future generations.

Dave Vetrano - We're sort of at a crossroads here as to where we go in the future. I mean we start talking about nine and a half billion people on this planet here in the next 40 years, we need to make some decisions and we need to make them relatively quickly

Buddy Huffaker - I think we don't even fully appreciate all the aspects of which sustainability intersects our daily lives.

Prof. Ann Behrmann - And think about what's going to happen with how you live your life and how it's going to impact the next generation.

If I'd ask ten different people what the meaning of sustainability is, you'll get ten different answers. People are going to come at it from different points of view the ability to continue what we're doing over the long haul using it in a way that protects the world doesn't have a negative impact work like nature relationships are healthy between things and not become degrading allowing things to maintain the same quality over time and thinking for the human race a hundred, two hundred, five hundred years down the line.

Buddy Huffaker - Not just for humanity's sake but for all those other life-forms as well. As we think about sustainability in the 21st century, we need to remember that this is not a new issue, this dates back generations, basically eons, as early as the 1930s. Aldo Leopold, wrote that the oldest task in human history is to live on a piece of land without spoiling it then seeing the impact of the dust bowl and the drought and what human beings could do to degrade the landscape and hurt their own economies their own livelihoods, that was deeply troubling to him and that was part of the impetus to write his book. It was back in the 1940s when Aldo Leopold wrote, "We abused land because we see it as a commodity belonging to us when we see land as a community to which we belong we may begin to use it with love and respect".

Margaret Krome - So, Aldo Leopold, he didn't talk about sustainability, using that terminology, but really what he was talking about with the land ethic is protecting the land, understanding our stewardship obligations to the land for our sake and for the sake of the ecosystem on which we depend.

Buddy Huffaker - When Leopold was writing the Sand County Almanac, we have to remember the world looked a lot different. There were only a couple billion people at that time, now were approaching eight billion people. People had a much closer connection to the land than they do now. Most of the population in the United States were farmers who lived in the rural landscape, so they truly did rely on the land for their sustenance and for their livelihood.

Dave Vetrano - When Aldo Leopold wrote about this area things were clearly out of balance. At the time of settlement, this was a tall grass prairie in oak savanna but after agriculture became the industry in the late 1800s things started to happen. The technology that the farmers brought with them from northern Europe, while perfectly appropriate for northern Europe, were not sustainable here in southwest Wisconsin so within a relatively short time massive amounts of soil erosion occurred because of over grazing on the hillsides and up and down cropping on the ridge tops into the bottom.

Jim Munsch - After all, Wisconsin was a huge wheat producer, way back in the 1800" s. The Europeans were the ones that brought that here. In Europe, that is not a problem because they have very gentle steady rains. Over here, that same production model was just a killer on our soils. If that wheat weren't up to hold the soil, and a two-inch rain came, which is not unusual in our area, they had huge erosion. They looked at this erosion not as a loss of soil, but they looked at it as a ditch creator around which it was very difficult to farm

Dave Vetrano - You're looking at 12 to 15 feet of sediment that eroded off the hill sides and filled in the valley floor. Virtually all the ground on both sides of this stream bank is topsoil that 200 years ago was up on the ridgetop.

Margaret Krome - And the system was on the brink of failure when the University of Wisconsin system said hey we need to help this state and the farmers in the state find new approaches to agriculture and dairy was one of the principal elements of that

Dave Vetrano - Before world war two, Wisconsin was dotted with many small farms and 40 to 50 acres was a fairly normal farm and make a living off the land. After world war two when we changed how we did agriculture, we got more into chemical farming and then the idea to get into bigger farming and then 70s Earl Butz, secretary for under Richard Nixon's administration, suggested that either get big or get out and that was pretty much the death mill for the small-time dairy farmers in the state of Wisconsin.

Prof. George Kraft - We saw dairy herd sizes going from average of 20s to 60s, 80s now 400 is by no means uncommon. And we have a couple hundred operations that get into that 1000 plus range.

Dave Vetrano - And so the small time dairy farmer has been pretty much wiped out in the state. So really in agriculture, sustainability is still evolving.

(music) - I ain't worried about tomorrow because I know everything will be okay

Dr. Richard Crates - As long as human beings have lived on planet earth, we have impacted our environment and that's the way it'll always be.

Prof. Kevin Fermanich - As human technology has increased, human population has increased, the impact on natural systems has increased.

Tony Schultz - We are of the natural world, we exist within a priori of species within the web of life and if we have things collapse around us we are going to be hurt by that.

Jim Munsch - And that our race is tied into nature through the soil, through the animals, through the whole biology of the earth, and people have grabbed on to the concept of sustainability.

Dr. Debra Pearson - The idea of sustainability has risen to such prominence because we are at what many would argue a tipping point. We're at the limits of some of our environmental resources in terms of good air, water, and soil quality and the way we've been degrading, what's going to allow us to continue to survive?

Prof. Ann Behrmann - But we haven't looked to the future generations. We've been doing everything I think pretty short sightedly in terms of how we interact with the planet.

Dr. Amy Kox - I don't think any of us can predict whether or not we have enough resources to sustain that many people or whether the next natural disaster might be something that's really catastrophic and that we can or can't recover from.

Prof. Doug Reinemann - So, unfortunately, I think we'll have to see more of the facts of the lack of sustainability in order for us to really start taking sustainability more seriously.

Michael Finney - Comes down to really caring. If there's enough caring about the quality of shared assets, of shared well-being, things work. Once we break down and stop focusing on that sharing then even the quality of our own personal life starts to be impacted.

Dr. Debra Pearson - I would argue that sustainability is incredibly important to direct human health impacts on our current health, our future health, our next generations health, and ultimately if you don't have health you don't have much of anything else.

James Syburg - Here's something for you to think about: you know the food that you choose to buy today and eat today you know will become the cells of your body tomorrow.

Dave Vetrano - People are starting to pay attention to where their food comes from. They want to have good quality food they don't want to have all the pesticides, herbicides, they don't want to have antibiotics, they don't have some of the issues that are really starting to cause some concerns.

Margaret Krome - And there's no question, there's very clearly documented research demonstrating that the quality of our food has a big impact upon our health.

Dr. Ann Behrmann - They did a study that looked at newborns and they did cord blood, which you know the first blood that comes out of the umbilical cord, and somewhere around 400 chemicals are in an infant's blood right at the time of birth. that meant they were chemicals that came through the placenta from the mother, although it's not been proven. I think one of the big suspicions about neurodevelopmental disorders and kids has to do with the body burden of chemicals that our kids are born with and you know it continues with our food sources. They did a great study on kids where they looked at pesticide residue in the urine but in all the kid's pesticide levels in their urine dropped when they were eating organic fruits and vegetables. Do we know which pesticides are bad for kids? No, but we do know that pesticides are known endocrine disrupters. We think that they probably have an

effect on the neurodevelopmental disorders like autism and attention deficit disorder. We know that pesticides increase your risk of cancer. The truth is that choices people make about what they eat can have a positive impact on their health and a positive impact on their pocketbook.

Dr. Debra Pearson - We have 40 known essential vitamins and minerals that we have to get from the food. We've identified over 8,000 phytochemicals that exist in the fruits and vegetables. One of the best ways to describe phytochemicals is they give the color to all the fruits and vegetables you eat. Phyto means plant, chemical means something a plant synthesizes, and plants synthesize all sorts of substances to help that plant grow and ward off insect attack and so forth and when we eat those fruits and vegetables and we consume those phytochemicals. They have numerous health benefits. Some phytochemicals are being studied for their anti-cancer effect or their effects against cardiovascular disease the list goes on and on and on and the importance of phytochemicals. If livestock are eating the grasses they're going to also accumulate some of those phytochemicals and then the meat products and the milk and the egg products we eat from them and that's a good thing but then the other big thing for livestock organically or sustainably grass grazed versus conventionally grain fed is the fat profile and I came out of a lipid lab from the University of California Davis, fat lab we called it, for a long time many of us thought of fat is just as one thing and one bad thing and in fact fat is not one thing there's several types of fats. So, there's omega 3 and omega 6. Our ancestors consumed anywhere from about a one-to-one ratio of omega-6 to omega-3 or maybe a four to one for most of human history. So, if you look at the American ratio now instead of one to one two to one four to one ten to one to twenty, thirty to one. That appears to be a problem in terms of human health. Long story short getting more omega-3 in our diet, bringing omega-6 down, is clearly advantageous in terms of lowering our risk to heart disease so we want more omega-3. How're you going to do that with our food? Since about the 1940s, how we raise our livestock what we feed them has really changed the fat profile in that livestock. We've gone heavily to grain feeding and conventional operations and the two biggest components there would be corn and soy. The fat in those, the oils in those, are 50, 60, 70 times more omega-6 than omega-3 and cows are what they eat, we are what we eat, and so we change that omega-6 and omega-3 profile of the cow or the chicken. So, we get a hope more omega-6 much less omega-3 and grasses contain relatively more equal amounts of omega-6 and omega-3 and so when we do the analyses on a milk or a meat or a cheese sample from cows grass graze, quite consistently that product from that cow is higher in omega-3 and the ratio of omega-6 to omega-3 in that is a healthier ratio relative to what we understand. It's one of the places where we've really disrupted the kinds of fat that we're taking in and we've push them in a ratio that is not helpful. All of that is also causing a shift towards sustainable farming practices.

Various - Agriculture is at a turning point right now. With regard to sustainability, because it affects the food we eat, how it shapes our water resources, alters the landscapes and ecosystems the water we drink, wildlife, soil health, community life, it's all of the things that make up, our environment in the health of our environment.

Jim Munsch - The minute that we started agriculture with our human race, which is about ten thousand years ago, we became by definition unsustainable, and the reason is that we were moving minerals and nutrients out of the soil into food and sending it someplace else to be consumed and the nutrients ended up in that place.

Prof. Steven Carpenter - When people talk about sustainable agriculture they're talking about agriculture that does not contribute too much greenhouse gas, that does not pollute the soil, does not

pollute the air, and does not pollute the water to an undue extent compared to other industries and human activities.

Margaret Krome - When farmers are weighing the three cornerstones of sustainable agriculture: environmentally sound, profitable, socially responsible, the right balance depends on who you talk to.

Daniel Diederich - If you're not making any money, and you can't afford to do the other two, so it has to be profitable at the end of the day. You have to take care of the environment because that's what we live on. Our land that we feed our animals with is exactly what we need to be passed down. That cow won't be here tomorrow. It's going to be the land that's here that we feed the cows with and socially acceptable because at the end of the day we need customers people need to buy our product and if they don't accept what we're selling and how we're doing it then it's not sustainable.

Andy Diercks - You have to be profitable enough to make the right choices. The right choices allow you to be environmentally sensitive and socially sensitive. Obviously, we don't want to be hurting our neighbors or our employees, we don't want to be hurting the birds and the bees and the fish. Economics have to work. If you're struggling economically you can't make the right choices for social and environmental issues.

Prof. George Kraft - The environmental portion, the economic portion, and the social portion can exist independently of each other for a short time but over the long time they are entirely intertwined.

Michael Finney - If one starts to fail, the other degrades. We tend to think that they're standalone and that they might even be competitive with one another, but in the long run they're synergistic and that's the interesting thing to imagine that they are synergistic. When one flourishes, the others are enhanced.

Dave Vetrano - And so you can't really separate one from the other, it's all connected. It is sort of like a body. It's like saying could your body function without a liver or could your body function well without a lung? Well no it can't, it's all tied together, it's all part of a system, and I think that's part of the problem as we have a tendency to look at things in pieces and not necessarily as a whole.

Prof. George Kraft - Perhaps the biggest chunk of sustainable agriculture is sustainable water. Sustainable water uses in concert with healthy lakes and streams and sustainable water quality good enough for people and fish and wildlife.

Todd Kalish - High water quality and all the benefits that brings in terms of tourism, recreation, economic prosperity to communities, is just as important as other land uses within that watershed that are impacting that water quality.

Joe Tomandl - See that rain cloud over there? That's going to bring us clean water. It's a bit of a double-edged sword because while it still replenishes our groundwater, replenishes our lakes, and our streams it grows our crops, it waters us, it waters our animals, it's also the thing that can also take soil along with it and bring phosphorus along with it.

Prof. Steven Carpenter - It's just a fact that the way we grow food now has a very heavy footprint on our lakes, streams, and groundwater. That was not the case 60 or 75 years ago because we didn't

have the technology the industrialized fertilizer the food additives for crops. We didn't even have the capability to have a concentrated animal feeding unit and now we do and so we have connected water to agriculture in a new way that is leading to a tremendous amount of damage to our water resources.

Bill Hafs - Look at this huge body of water that we've got here and people take it for granted that it's endless we live on the great lakes, there's so much water here, but now we're recognizing that it's not endless it's the resident time of what we put into this lake is a long time. 100 years, I hear, that it takes for what we put into this system before it exits Lake Michigan. This body of water here is the source of drinking water for so many people around the Great Lakes, including the city of Green Bay and the suburbs. I think the average person isn't really aware of the problems we've got in the Fox River and Green Bay, but this is a really important issue. Drinking water that's right at the top of my list. Without that what do you got?

Prof. Steven Carpenter - There's tremendous nutrient flow from the Fox Valley that comes into Green Bay and Green Bay is a somewhat confined region of Lake Michigan as those nutrients come out of the Fox Estuary, they don't mix into the lake they don't get diluted right away. So, Green Bay is definitely a pocket that's susceptible to pollution.

Bill Hafs - So the bay is really a reflection of what's happening in this watershed.

Prof. Steven Carpenter - By the 1970s, we had pretty much cleaned up the human sewage problem but the runoff from agriculture had more than replaced it.

Missing (Blue shirt and Glasses) - So the sources of phosphorus are either fertilizers or manures, primarily, there are some natural phosphorus but again most of its coming in from manure and fertilizers. And when we have high phosphorous in the soil, it's vulnerable to loss. Phosphorus tends to stay connected to the soil particles in the organic matter the most, not real soluble, but when we have excess in the soil or when we lose that soil from the landscape through erosion then the phosphorus gets into the water. We know that much of what runs off the landscape happens in just a relatively few days a year. When we have larger rainstorms and that's also when most of the phosphorus or products that come from animal waste or from other fertilizers and from soil get off the landscape and get into the water.

J.Val Klump - What's going on in the bottom and Green Bay is really important, especially when it comes to dissolved oxygen and you may have heard about the hypoxic zone or that what they call a dead zone. It's an area the bottom water which has very low and sometimes zero dissolved oxygen and so that's tough on organisms and so that's a that's a problem in Green Bay, it's a problem in Lake Erie, it's a problem in the Gulf of Mexico. There are probably hundreds of hypoxic zones around the world all driven pretty much by the same problem, and that is you know excessive nutrient loading or phosphorous and nitrogen coming in from the landscape.

Dirk Koopmans - And the reason that's important is because well there's a lot of oxygen in the atmosphere, there isn't much in the water, so there's much less of it available for breathing for life under water. The main issue is the supply of nutrients and that phosphorous feeds a lot of algal growth and phytoplankton growth in the bay. When all those algae and phytoplankton die the bacteria that degrade that new fresh organic matter they breathe in oxygen and breathe out co2. What that means then is there's less oxygen available for the life that needs it. This is a non-nitrogen fixing cyanobacteria. The

toxin that it produces, produces a microsystem its liver toxin. Yeah, which makes water undrinkable, unpalatable. The citizens of Green Bay haven't gotten their water from Green Bay for a long time so it's not directly a drinking water issue for the citizens of Green Bay, but it's still a water quality problem.

J.Val Klump - One of the problems I think we face here is people take water for granted. These lakes are simply a reflection of what happens and for all intents and purposes anything you throw toss leak or like get into the system if it goes in today is a good chance you will drink it tomorrow if not tomorrow sometime in the future. Because right now the environment subsidizes most of our activities. We do not pay for dumping stuff in the lake. We use that as a repository for a waste and that's not right. We can't continue to do that, it's not a sustainable activity. You know somebody said the future has no constituency and that is so true. Your great grandchildren can't come back to you and say why didn't you do x, y, and z? They don't have a voice today it is totally up to us.

Michael Finney- It took us three years in Green Bay working with scientists and people who had studied water to actually answer the question: could we clean it up? And then we had to figure out, well, how do we get people to do that and that's the challenge we're into now. A couple decades of effort to try to see if people can make the changes that are required. We know what those changes are. The challenge will be can we get everybody to collaborate again to do those changes.

Margaret Krome - The interesting thing about sustainable agriculture was that all over the country communities of farmers began responding to the same set of concerns and wanting to accomplish the same things. Environmentally sound, profitable, socially responsible agriculture because they were losing ground economically and they were concerned about their impact on water quality and soil erosion. So, farmers wanted to do the right thing.

Andy Jaworski - Farmers genuinely have a passion for caring for the land. Otherwise we wanted to be doing what we're doing. You know being a farmer is a lot of work no matter which way you look at it. Our survival depends on the land being able to produce. So, if we don't take care of it and it degrades in one way or another that land will not be able to produce, and the farm will no longer be profitable and then in a sense, you lose the farm.

James Syburg - All farmers want to be good environmental stewards. Many of them are living on land that their father's grandfather's great-grandfather's lived. So, the understanding and the paradigm shift it's not to disparage organic versus conventional, but the paradigm shift needs to be that this is about going forward. Using some of the best that we have, that we've ever learned, that we've ever invented, that we've ever utilized, and applying it along with the best farmers that we have, this country has the best farmers in the world. So, applying technology won't go away just because you're going from conventional to organic or applying these more sustainable farming practices. They'll only expand, you'll only find new ways to use them. That should be the excitement and the challenge and if that's all done on the foundational principle that you take a benchmark of where your farm is now and your soils health on your farm right now, and you look to improve that as well as improve yields and gain and everything else. Then you'll know the difference between wanting to be more sustainable and being more sustainable.

Prof. Doug Reinemann - Where ever you practice agriculture on this planet, the primary condition that you're concerned about is the soil. So, the type of soil, the depth of soil, the slope, all have an

enormous amount to do with the way that you manage that land in order to maintain the health of the soil the sustainability of the soil, the ability of the soil to continue to produce crops and food.

Soil...(x5)

And it always comes back to, protect that soil. Because the health of our soil, basically, reflects the health of our plants, and the productivity of our plants and our forages, which directly relates to the health of our cows. And if all of that is in balance we have got a very environmentally and economically sustainable operation.

James Syburg - So, all of these minds are coming together and what they are all realizing independently is that the soil has a tremendous role in correcting each individual issue, and the intersection for all of these areas whether its climate change, whether its human health, whether its animal health, environmental health. The one intersecting point, the one dot where all the lines cross through, is the soil.

Jim Munsch - The other non-sustainable issue. Its soil. We are losing soil to grow crops in at a fairly high rate. It takes 100 years to build an inch of soil, this is science. As we erode these soils away, you suddenly have five or six inches of soil that can be lost over 100 years and only one inch will be replaced. This may seem very severe to somebody who is 60 to 70 years old, but it is going to be severe for their offspring's offspring's offspring.

James Syburg - There are scientists around the world that are looking at the fact that in some parts of the world there's only about 60 years' worth of topsoil left. And in some parts of the country even in North America, we have soils that are so degraded, that the farmers are not actually farming on topsoil anymore they're farming the subsoil. The soil that was below the topsoil.

Joe Tomandl - We can lose an incredible amount of soil if we don't protect it. And if we lose our soil, we lose our farm. We have all seen the phenomenon of these intense rains. We're standing here in a day where we just got a two-inch rain north of here in less than an hour. They're serious. And the only way that keeps soil on the ground during these rain events is permanent ground cover. One of the biggest things to keep it where it is, it needs to be underneath the roots and underneath our plants in order for them to grow. And that's how we continue to increase the organic matter on our farm and in our soils. We can't afford runoff; we can't afford soil erosion.

James Syburg - When you talk about soil health, organic matter or the organic content in soil is one of the key indicators and it's huge. Organic matter is where the nutrients are stored, organic matter is where the beneficial biology is housed. It holds two and a half to three times it's weight in water. So, it is also where we can mitigate storm water run-off and also store water in fields instead of having it runoff which benefits both the environment and the neighbors around the farm, as well as the farm. For every one percent we can raise a farm field, or soil's organic matter, for every one percent, we can store an additional 16,500 gallons of water per acre. But it also is going to help keep ground water clean and surface waters clean. Organic matter in soil is the sponge. So, if you hold it and it doesn't run away, it doesn't take the valuable soil, the valuable topsoil itself with it, and it doesn't take the nutrients with it. By increasing the organic matter, that's not only going to have the biology that's going to naturally cycle the nitrogen and other nutrients from the atmosphere, but it is going to hold on to any of those inputs you apply, whether it's manures, organic, or conventional fertilizers.

Rick Adamski – Organic matter is a part of life. It's a continuum, the circle of life. Organic matter is nothing more than living and dead matter in the soil that's contributing to the mineral elements, the water, the air, that's where the essence of life is really being formed where you take the photosynthesis, the sun energy, and some miracle happens in that soil and it's actually enhanced by the organic matter so that it multiplies. So, when we discount that organic matter level in the soil then we have to buy in nutrients. We gotta buy in phosphorus, or potassium, or nitrogen whereas we can reduce those purchases or even eliminate them with just enhancing the organic matter level in the soil. Maybe we don't need irrigation or not as much irrigation. Maybe we don't need a drainage system to get rid of excess water with just extra organic matter in the soil.

So, when we till the ground regularly were exposing the ground several times in the course of a year and its loosening the structure that's in place. So if you make it vulnerable to a rainfall event and we have had more and more heavy rainfall events that soil is not being held together by the roots of the plant and it can be washed away very easily and every time you till the land you're actually oxidizing that carbon and its actually, what's captured in the soil is going back into the atmosphere. So, you have to depend more and more upon purchased fertilizers, whereas the organic matter that is the equivalent of multiple bags of fertilizer as long as you have a viable live organic matter in the soil.

Brent Petersen – We've destroyed a lot of the glues and the organic matter that are in our soil our existing soils by doing the tillage. So, when we're doing the cover crops and doing the no till what we're trying to do were trying to reestablish the organic matter that's in the soils, the glomalin that's in the soils, which is basically the glue of the soils that holds these soils together and to try and stop the sediment and nutrient runoff and also increase the infiltration in these soils here as well.

James Syburg - The truth about adopting more sustainable agricultural practices you know through, the use of biomimicry and increasing organic matter and biological life in your soil and reducing inputs, is that it can be done it's happening on farms and on our farm we've been able to take some fields in as little as five years and increase the organic matter one percent that equates to hundreds of thousands of gallons of water, additional water, that wasn't stored in those fields before being stored in those fields. That for me as a farmer means my crops drink that. That for me as a farmer in this community means that the water from my farm doesn't make it to the lake.

Prof. Steven Carpenter - Sustainability is a very broad term that has to do with everything people want, and lakes are one thing people want particularly in Wisconsin where we have fifteen thousand lakes.

Prof. George Kraft - part of sustainable agriculture is having sustainable waters the two of them go together

Lee Luft - This is an issue throughout the entire state of Wisconsin if you happen to live in Dane county then you know about lake Mendota and lake Monona and you know that they turn green with algae virtually every summer. If you live in the central sands part of the state of Wisconsin, you know that those sandy soils will allow whatever is placed on them to permeate very quickly into the groundwater. You also know that extracting too much water for some of the larger agricultural operations has even resulted in a lowering of water levels in some of the lakes and drying up of some of the smaller streams and even rivers.

Prof. George Kraft - This is Wolf Lake a place where hundreds of Portage County residents might have used twenty years ago on a nice hot weekend. Here the lake has been drawn so much by pumping here that this lake is no longer usable for fishing or swimming. The science here conclusively ties pumping to low water levels at lakes and streams and aquifers. Wolf Lake here, as well as the other lakes, are attached to ground water. Pumps draw water off for other purposes, water levels go down, levels at lakes go down, flows and streams go down. This issue was already known in the 1960s or 1970s. By 2005, pumping had developed to a point where that during a very modest dry period we saw lakes disappearing and streams drying up. All waters are waters of the state. That means this Wolf Lake here, the little Plover River, many of the other lakes and streams in central Wisconsin that have been impacted by pumping, they are something that all Wisconsinites have taken as a loss. The sustainability stool of social environment and economy has become unbalanced here, certainly on the environmental side, others might argue also on the economic side here because lakes like this are the calling card for places like Portage County get new business and young people to come in. And so, for the last 11 to 12 years this has been at the forefront of a lot of discussion of water sustainability.

Andy Diercks - Well pretty much this whole region, the whole central sands, is all irrigated we couldn't be growing crops here without it. We have one of the most well replenished aquifers in North America here. We can't we can't farm without it. We have some surface water issues on the divide and between that you can see maybe in the background between where water rain would fall on this side would end up in the Mississippi river fell two miles to our east it would end up in Lake Michigan and so there's some challenges along that area where they don't get a lot of runoff from rainfall.

Prof. George Kraft - You're right now this pumping impact is fairly localized to this area of a hundred miles by 50 miles and if you're a person that doesn't recreate on lakes and streams you might not even see it when it's in your backyard and so it's a local very serious problem. It's spreading to other parts of the state, but it hasn't grown to this politically critical mass. You know the other thing about the Central Sands situation is that this is sort of the canary in the coal mine. Farming practices also have impacts on the water quality. The chief impact is nitrate pollution. There's a drinking water standard of 10 and it's very common to find it 20, 30, 40 in the groundwater in this area. To a lesser degree, there's pesticide residues that come along with it.

Dr. Ann Behrmann - Well we tell people is if you if you have well water in Wisconsin you should get it tested for nitrates. If you have high nitrate levels and you should really consider getting a tested for pesticides. UW-Stevens Point has a great groundwater resource center where people can look online if you look up UW-Stevens Point and find out what wells were tested for in your area and then it kind of gives you an idea about what you want to pay to have your well tested for.

Andy Diercks - Those of us that live out in the country or even in a small town like Coloma 450 people, certainly what we do on the farm has an effect on those people. But environmentally through our work with the world wildlife fund in the UW the practices we do are much more thoughtful, much more focused on their impacts than they would have been 20 years ago. There's about a hundred different diseases and pests that potatoes are susceptible to and potatoes are pretty intensively managed. We use integrated pest management. The sand is a great system you put nutrients in you get crops, nutrients out, but it's also incredibly efficient leaching system if you're not using nutrients or pesticides efficiently so it's not sustainable for us to be flushing nitrates into the groundwater. It's not, obviously if

we paid for those nitrates and don't want to be doing that but also, it's not a very neighborly thing to do. So, we spoon feed which means we make lots of very small applications we're very wary of the weather because if we put a bunch on and then we get an inch or two rainfall it flushes through the system and then it's up in the groundwater.

Prof. George Kraft - I think in the current time with emphasis on business and no regulation and what people perceive as creating lots of jobs are trumping whatever environmental concerns there are no matter how modest. The old axiom is: it's easier to argue about the science than to argue about the policy direction. So, if we can argue and cast aspersions on the science and say it's doubtful that's an easier thing to argue than saying: "hey pumping is drying up the lakes and streams should we continue drying up the lakes and streams or should we develop some management strategies". And a lot of times frankly it's easier for them to ignore the science or push it to the side because the science complicates the decision-making. People are tricky creatures though the way we perceive things the way that we act upon them. And the future is uncertain. Until something happens in the legislature, it's going to be back to the wild west days where we're going to be permitting high capacity wells any time pretty much that somebody wants and without regard to lake and stream health here.

Michael Finney – So, I always look at, again, agriculture as oftentimes a bridge between what happens in nature and what happens with people and when that bridge is strong, both sides are healthy when that bridge starts to break and crumble both sides of that bridge start to have impacts.

Margaret Krome - But you know I hear farmers, mainstream farmers in the state who say it's time we ought to be responsible. We want to be held responsible. We are stewards and we're proud of our stewardship. We don't want to have bad actors contaminating the water and ruining our reputation.

Dr. Richard Crates - We are all in this together and we have to realize that each one of us has our own separate strengths so there's a lot of room for a lot of farming systems under the umbrella of sustainability but what we need to do is identify the most significant goals that we're trying to achieve and clearly it is to protect the waters of the state. Clearly it is to keep our soil in place and clearly it is to raise healthy food.

Dr. Rod Olsen - I am so excited about the way a culture is thinking about things, how the producers are looking at how they can make a profit and keep the soil on their land, keep the phosphorous on their land that's good for them and it's good for our waterways.

Margaret Krome - One of the things that's been happening because we have a lot of farmers in the state in livestock and dairy that are very interested in finding new ways of handling and feeding their animals. A lot of them are trying managed grazing.

Dave Vetrano - The managed grazing programs are designed to allow a person to you know raise either milk or beef off an acreage and do it in a way that from an environmental standpoint really has no impact. A well-managed pasture the manure stays on the pasture, there's no herbicide pesticide runoff there's no soil erosion and so many of the issues that as a biologist I would have had with conventional ag systems pretty much disappear with the grazing system. The grazing community is not only a way for people to maintain make a living at it but it's also a way to fundamentally rebuild the rural community, which in my mind is has been suffering a long time since the since the 1970s.

Rick Adamski - For 30 years the foundation of our farm has been grazing so it's not the same as my grandparents when they were grazing. I think they were building barbed wire fences. Fifty years ago New Zealanders were developing a low-impedance energizer that was able to transmit electricity on fences and being able to do a better job of containing those animals, not to mention the portable reels and the poly wires so that we can change fences more often, being able to handle a larger number of animals, being able to move them frequently and actually utilize the pasture better. We know that cattle do best when they harvest fresh pasture. An old friend of mine, he said years ago, "There's two things that always happen when you harvest hay: One its costing you money. Two it'll never get any better than when you cut it". So, when cows graze its always the best quality that is possible and it doesn't cost that much money because the cattle know how to harvest it. We don't have to handle any of their manure. It's being deposited back on the land. And when I see a cow pie I think of all the bacteria that's in there I think of the food stuffs that's regenerating into organic matter . I think of beetles and earthworms that are going to feed upon that and supply other nutrients so that they can break it down and it's the circle of life.

Joe Tomandl - Managed grazing is what really brought us here. That is the most sustainable way for us to get started farming from an economic and environmental standpoint. So, in essence, our cows do a lot of the work through the growing season. Plants have roots, cows have legs, send them out to do what they're naturally supposed to do for millions of years on this earth. And go out and graze good high-quality forages. Basically, harvesting their own feed and bringing milk back to the barn.

So as agriculture progresses, our farms have gotten larger and larger and when farms get that large it's very difficult for a new farmer to enter into it. It's just plain you cannot afford to do this. One of the benefits of managed grazing is it is the perfect inlet for beginning farmers. In Wisconsin we lose 500 dairy farmers a year. That's just dairy farmers. So, we really need to be looking at this not only as an ag industry but as a rural community and a consumer. It's important that they're there and that they stay. So, in addition to that 3,000-cow dairy or that 5,000 cow dairy we should also have 30 independent 100 cow dairies. The sustainability of our actual dairy industry takes all of them.

Andy Jaworski - And trying to understand how the ecosystem works naturally that's the measurement that we should be shooting for. You think about on the plains where we have great soil and a lot of organic matter and what grew that soil it, what made that soil, and what made all that organic matter was grass growing and then the animals grazing it. The role of the ruminant animal is to take low energy forage and convert it into a higher energy product like meat or milk. The free energy we can get is from the sun right. All this grass here that can absorb that sunlight, use a photosynthesis process it in grow forage and I think then that's where the call comes in that room in an animal can take that forage that's what she's built to do he's not built to digest grain she's built to digest forage eats a lot of it and converts it into meat and milk. So, they're storing energy you could almost think about the cows being a battery for energy and how we could store more energy on this or it's just with cows it's kind of an interesting thought. When you see the cattle out here as they get to fulfill their role on this earth and I think it's really important that versus the confinement lot where okay, well, we're just going to use you we're going to use you as a thing you're going to produce milk for us and that's all you are. I think you have to have a respect for what the animal is. I'm not just saying this to fluff for your film. It's I think it's part of what I really do believe here and why I'm doing what I'm doing. It feels good it feels right to farm this way.

Joe Tomandl - Sustainable agriculture can mean a thousand things but let's talk about one of the biggies and that's that 500-pound gorilla out in the field.

Various - it smells like manure. The manure a lot of manure nutrient outfalls organic matter or manure as we would call it product at the cow that we'll refer to as organic manure that comes out of the cow waste product. Manure can be a fantastic resource and it also be a fantastic problem.

Lee Luft - When you think about how many quadrillion gallons there are in the Great Lakes basin and in the bay of Green Bay, to be able to put enough nutrients in that water to cause what is happening here means we're putting in a very substantial amount. What's happening in this lake will impact everyone in Wisconsin most certainly.

Prof. Doug Reinemann - The growth in the size of dairy farms is a phenomenon that's occurring all over the world. Cafo is a farm that has more than a thousand animal units, which works out to be about 750 milking cows.

Randy Ebert - My grandfather milked about 45 cows. My dad milked around about 170 cows. The old saying years ago was you never had more cows than what your wife could milk. That's no longer true today. We have decided to do more on the volume side which some people think is good and some people think it isn't. We've taken it to about 3,500 cows and about 3,500 heifers.

Kenn Buelow - We had zero cows and we went to 4,000 and it's because if you try and grow, you always hit these walls where oh I did that wrong, now I did that wrong. With here we optimize everything, so it is efficient.

Prof. Doug Reinemann - In Wisconsin the result has been one could argue more dairy cows in particular parts of the state than that ecosystem can accommodate. So, when you have large animal operations that that risk of those nutrients being recycled, recirculated through the environment is just a bigger risk. It's not to say that it can't be done but it takes technology, it takes planning.

Kenn Buelow - Why do I think large animal operations are so much in the spotlight right now? I think they're an easy target because people don't understand how they operate. Because they don't understand it they fear it a little bit. They're large, people are a little fearful of large, so we have 8,000 cows so maybe some people really view that we need to stay like we were in the past with small operations and there's a place for that but there's a place for large ones too I believe.

Tony Schultz - Sustainability versus domination. a Cafo is a form of domination. Economically, socially, and environmentally. But people view that as a metric of success and so if you're thinking within that system like if I can get this many cows in one space that will be success you're at odds with other systems.

Margaret Krome - And increasingly the legal system is taking notice.

Lee Luft - Especially the Wisconsin supreme court, at the end of 2015, issued a ruling that indicates manure will be considered a pollutant if it contaminates a neighboring well. Each cow produces about as much waste as 18 humans and if you have 1,000 or 5,000 cows at one spot you can think that's a lot of animal waste that needs to be dealt with. We don't have the infrastructure in our farms like we

do in our communities to treat that waste and often it's easiest to spread them into our near the place where it's generated so quite frankly I think you know there's sort of a carrying capacity issue. Do we have enough land for the amount of manure that's generated particularly in this watershed that leads to Green Bay?

Ken Buelow - How do we handle our organic matter or manure as we would call it. First of all, it all gets collected and goes through a digester and there with digesters in both dairies, so we make electricity with it. Then we separate the fiber from it. We'll dry that fiber for bedding for cows and then that liquid portion we store. We have about 13 months storage, so we don't have to do any winter application and we do a lot of summer application. We really try to put 75% of our nutrients on the plants while they're growing rather than fall or spring because that's when the roots are there that grab the nutrients, that's why where the roots are there to hold soil from running off.

Randy Ebert - An adult cow will produce about 30 gallons per day of a product that we call our organic manure. Their manure that then gets mixed with the water, getting it into more of a liquid fashion which makes it easier for us to handle it at a larger volume. Between all of our sites we produce about 40 million gallons of product of the liquid product.

Nancy Utesch - And doesn't it just blow you away we're mixing clean, potable water with manure in a place a global awareness of water and how valuable it is and yet we are absolutely we must either have an arrogance about it or there must be such a glut of it which we do know we have here in this northeastern region of the state that is actually abused.

Randy Ebert - We then go through multiple stages of separation. Recycling the sand that's in it to be again, recycling the large particle fiber for multiple uses. After that process today it is stored in our lagoons until it is time to be a field applied for the growing crops. A twenty-thousand-gallon application per acre would be the equivalent of about two thirds of an inch of rain. Those would get applied in a one-time application and we incorporate all of manure. Those are being applied for the crop that's going to grow next spring and we know that there are significant weather events, both in wet winter and in spring, that can affect whether that product and that soil stays in place.

Lee Luft - It's taken a long time for Kewanee county and some of our surrounding counties to come to grips with the problems we have here. Nature is sending us a very loud strong and clear wake-up call that it's time to act. We've talked about it we've studied it we're now very certain what is causing our problem. It is the hundreds of millions of gallons of liquid cattle manure that is being applied in vulnerable areas such as ours that's having the impact that it's having.

Randy Ebert - Everyone wants to talk about manure runoff which is considered a point source. That's not our big issue here, our big issue is non-point runoff. I don't care whether it's a piece of parking lot, a piece of person's lawn a golf course, or agricultural field there is nonpoint pollution that all washes to Lake Michigan on an everyday regular basis. Every person has a piece of lawn that's putting stay green on there is a part of this issue. We're just the larger part of it but we all have to do a better job. Everybody that owns a piece of property farmers just are bigger in that pedestal because of the volume of land that we have.

Nancy Utesch - So you don't have to be a scientist, all you have to be as an individual living in your community and recognizing that the major rivers that you have there are on the EPA's impaired

water listing and that you have 34% of the tested wells are contaminated and cannot be used in the homestead's where they're at. A USDA researcher has called our water that that he would have expected to find in a third world country.

Dr. Debra Pearson - And of course, that has literally meant that some people have gotten sick

Lee Luft - So the manure was able to penetrate through the very shallow soils, into the bedrock through the sinkhole and enter into the groundwater stream quickly. Within a matter of a day or two 16 separate families became ill and one child was hospitalized because they were drinking the contaminated water.

Prof. Ann Behrmann - Now in Kewanee county there have there have been kids who've been exposed to this bacteria E. Coli O-157 and this bacterium can be deadly it not only can people can die from the bacteria but the often kids often get kidney failure from it. Something a disease called hemolytic uremic syndrome

Lee Luft - We've had our local high school set up a clean water kiosk to allow families to come to the high school and received free bottles of water so that they can sustain themselves in their homes.

Lynn Utesch - We know scientifically that we've gone beyond the carrying capacity of our land. We know that it's running off into our rivers it's going into our groundwater. I think we need to start to really have a common-sense discussion about our agricultural system. You know what is it that's going to be the balance between agriculture and our water. Agriculture and our health for our citizens. It's not about the farmer or farming as a system. It's about the people that choose to actually do those practices that are going to harm our environment. There's nobody that says that you have to put on 16 thousand gallons per acre right next to a waterway.

Nancy Utesch - Water just doesn't show up in your tap it's coming from a source but I'm sure if most people in Green Bay were asked they would not know that their water was coming from the Kewanee area.

Lee Luft - The message is not that we need to be anti-agriculture. We can't exist without today's agriculture. Let's face it, we need a healthy agricultural industry. The message is that we need a change in the agricultural models, especially in areas that have the vulnerable geology that we do. And that's really what we're talking about here.

Prof. Steven Carpenter - People would be outraged if we dumped large amounts of human waste into Wisconsin lakes. We need to get to the same point with livestock where we realize it's not a great idea.

Joe Tomandl - We can't deny that our water quality is going down, that's a scientific fact.

Lee Luft - Farmers are now committing to be a part of it. They even indicated that they recognize that they're part of the problems and that is a huge step.

We have to start looking at other tools that revolve around permanent ground cover and soil loss.

Randy Ebert - We can't be status quo and say what we did before is good enough. We have to continue to get better. We used to be commodity based and now all the sudden we're talking about maybe these priorities need to be environmentally based.

Lee Luft - That sense is now shared by those in our DNR and debt cap and also the EPA.

Bill Hafs - We all have a part in this. It's just that agriculture offers this golden opportunity, but we need some really talented conservation staff, good agronomy staff, that can build a relationship with a farmer which could be beneficial to them and us and the water.

Randy Ebert - It isn't that we have a manure problem, I believe it is more we have a water problem. We need to take the water out of the manure and make two more concentrated manure products that we can apply when the crop is growing. To get this liquid out, we are going to need some form of ultra-filtration. We are going to need some sort of reverse osmosis.

Prof. Steven Carpenter - Some people do think science is a simple solution and a lot of people are working on better technology for controlling phosphorus but we're not there yet and the technology we have now is pretty expensive, it's like providing sewage treatment for cows.

Lynn Utesch - We don't need to be using water to flush down barns. You know nowhere in nature do any animals all stop in defecate in one big hole in the ground other than man and unfortunately now we've made it, so the cows do. These new technologies all they're doing is dealing with a symptom of a broken system. We need to go back to ground zero and start to look at how is it done in nature and how can we replicate that.

Prof. Doug Reinmann - There are technologies that have been proposed to concentrate nutrients in the manure in order that it can be moved off the farm. From an ecological standpoint that disrupts that whole nutrient balance. Now we've broken the cycle of the dairy ecosystem

Joe Tomandl - As a society and as industry we value a crop by how many bushels and what the value of that bushels are. Pounds of milk and what the value is. We never subtract the environmental impact. So, if we had an actual dollar figure that was associated with every pound of phosphorus and we really subtracted that off. Now we're truly going to figure out the economic impact of our different agricultural systems. And once we figure out the true economic impact our more sustainable agricultural management systems will rise to the top and it'll give the consumer, it'll give the agency people and our whole population in general what it wants.

Prof. Steven Carpenter - Get everybody together and say we're going to pay for a balanced phosphorus budget. We're going to figure out how to get our phosphorus budget in balance so we're not overloading the soils and therefore overloading the water. Then we're going to do whatever it takes we're going to treat manure, develop crops that are really good at drawing the phosphorus out of soils. So, work with farmers to make these technologies available across the landscape that don't pollute the environment that they use.

Joe Tomandl - The consumer is educated. We maybe need to listen to them and give them what they want not tell them what they want. Not only from a product standpoint, but actually from a production standpoint.

Dr. Richard Crates - What can the public do to encourage sustainability?

Buddy Huffaker - Just because you live in a huge apartment complex doesn't mean you're not an ecological citizen, doesn't mean you don't have a role and important place in the search for sustainability.

Dr. Rod Olsen - We all eat. We all are responsible for the fact that that they are providing us with food.

James Syburg - Actually any individual watching this film, you know, can be part of making this change to a more sustainable agricultural system just by simply making a food choice, voting with your wallet three times a day, they can be as much a part of the change as the farmer and the tractor. Farmers in this country will grow what people want. Farmers in this country will grow what people demand. It's been done since the dawn of agriculture, so it's really consumers becoming more ecological eaters that are driving the agricultural sustainability movement.

Margaret Krome - One of the things consumers can do is to get to know where your food comes from and support food that is produced the way you want it produced.

Jim Munsch - And this is where you have to do your homework because all the big companies that are selling food are going to claim a certain degree of sustainability. The average person can make a difference by what they eat and what they buy.

Dr. Richard Crates Their dollar is actually the final vote on what it is they value.

Lynn Utesch - Make the right choices for what's right for all of us. Not only good for your health but also good for our environment. Is it impacting other people's lives

Micheal Finney - It is sort of like thinking in two different realms: one personal and one relational.

Lynn Utesch - And I think that's really going to be the driving force in all of this. It's not going to be our government it's not going to be the food industry. It's going to be the consumers and especially young mothers that are demanding for their children that they get big clean healthy food. They have a list of questions because they know what's taking place.

Tony Schultz - If you ask those questions, you're going to ask questions about sustainability and you're going to help create a system of, not only sustainability, but food sovereignty so local democratic control of food systems.

Lynn Utesch - They're choosing sustainable agriculture, they're choosing organics. That genie is out of the bottle.

Prof. Steven Carpenter - I think it's important the public realize that we have really cheap food in the United States, it's really abundant and producing that food on the cheap involves some pollution. If people don't like their lake polluted, they need to be willing to pay for food that's produced in a non-polluting way.

Kat Becker - So joining a CSA is a really easy way for people to commit to a farm in a way that's different than a traditional market relationship shop at the farmers' market.

Margaret Krome - You also can make sure that this issue is spoken to by people whom you elect for public office.

Prof. Doug Reinmann – So, there's certainly a reason for hope. We haven't ruined the planet yet. So, I really encourage people to think about what it is that gives them meaning in their relationships and in their lives and to put that up against what the material requirements of those are and so if we can rethink the material needs to give us meaning and happiness and fulfillment it can really reshape the whole discussion about sustainability.

Dr. Rod Olsen - With any relationship you need to give back in order for it to last. That lake has got all kinds of ability to clean itself. We need to give back to our lakes. We need to give back to our rivers. There's ways to do it it's not hopeless and we'll have some clean lakes that our grandchildren will thank us for.