**Rachel Hultengren:** Hello and welcome to Free the Seed! This podcast is for anyone interested in the plants we eat – farmers, gardeners, and food-curious folks – who want to dig deeper into the story of where their food comes from. It's about how new crop varieties make it into your seed catalogues, and onto your tables. I'm your host, Rachel Hultengren.

In this episode, we'll be joined by Dr. Claire Luby and Dr. Irwin Goldman, two of the co-founders of the Open Source Seed Initiative. We'll discuss the importance of genetic diversity in plant breeding, the evolution of intellectual property rights as they apply to plants, and the efforts of the Open Source Seed Initiative to maintain fair and open access to plant genetic resources.

Dr. Irwin Goldman is a faculty member in the Department of Horticulture at the University of Wisconsin-Madison, where he has taught and led research in plant breeding for the past 26 years. His breeding program focuses on carrot, onion, and table beet.

Dr. Claire Luby conducted her PhD research at the University of Wisconsin-Madison in the Goldman Lab, and was the first Executive Director of the Open Source Seed Initiative.

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**Rachel Hultengren:** Thanks for joining us today! Maybe we can start pretty broadly – what is the OSSI, for folks who have never heard of it before?

**Claire Luby**: So the Open Source Seed Initiative… it is a project to basically liberate plant varieties from the constraints of IP rights and facilitate sharing and exchange of crop varieties amongst plant breeders and amongst farmers and gardeners.

**Rachel Hultengren:** For those who maybe aren't familiar with intellectual property as it relates to plants and might be familiar with patents for things like electronics or other physical invented objects, Irwin maybe you could tell us a bit about the brief history of IP as it relates to plants?

**Irwin Goldman:** Sure, yeah, and I think you know I've been fortunate to have a front row seat in that. I've been involved in plant breeding first as a student and now as a faculty member for the last 35 years or so. And during that time, I've watched seeds go from something that you would just freely send to somebody, anybody who requested your germplasm…

**Rachel Hultengren:** When you say 'germplasm', what does that word mean?

**Irwin Goldman:** Yeah, so, germplasm would be the raw material that the breeders are using to develop something. So it's their seeds, but it could be cuttings, it could be, you know if they were breeding a vegetatively propagated species. But just their raw material, let's say the unique material that they're using to improve a particular crop.

We would share that quite freely in the early days and in the late 80's and into the 90's, there became a much greater interest in controlling those seeds and controlling those genetics. And some of that can be controlled by tools like the Plant Variety Protection certificate, which is available through the government, and is an instrument that allows the breeder to essentially protect the variety that she or he develops, but still make that variety available for breeding by other breeders. As time went on, people began to pursue more restrictive forms of intellectual property protection, which extended to US

Patents, utility patents, which would cover in some cases, the variety and what anyone could do with the variety. It might restrict breeding, it might even restrict research on a particular variety, to particular traits that became patented, where a particular very interesting , say, agriculturally important trait might be patented, which would essentially foreclose the opportunity of any other breeder or gardener or farmer to start working with that material in a breeding context.

**Rachel Hultengren:** What's a good example of one of those traits that might be patented?

**Irwin Goldman:** A good example is the exserted broccoli head, where the mutation or the genetic variant where the head is exserted, making it much easier to harvest, that trait was patented. And so anyone breeding broccoli anywhere would potentially be infringing on that patent if they were to release their material. And I think that kind of patent… it has a very chilling effect on the plant breeding community, because I think people then start to wonder, well if my material is infringing, then I don't have any what is called "freedom to operate".

So we became concerned with how Intellectual property impinged on our freedom to operate. We were worried that our freedom to operate was being limited by extensive intellectual property rights of all different kinds.

**Rachel Hultengren:** In a practical sense, Claire, what is the impact of that impingement? What does restrictive IP protection do to plant breeders?

**Claire Luby:** So plant breeding is basically based on selecting plants, making crosses and then selecting plants, with various combinations of characteristics that are beneficial for your…whatever you want to select for. And you need genetic diversity in order to do that. You need to be able to access all of these various potential combination of traits as a plant breeder.

We're still trying to figure out exactly the effect that intellectual property rights on plants have had on the actual genetic diversity that are in our crop plants, however one of the things that we have found is that it is much more challenging to exchange, as Irwin was saying, exchange material amongst people and also there is this chilling effect of IPR on using existing varieties. So basically plant breeding is based on improving varieties iteratively over time and for different environments and situations, and if you can't access varieties to continue to improve them, you can sort of stall out.

**Rachel Hultengren:** So that chilling effect you talked about on plant breeders and their inability to exchange seeds - what's the fear there with downstream effects? How might that affect a farmer, or a gardener, or consumers?

**Claire Luby:** This can have an effect on what genetic diversity is available to farmers, how fast we're making improvements. I think there's a lot of questions that don't have sort of specific, researched answers or tested answers, but I think there's sort of the thought that that if you don't as a plant breeder, have as big a pool to draw from, to use in your breeding program, you may not be able to make as much gain from selection, if you don't have access to those materials. Our whole agricultural system is based on the exchange of varieties over time and space, and we should be able to keep exchanging things to continue to do plant breeding.

**Rachel Hultengren:** Would you say that the slowing down of plant breeding means that farmers have, in the future, potentially fewer options of what to grow in their fields?

**Claire Luby:** Yeah, and I'm not sure that we can totally say that you know plant breeding has slowed down. We can say that the landscape of where plant breeding is happening has changed over time. Yeah, I think to a certain extent it's a food security issue. It's a making sure that farmers growing crops in all places have access to varieties that will perform well in, in their environment, um… and making sure that if they choose to save their own seed, um, that they are able to do that. Whereas intellectual property rights can infringe upon the ability of a farmer to actually save their own seed.

**Irwin Goldman:** And I would say, too, Rachel, that the… you know, as the world continues to urbanize, and as the sources of our germplasm – our raw germplasm – go away, we as a civilization I guess need to hope that we've preserved the useful genetics that are out there from the wild, before it disappears, and hopefully we're supporting the gene banks that hold that genetic diversity, and it would seem to me with climate change and with all the things we're facing, we want to do everything we can to not just make sure that we have that diversity in gene banks, but also that we do as much plant breeding as we can and exchange useful germplasm. So it seems to me that intellectual property rights sort of go at the future of food security in a way that makes it more difficult for us as a civilization. So this is a concern.

**Rachel Hultengren:** I'm curious about the process of a company obtaining a patent on either a trait or a variety specifically. How would a company go about doing that?

**Irwin Goldman:** It's surprisingly not that difficult to write those patent applications. There are several key tests for patentability that the US Patent and Trademark Office has, and you have to show that it's non-obvious and you have to show that you have something novel and useful. One might question the non-obviousness of certain crop patents, but if you are persistent and if you have good legal representation, uh, and you have time, because we understand that these patents on crops are taking many years to get through the US patent and trademark office, but if you have on average, say, five years to wait, you can often get some of the claims that you've applied for in the form of a patent.

You might not get the broad-based claims which could include the process or the techniques you used in breeding, the traits that you want to patent, but in many cases people are able to get patents on the varieties themselves that they have developed. And then with that patent, they can restrict others' use of it in many different ways, including breeding, research and seed saving, that sort of thing.

**Rachel Hultengren:** It's my understanding that the argument that companies make is that intellectual property rights are necessary to support innovation, given the time and resources that go into developing a new crop variety. Is that an argument that you find compelling or convincing?

**Irwin Goldman:** Definitely. I mean, the cost of doing this R&D is very expensive, and IPR would be one way to recoup the cost. However, unlike industrial technologies where you know it's not a living thing, we as plant breeders are working with materials where we require – we have to use other genetics and other germplasm to improve the crops we work on. So in essence, as we go down the patent route, we are foreclosing the opportunity to do that kind of crossing that's necessary. So yes it can be remunerative for the people who hold the patents, but the downstream implications for us in terms of the crop futures, is not so good. And I think it will reduce the number of players involved plant breeding. Possibly the global consolidation of the seed industry that we're seeing today is not a coincidence and a number of the companies are companies that have chemical and pharmaceutical divisions for whom patenting is well established.

**Rachel Hultengren:** Claire, how did you first learn about this issue? Irwin's talked about, sort of, having this first row seat for the last 30 years of his professional career; how did you start learning about intellectual property rights and how they apply to plants?

**Claire Luby:** Yeah, so I was doing my masters with Irwin at the University of Wisconsin, and that was in plant breeding, and I was also doing a certificate through the Nelson Institute in environmental studies, and as part of that certificate we needed to work on a community outreach project. I had heard Jack Kloppenburg speak, and he's been working on these issues for his whole career, for the last thirty years, and he and another lawyer had come in to give a seminar in the plant breeding program, and it raised a lot of these questions and I think it sparked my imagination and my interest, and I was in the process of figuring out what I might want to study for my phd project. And as a culmination of this, I started working with Jack and Irwin had an interest in, in this whole space, as well. And we started, sort of, meeting more regularly along with a number of other people who have been involved with the Open Source project. My phd project was co-evolving with the whole open source seed initiative project. I was drawn to these questions that this whole space raises, in terms of who can really own a crop variety, and questions of ownership, questions of large scale impact on our farming and agricultural landscape and communities. That was where my interest came from, and then I sort of just kept digging deeper. Yeah, it's been a really rich space, and really rewarding space to work in, I think. I get to work with a lot a lot of different people in the seed system, so that's been really fun.

**Rachel Hultengren:** So it sounds like the timing just worked out really well for you to start joining the conversations that led to the founding of the Open Source Seed Initiative.

**Claire Luby:** Yeah, I think so.

**Irwin Goldman:** It was really perfect because we you know at that moment, as the issues were sort of crystallizing for us, the opportunity to not only develop a project like the open source seed initiative but also to do a graduate research project on that subject to sort of inform some of the work, that was really great timing.

**Rachel Hultengren:** So you two have collaboratively developed eight carrot populations that have been pledged as open source; did those come out of the graduate research project you just mentioned?

**Claire Luby:** Yeah, so that was sort of the coevolution of my phd project and the open source seed initiative. So those populations came out of this work that Irwin and I did looking at using carrot as a model crop to look at all of the commercially available varieties and the genetic diversity available in those commercially available carrot varieties and then the phenotypic, visual characteristics of those varieties. And we characterized all of those and we also looked at the intellectual property rights that were associated with each of those. And in using the ones that didn't have any intellectual property rights associated with them we characterized them based on market class, or color, type and then made these eight populations that were then released through the open source pledge, and those are sort of meant to be breeding populations, or populations that people can use to select new varieties that would then also be open source.

**Rachel Hultengren:** What would you say your hope for those is now that they're up on the website and pledged as open source?

**Claire Luby:** We've got quite a few sort of participatory breeding projects that we have been working on with those populations. So people have requested them, and we've sent them out and a couple of the projects have involved people growing out those carrots, and doing selections on them for characteristics that they like, and then us helping with some of the crosses and seed production pieces of that, to sort of make new varieties out of those initial large crosses. They're relatively diverse populations. You can just grow them as a variety, I suppose, but you can also use them and select out roots that you particularly like.

So that is already happening. And I think that was the goal, to create these populations that would represent the commercially available material, so elite carrot material that was available as open source.

**Irwin Goldman:** And just to give you a feeling for this, over the last week I've had two seed requests, from two different countries - one from Germany and the other came from Pakistan – and these are both from companies in those countries, and they would like, and they wanted our carrot seed that we had developed at uh through our in our breeding program we had developed a series of inbred lines of carrot that are controlled by our university through its tech transfer office.

And they're not patented, but they're licensed. And the license is a form of intellectual property right that controls how those inbreds can be used. So when the company requests those from me, I mean, we have a series of back and forth conversations about the ways they could use those materials. They're restricted from using them in sorts of breeding activities, and they have to pay a royalty if they use them, and it works and we ultimately will send those seeds to them. But if the same company or any individual contacts me and asks me for the Open Source carrot seeds that we're talking about, I can send them immediately, I can say "there are no strings attached, you can do whatever you want with these so long as you don't restrict any one else's use of them." And there is a tremendous joy in doing that, in being able to provide seeds to people so that they can grow them as a variety, or can breed with them, or whatever they want to do. As a public plant breeder, it gives me great joy to be able to just make those seeds available to the world. And so that's one of the differences between the licensing model that we use, and the open source model.

**Rachel Hultengren:** How did you choose the phrase "Open-Source"?

**Irwin Goldman:** It really came from the open-source software movement. And we were in our early days of this project, I think we were quite interested to know about how it developed there. We became really interested to learn some of the differences between what "free" and "open source" meant to the software industry, and we modelled our ideas really off of that. I mean, we we also learned that seeds and the genetics that are encoded in those seeds is a little bit different than computer code, in some important ways. But I think the overall concept of open source and the name open source did translate pretty well.

**Rachel Hultengren:** What are some of the differences between computer code and genetic code?

**Irwin Goldman:** I guess the biggest difference is the copyright. You can copyright the computer code. And so, you know, that's one difference, that you can't do with the biological materials. And so sometimes computer code is copyrighted. Another thing we learned early on, was that it's - I don't want to say that it's relatively 'easy', but an individual sitting at a computer terminal with a lot of knowledge can write code. But breeding plants is a very time intensive, labor intensive, resource intensive process

that can take many years and require fields and greenhouses and specialized equipment. And so you know, we realized that we were in a slightly different space than the code writers. At the same time, I think, the concept translates quite well. And I would boil it down to tinkering. You can take a set of materials and you can tinker with them and change them, and then that changed thing then becomes available to the community. Just like if you change the software code and then that code goes on, the same thing with seeds. You breed something new and then that new material becomes open source for the community to use.

**Rachel Hultengren:** So the open source in both cases refers to the commitment of those who use it later on to not restrict others' use of that material, whether it's code or plants.

**Irwin Goldman:** Yes, exactly, I think that's the key – is that it doesn't mean that it's free. You can charge for open source material , you can have a fee for it, you can have a royalty for it, so it can be remunerative just like other crop models and licensing models, but you are agreeing when you use it that you will not restrict others' use of it. And then, importantly, if you make a cross between an open source variety and anything else, that progeny becomes open source. So the power of the model is its virality, the sense that new progeny become open source, and so it grows in that sort of natural way.

**Rachel Hultengren:** That commitment to open source and to not restricting that material, that's embodied in the Open Source pledge. Can you tell me a bit about how the pledge came to be? How did you end up on that, as opposed to expressing that same vision?

**Claire Luby:** Yeah, I mean, as Irwin was saying, this idea came from the free and open source software movement, which uses a copyleft type of license. So basically attached to all of that software code there's also a license um, that says, "You can do anything with this code, you know, you can use it as is, you can improve it, so long as this code and any of its derivatives also remain freely available for others to continue to use for those same purposes." So we initially developed a legally defensible license for seed. But as Irwin was mentioning, seed and software have some fundamental differences, one of the most fundamental being that seeds are actually alive and are actually physical objects that grow and can reproduce themselves.

And so the seed company that we were working with balked at this license. They said, "Hey, this license is eight pages long, it's totally impractical to put on a seed packet." And it was also pretty indecipherable to anyone but a lawyer. It was very hard to figure out what this eight-page document was really saying. So it was just very impractical in terms of actual exchange of seed. So we decided "Hey, let's just boil this down. What are we really saying here?" And we came up with the pledge, um you know, which is two sentences long and basically says you're allowed to do anything with these seeds given that you don't restrict anyone else's ability to use these seeds or their derivatives, that people have freedom to continue to use them.

The other aspect being that licenses are a form of contract law, so that in order for them to be effective, both parties have to agree to the contract. And as Irwin also mentioned, software is protected by copyright, and sort of that license is on top of a copyright. So the person that's releasing it can say, " This is my code; I'm releasing it in this way." But with seed, if you don't get a plant variety protection certificate, you don't actually have any claims to ownership. So the license is the only thing. But if that doesn't get transferred, as I think it would be very easy to happen with seed, right, it's very easy to hand

off a few seeds to someone without an eight page license attached. It sort of got into this space of sort of impractical for what we were trying to do.

So we've developed this database and registration system for open source varieties, and then having them be distributed with the pledge, which we've found has been a lot easier… people understand what it means when they read it.

**Rachel Hultengren:** Can you tell me more about the database?

**Claire Luby:** Yeah, so how OSSi is currently set up is that we have a committee, it's called the Variety Review Committee and people who have done selections or plant breeding on a new variety can submit that variety to the Variety Review Committee, so there's an application process and it involves having a pretty extensive conversation with the committee and the breeder about that variety to determine what are the parents, what kind of selection was done, what is this variety, what make it something different? And once it is accepted as open source it then goes up into our database with an extensive description of the variety, also where that variety is available. So we don't distribute seeds, but we work with seed company partners that do distribute seeds, so the sources of all those OSSI pledged varieties also go up on the database.

So it serves as sort of a form of registration, that that variety was developed by So-and-So, and it has these characteristics and is available in these places.

**Rachel Hultengren:** How many varieties have been pledged to be Open Source?

**Claire Luby:** So there are now over 400 varieties, of over 40 crops. We work with 58 seed companies and 38 plant breeders. So we've grown quite a bit in just the past few years we've been around.

**Rachel Hultengren:** I would like to shift a little bit and talk about your vision for the future. How would you describe the future you hope OSSI contributes to?

**Irwin Goldman:** Well, you know, for me, the thought of developing a very substantial catalogue of varieties, so right now let's say we're  over four hundred varieties, within a few years time, you know, maybe we'll have a thousand varieties of more than 50 different crops. That catalogue represents a very significant pool of germplasm that remains in the public domain and that hopefully in perpetuity can not only be, not only exist as varieties but will expand because people will use it in crosses and those progeny will become open source. So to me, that repository, or that collection, or that catalogue of genetic material represents a very unique genetic resource that we're contributing to the community. And so curating it and enforcing it and marketing it and publicizing it and doing all the things that would be needed to ensure its continued use to me would be a wonderful activity for us.

Maybe if we haven't mentioned it already, the Open Source Seed Initiative is a 501c(3) now, and so it is a nonprofit entity and I would say that it's largely an educational and outreach organization. So in the sense of it contributing to the community in terms of the knowledge of and the collection of open source seeds and how they're used and what they can be used for is very very exciting.

**Claire Luby:** Those are very in line with what I also hope for OSSI in the future. One other thing is kind of this educational component of getting more people engaged, and getting more people doing plant breeding in more places. I think that is one of the things I would love to see this project inspire. A more

decentralized plant breeding system, having people making , tinkering!, making selections and doing, doing breeding in all different parts of the world.

**Irwin Goldman:** Yeah, I love that idea, I love that it um… They have a resource now, that they can start with. It's true that there were seeds, always seeds available to them in various ways, but now there's a dedicated resource that they can go to, and a collection of several dozen breeders with whom they could probably interact around this material.

**Rachel Hultengren:** If someone were interested in getting started with a plant breeding project just with seeds that they'd grown on their farm or in their garden, how would they know whether that material had intellectual property rights associated with it?

**Irwin Goldman:** Boy - that's a great question, Rachel, because it's not always apparent. And in fact even the seed catalogues from which they would buy there seeds might not actually list the intellectual property rights uh, the variety has. So it often becomes a detective project for somebody to try to get information about how their variety might be protected. And the problem with that lack of transparency is that if you started a breeding project with the material and went several years down the road only to find that the material wasn't available or that you did not have freedom to operate with that material, it would be quite upsetting. And so, you know, another maybe another direction for OSSI is to try to help with the transparency issue so that it is clearer, for seeds that are sold, that their restrictions are listed. I think that would help people, help guide them as to whether they can use that material or not in a breeding program.

**Rachel Hultengren:** That's interesting, just how much work it can take to get to the bottom of what the restrictions might be on a given variety if it doesn't say in the catalogue and you don't find that information easily looking on the seed packet. Does that just take a long search on the US Patent and Trademark Office website?

**Irwin Goldman:** I mean, that might be one of the places, but more often than not, the intellectual property will be in the form of a bag-tag, which is a set of text on a seed packet, or in a seed container, which has its own contractual obligations. *It'll say something like,* "By opening this packet, you are agreeing to the following conditions." And that may have come in a larger seed container that was then opened up and repacketed by a seed company that sold small packets of seed and did not pass along those particular restrictions.

So I think it's really tough for a gardener or a farmer or a plant breeder to know now exactly what the terms are for the seed. And this is, we hope, one of the things we hope the Open Source project will do is make it very clear that, at least for these particular varieties, the expectations of what you can do with them are very, very clearly spelled out. As for the more complicated ones, I do think this is an area that we want to contribute to in the future. And there might be several ways we can help improve the transparency.

**Rachel Hultengren:** Those bag tags that you just mentioned, that's sort of what you were emulating with the pledge that's printed on the seed packets now?

(Irwin) Right, we were inspired by that in a sort of interesting way, um, you know, by saying we want you to say when you open this packet, that you have the full rights to do whatever you want with it, and

don't restrict anyone else's use. And so in that sense, the pledge that we have is a kind of bag tag that allows for open access, and we wanted to use it in that way.

By the way, we've explored this and we believe that that pledge is legally enforceable. It's a form of a contract, it's quite specific, and we hope that people will treat it as such.

**Rachel Hultengren:** Have there been examples of that being tested?

**Irwin Goldman:** Not yet. And, you know, frankly, as an educational and outreach organization, we want to put our energies in those two things, not in litigation of any kind. And we've been very fortunate that the community has embraced this and treated it respectfully. But we're aware that there may be times down the road when we have to you know more carefully guard it and protect it, and I guess we'll cross that bridge when we come to it. But the good news is that the pledge isn't just a hope, that the pledge is an actual contractual arrangement between the person that opens the packet and the provider of that seed, ensuring those freedoms. And so that's kind of a nice feeling, that that can be perpetuated.

**Rachel Hultengren:** So it's not just that the Open Source Seed Initiative hopes you will take these seeds and do something altruistic with them, it's that by opening this packet, you're express that you're sharing the intention of keeping them free and with free access.

**Irwin Goldman:** Exactly, and when we started, Claire mentioned the long license; we were clearly hoping for something that was binding. We decided not to go with that, we decided to go with the pledge. I think the good news is that the pledge does have some enforceability, and that it can't just be simply disregarded. We are actually saying that when you open that packet, you have the right to do whatever you want and make sure that you don't restrict other people's use of it, and that seems to be able to hold up.

**Rachel Hultengren:** What do you hope listeners will take away from this conversation?

**Irwin Goldman:** Well for me, the trend in the seed industry has been unidirectional for the past 30 years, towards much greater control over seeds. And certainly as the technologies have increased in complexity and in cost, there are some reasons why that has to have happened. But the message I'm hoping a listener will receive is that actually there's a little more diversity in the seed system than perhaps there had been. And even though OSSI is a relatively young organization, and even though 400 varieties is not a huge slice of what's out there, this effort represents the introduction of a palette of diversity that wasn't present before, that we hope can grow into the future. And so the one way directional control over seeds maybe has a few bright spots in it, in this way.

**Claire Luby:** Yeah, I think it gets back to one of the things we were talking about, right? The more awareness of these issues, maybe be inspired to try some seed saving or selection themselves if they're so inclined and have the resources to do so. And yeah, just to understand a little bit more about what the Open Source Seed Initiative is, and why we're here, and why we're doing this work. So.

**Irwin Goldman:** Yeah, and to Claire's point, just there, you know, we've had some wonderful conversations with people who have received these seeds from various channels and then get back to us with questions. I mean one guy grew our lettuces and then he wrote and said, "How do you get seed from a lettuce"? You know, which is a great question, but it is not apparent to everybody how lettuce becomes seed. And so, we feel like, in some ways, it's democratizing this seed production and plant

breeding practice that was normally very, you know, maybe obscure to people, and brings it to them in a new way. That is pretty exciting.

**Rachel Hultengren:** Thank you both again so much for joining me today to talk about OSSI; it's been a really informative and enjoyable conversation!

**Irwin Goldman:** Thank you, Rachel. You asked really excellent questions, and it was really easy to talk to you.

**Claire Luby:** Yeah, thank you!

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**Rachel Hultengren:** We've been speaking today with Dr. Irwin Goldman and Dr. Claire Luby about the Open Source Seed Initiative

You can find more information about the Open Source Seed Initiative at http://www.osseeds.org, where you'll find our show notes, along with the transcript of this conversation. The website also hosts the Freed Seed database, where you can learn about the more than 400 plus varieties that have been pledged as open source, including the carrot populations that Claire talked about. There you'll find information about how to request seed if you've been inspired to start a carrot - or other vegetable - breeding project yourself.

Let us know what you thought of the episode by tweeting @OSSeeds. You can find us and like the Open Source Seed Initiative on Facebook to join an online community of folks interested in the future of intellectual property in plants. If you'd like, you can give us a review on iTunes, which will help other potential listeners find us there. Our theme music is by Lee Rosevere.

Thanks for joining us – until next time, I'm your host, Rachel Hultengren and this is Free the Seed.