Stories and Lessons Learned From a Career in Reforestation and Restoration Nurseries

Working in the nursery industry combines a passion for growing plants with the science of understanding how plants grow—or fail to grow—and the frank realities of running a business. Those individuals whose careers span decades accumulate experience and contacts that are invaluable for the next generation of nursery staff who will continue the work of growing seedlings.

To help facilitate this transfer of intergenerational knowledge, *Tree Planters' Notes* is launching a new column that features practitioners, drawn from nonprofits, private industry, Tribes, and State and Federal agencies, whose knowledge has influenced nursery practices for the better.

The inagural column is based upon "Nursery Perspectives on Native Plant Restoration from Forest Service Lifelong Learners," which was presented at the 2024 Combined WFCNA & ICSGA Meeting held September 4–5, 2024, in Wenatchee, WA. The presentation featured Kas Dumroese, Aram Eramian, Diane Haase, and Tom Landis reflecting upon their career and lessons learned.

To view a recording of the presentation, visit https://vimeo.com/1040258199/5575493906.

Kas Dumroese

Senior Scientist, U.S. Department of Agriculture (USDA), Forest Service, retired

Dumroese worked for 17 years with the University of Idaho before transferring to the U.S. Department of Agriculture's Forest Service. As a research plant physiologist, he worked at the agency's Southern Research Station, National Agroforestry Center, and Rocky Mountain Research Station. During his time with the Forest Service, Dumroese was a member of the Reforestation, Nurseries, and Genetic Resources (RNGR) team, which produces *Tree Planters' Notes*.

What Changed During a 40-Year Career

When I started, we began thinking more and more about native plants and a little bit less about the tall, cylindrical cellulose objects (trees) that we had focused on; during this shift, the Western Forestry Nursery Association turned into the Western Forestry and Conservation Nursery Association. I've watched the decrease in the demand for bareroot seedlings and an increase in container seedlings. With that increase in container seedlings, we've gone from a couple container sizes to gazillions to work with.

Over the decades, robust programs disappeared or became smaller. For example, the British Columbia Ministry of Forests in the early 1990s had dozens of employees working solely on nursery issues; there isn't anything like that anymore. Maybe that's because we've solved a lot of our problems, because funding priorities have changed, or maybe it's for some other reason.

When looking at technology and workforce changes, I went from computer punch cards to a computer that I carry in my pocket. We have better tools to help make some informed decisions. There used to be locals who would come in to work on a packing or sowing line. A lot of this work is now contracted out.

There are also a lot of research or management topics that we don't talk about as much anymore. When I started in the industry, Fusarium root disease was a big deal. [Fusarium (*Fusarium oxysporum* f. sp. *radicis-lycopersici*) root disease can result in rotting roots, wilting, or stunted seedlings.] Some nurseries would lose half of their crop to this root disease. Now, we don't even talk about *Fusarium* anymore. Fall fertilization is another issue that we don't really discuss as much.

How I Approached Working With Nurseries

During my career with the Forest Service, I homed in on several things that influenced how I worked with nurseries. First, what's the problem, issue, or need? It helps to be curious, a good listener, and a careful observer. A lot of the topics that the Forest Service pursued, or I pursued as a researcher, came from discussions during professional meetings or casual socializing, during which issues and needs would percolate up to the top. Those would be the topics that we'd pursue because we knew those were interesting to growers.

Second, once a problem is identified, who can help with it? I've worked with nursery managers, academics across the United States, and international friends, which has really been the special part of this career. And when I found people who could help me, and whom I enjoyed working with, those were the ones who I kept pursuing. Find the people you like to work with because after 40 years, when you're reminiscing, those are the ones who will bring a little tear to your eye.

I always tried to be pragmatic too when visiting nurseries. I wanted to challenge growers who did the same practice because that's the way they've always done it. However, I also didn't want to come in as an arrogant scientist, demanding that something be "fixed" only to break a proven process. I wanted to find the balance of challenging growers to do things differently and improve, but not necessarily making a change for the sake of changing. That's been one of my mantras.

How the Forest Service Served Nurseries

It is really heartening to see the *Native Plants Journal* and the propagation protocol database (https://npn.rngr.net/propagation) being used. That was another project the Forest Service developed after hearing about the need.

When pursing a new project, I wanted to help nursery managers and restoration people. I also wanted to advance the science with my peers and advance my own career. If there were ways that we could align the needs of research, the Forest Service, and industry managers at the same time, those were really good projects.

And at the end of the day, it's important that the Forest Service shares what we've learned: We want to help nursery managers and restoration ecologists do their job better and more efficiently and get better results. This requires knowing your audience when developing training materials. Our approach spanned the lay people to the technical professionals to ensure we were hitting our target audiences with the information they need. The Forest Service also understood that these audiences have different needs of how they assimilate and put knowledge into practice. That's why we produced a Spanish version of the "Tropical Nursery Manual"—we're trying to bridge those gaps and reach particular audiences.

I've been really blessed and fortunate to visit the Forest Service Washington Office and accept awards on behalf of the Reforestation, Nurseries, and Genetic Resources team. Many of the products that team developed have been recognized for their quality by different Chiefs of the Forest Service (figure 1). That's been really a special part of my career, working with a team of folks all committed to how we can promote success in this field.

Figure 1—In 2017, the Reforestation, Nurseries, and Genetic Resources team received the Chief's Award for outstanding technology transfer nationally and internationally, which Kas Dumroese accepted on behalf of the team. Left to right: Dumroese; Deputy Chief for Research and Development Carlos Rodrequez-Franco; Associate Chief Lenise Lago; Chief Tony Tooke. Photo courtesy of Kas Dumroese, 2017.

Revisit the Past To Inform the Present

What we do is very cyclic. Every year, we always have people coming in and people retiring. We always have to keep going back to the basics that we already know and reinforcing practices when new people come in.

This also applies to management practices. Those of us who've been in the industry for a long time, we've seen things happen multiple times. If someone new announces they have the best idea ever, somebody's probably already talked about that and done the research. With access to research through the internet, there is no excuse for not reviewing past literature.

Aram Eramian

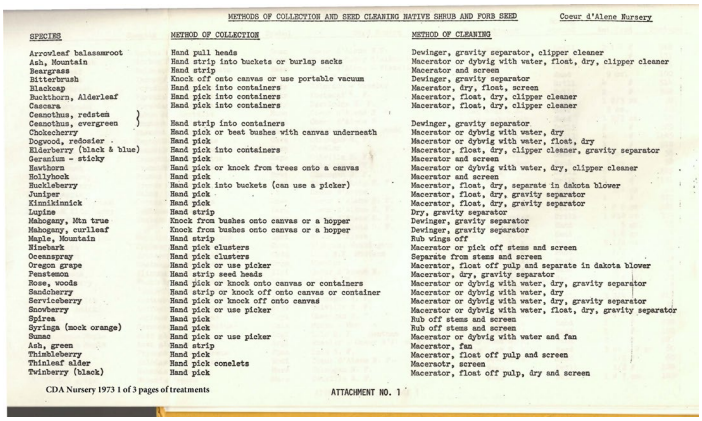
Nursery Superintendent, USDA Forest Service, Coeur d'Alene Nursery, retired

For the first 15 years of his career, Eramian worked for the Forest Service in timber, fire, silviculture, and tree improvement on the Clearwater and Idaho Panhandle National Forests. In 1992, he started his nursery career at Coeur d'Alene where he managed the Tree Improvement Program. Eramian later switched to bareroot management and went on to be the assistant nursery manager. In 2015, he became the nursery manager, a role he still holds.

Everything Old Is New Again in Native Plant Propagation

At the Coeur d'Alene Nursery, we started growing native plants because conifer production started going downhill. We thought that we were leading the charge during this time, switching to growing native plants. When Joe Myers, the former nursery superintendent, shared that the nursery grew native plants in the 1960s and 1970s, I never checked the records until I prepared for this talk. When I reviewed our annual reports from the early 1970s, we were growing bareroot native plants out in the field from 1968 to 1980. In 1972, we built our first greenhouses. In 1974, we produced 340,172 bareroot native plants outside; this year is also when we started growing native plants in containers. Old is new.

As we switched to growing native plants, we submitted propagation protocols to the *Native Plants Journal* and native plant propagation protocols database, both of which had been recently launched. Then in a file cabinet I found a document, published in 1973, that detailed cleaning methods for native plant species (figure 2). There were also stratification protocols and how they were sown into bareroot fields. The document listed many of the species that we work with now but there were some unique ones as well. We're in the process of having this document digitized and making the information available.



METHODS OF COLLECTION AND SEED CLEANING NATIVE SHRUB AND FORB SEED — Coeur d'Alene Nursery

SPECIES	METHOD OF COLLECTION	METHOD OF CLEANING
Arrowleaf balsamroot	Hand pull heads	Dewinger, gravity separator, clipper cleaner
Ash, Mountain	Hand strip into buckets or burlap sacks	Macerator or dybvig with water, float, dry, clipper cleaner
Beargrass	Hand strip	Macerator and screen
Bitterbrush	Knock off onto canvas or use portable vacuum	Dewinger, gravity separator
Blackcap	Hand pick into containers	Macerator, dry, float, screen
Buckthorn, Alderleaf	Hand pick into containers	Macerator, float, dry, clipper cleaner
Cascara	Hand pick into containers	Macerator, float, dry, clipper cleaner
Ceanothus, redstem Ceanothus, evergreen	Hand strip into containers	Dewinger, gravity separator
Chokecherry	Hand pick or beat bushes with canvas underneath	Macerator or dybvig with water, dry
Dogwood, redosier	Hand pick	Macerator or dybvig with water, float, dry
Elderberry (black & blue)	Hand pick into containers	Macerator, float, dry, clipper cleaner, gravity separator
Geranium - sticky	Hand pick	Macerator and screen
Hawthorn	Hand pick or knock from trees onto a canvas	Macerator or dybvig with water, dry, clipper cleaner
Hollyhock	Hand pick	Macerator and screen
Huckleberry	Hand pick into buckets (can use a picker)	Macerator, float, dry, separate in dakota blower
Juniper	Hand pick	Macerator, float, dry, gravity separator
Kinnikinnick	Hand pick	Macerator, float, dry, gravity separator
Lupine	Hand strip	Dry, gravity separator
Mahogany, Mtn true	Knock from bushes onto canvas or a hopper	Dewinger, gravity separator
Mahogany, curlleaf	Knock from bushes onto canvas or a hopper	Dewinger, gravity separator
Maple, Mountain	Hand strip	Rub wings off
Minebark	Hand pick clusters	Macerator or pick off stems and screen
Oceanspray	Hand pick clusters	Separate from stems and screen
Oregon grape	Hand pick or use picker	Macerator, float off pulp and separate in dakota blower
Penstemon	Hand strip seed heads	Macerator, dry, gravity separator
Rose, woods	Hand pick or knock onto canvas or containers	Macerator or dybvig with water, dry, gravity separator
Sandcherry	Hand strip or knock off onto canvas or container	Macerator or dybvig with water, dry
Serviceberry	Hand pick or knock off onto canvas	Macerator or dybvig with water, dry, gravity separator
Snowberry	Hand pick or use picker	Macerator or dybvig with water, float, dry, gravity separator
Spirea	Hand pick	Rub off stems and screen
Syringa (mock orange)	Hand pick	Rub off stems and screen
Sumac	Hand pick or use picker	Macerator or dybvig with water and fan
Ash, green	Hand strip	Macerator, fan
Thimbleberry	Hand pick	Macerator, float off pulp and screen
Thinleaf alder	Hand pick conelets	Macerator, screen
Twinberry (black)	Hand pick	Macerator, float off pulp, dry and screen

CDA Nursery 1973 1 of 3 pages of treatments — ATTACHMENT NO. 1

Figure 2—In 1973, staff at the Coeur d'Alene Nursery saw value in documenting methods of collection and seed cleaning for native shrubs and forb seed. This information is still useful for nursery managers, 52 years later. Photo by Aram Eramian, 2024.

Reconsidering Planting Assumptions

With the climate shift we've seen in northern Idaho, people need to plant a little earlier than they have been. And this gets back to the statement of, "This is the way we've always done it."

In October, we've asked people, "Are you sure you want to plant right now?" They reply, "Oh yeah, I've looked at my site and it is ready to go." I then ask if they've looked at the soil, and their response is no. Soil temperature is critical because you need 40 °F (4.4 °C) or above to support root development. It takes a couple of weeks for the roots to grow and move moisture up and down the stem. If moisture's not being moved, the seedlings will dry out; come spring, there will be a bunch of dead seedlings. This also applies to spring planting. When planting dormant seedlings, it takes a little while to wake up. If it stays cold, they'll remain dormant.

We get a lot of requests for sowing conifer seed directly on a site. One memorable example is when a team tried to sow whitebark pine (*Pinus albicaulis*) seed—all they did was feed the rodents. About 10 years ago, another researcher suggested planting whitebark seed coated with cayenne red pepper, which the rodents seemed to really like. He had one site that was successful, which everyone focused on, but they did not pay attention to the failures. The success rate for direct-sowing conifer seed is very low, especially for whitebark pine. That's why it is important to look at the literature and see what happened across the range where direct seeding of conifer seed is being applied.

Our clients own their seed; we are just responsible for maintaining the proper storage conditions to ensure viability. Whitebark seed is expensive to collect, and as a nursery manager I feel a personal and professional obligation for the seed to produce seedlings.

The Importance of Engaging With Clients

I've learned over time that "Please" and "Thank You" go a long way. And "Yes" means "Yes," and "No" means "Maybe," and you need to ask the question in a different way.

Despite being part of a Federal agency, the Coeur d'Alene Nursery does not receive congressional funding; it depends on the customers who do business with us, so our focus is on customer service. If nobody grows with us, the nursery doesn't exist. If a client calls and asks if I have a minute to chat, I say, "Yes."

Because we are customer-service focused, it's important to keep customers engaged. I ask questions about how the stock type is working for them, because, as I tell our customers, "If we're giving you a stock type that's not working, you must tell us. We don't want to take your money and just keep doing the same thing repeatedly."

Like what Kas said earlier, if I ask a customer why something is being done a certain way and the answer is, "That's the way we've always done it," I stop and ask why. We should all be learning.

Diane Haase

Western Nursery Specialist, USDA Forest Service, retired

Haase's career includes 20 years as the associate director of the Nursery Technology Cooperative at Oregon State University and 15 years as the western nursery specialist with the Forest Service. She produced dozens of publications, presentations, meetings, workshops, and conferences, and served as the editor of *Tree Planters' Notes*.

Recruiting the Next Generation—Then and Now

Twenty-five years ago, while at Oregon State University, I made a radar graphic of the different careers in forestry to show that nobody thought much about nurseries because we were off the radar. If you asked somebody the top 10 things that come to mind when thinking about forestry, they would likely list wildfire, recreation, or timber harvests but not nurseries or seedlings. I convinced four nurseries to offer paid summer internships, and went to horticulture, forestry, and botany classes to give my spiel of how great a job it is to work in nurseries. We had zero applications.

In the last few years, we now are definitely on the radar (figure 3)! There are so many national and international programs with lofty, unprecedented goals for forest restoration. Some of these goals have deadlines by 2030, which is a little ambitious, but at least they're out there.

My advice is to leverage this current enthusiasm, attention, and funding because who knows how long it's going to last. Be vocal about what we do. Those of us who work in nurseries tend to be introverted. We chose to work with plants, not people. Nonetheless, it's important to be vocal and to talk to the right people and make sure they understand what we do. The people who are making decisions usually know nothing about plants.

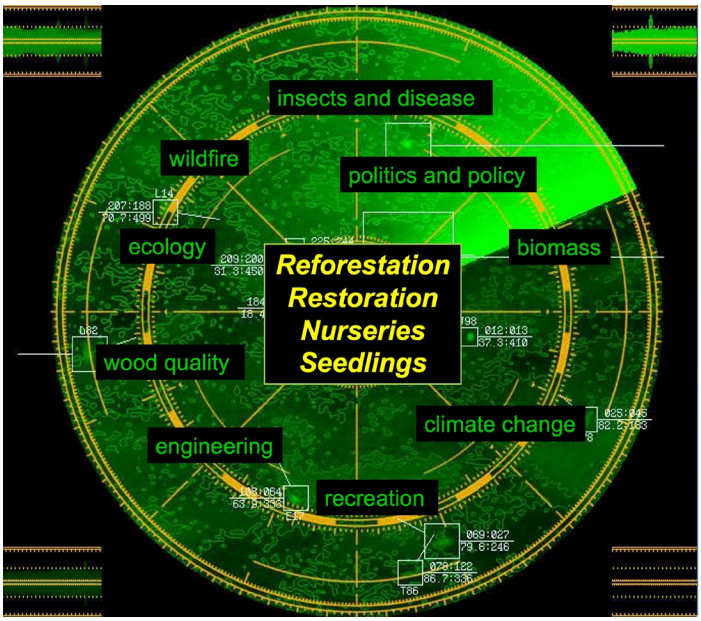


Figure 3—To convey the reality that nurseries were not thought of as a forestry-related career, 25 years ago, Diane Haase developed a radar graphic of forestry career options that didn't include nurseries or seedings. Now, with the focus on reforestation and the seedling pipeline, developing a nursery career pipeline is a priority. Image by Diane Haase.

Reconsidering Planting Assumptions

When I was at Oregon State University, we did a lot of research on fall planting. We looked at the gradient of soil moisture and temperature, as well as locations from the coast to inland and into the valley. Planting began in August and ran through January. The seedlings planted in August closest to the coast did amazing because there was plenty of soil moisture. But beginning in October, the soil temperatures became colder and

the days shortened. We couldn't capture that benefit of fall planting, however; it was very site dependent. The further inland, the plantings in August had 100 percent mortality. Re-creating the planting on the east side also resulted in high mortality.

A Nursery's Role in the Reforestation Pipeline

There's a lot of talk about the reforestation pipeline. I am really happy to have had a part in writing a paper on the reforestation pipeline that got a lot of attention (Fargione et al. 2021). In the paper, we addressed each part of the process: seed, nursery, outplanting, and postplanting (figure 4). I will point out that it really should be called the "restoration pipeline" because this process is relevant to every kind of planting project, no matter what species are being planted or how big the project is.

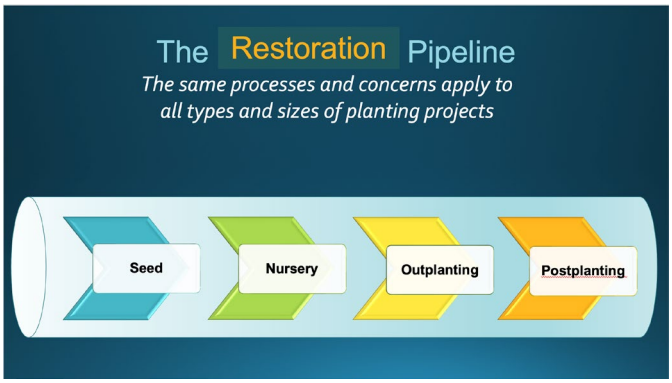


Figure 4—One of Diane Haase's accomplishments is her work to characterize the reforestation pipeline and the need to address each part of the pipeline when it comes to reforestation. Image by Diane Haase.

The one thing that is an issue with the pipeline is the huge focus on nurseries. If you're in the nursery, maybe you don't think that's such a bad thing. However, the focus is all about nursery capacity and the need for more seedlings. But, if we do not have the seed to grow those seedlings or the people to put them in the ground, what's the point?

We need all the parts of the pipeline in balance, with field performance as the ultimate goal. Whether you are working in the nursery or collecting seed, the metrics can't solely focus on pounds of seed collected, or number of seedlings produced, or number of trees in the ground. The metric needs to be the number of surviving and thriving plants. We can't just plant and walk away.

I see this "plant and walk away" approach with both forestry and native plant restoration projects, especially grant-funded projects. Over the course of a 3-year grant, the organization does the project planning, plants the plants, does a survey, and then the grant ends. After that, there is little attention to how the plants grow or survive in the long term.

To balance all the parts of the pipeline requires communication. Because there are so many people at every stage of that pipeline, you need to talk to each other regularly. This challenges the introvert aspect of us plant people, but communication is important. Nurseries should visit field sites; field people should visit nurseries.

Revisiting Previous Research

There's value in revisiting research because the climate is different, stock types are different, and restoration goals are different. A researcher asked me about doing a shading experiment, using inverted cups to shade seedling stems as they did in the 1960s and 1970s. I encouraged him to conduct the experiment because we have different stock types and different problems. The results showed there really wasn't much of a difference, likely due to it being a small-scale study (Vetter and Haase 2021).

Regardless, we should always be asking: Can we learn something new given the changes in industry goals and in the environment?

Tom Landis

Owner, Native Plant Nursery Consulting, Medford, OR

Landis started his career with the Forest Service on the Modoc National Forest. From 1974 to 1980, he was a plant pathologist in Denver and then the assistant nursery manager at Mt. Sopris Nursery in Carbondale, CO. From 1980 to 2004, he served as the western nursery specialist for the Forest Service in Denver and later in Portland, OR.

Finding My Path to Nurseries

I graduated with a Bachelor of Science from Humboldt State University and received a Master of Science and a Ph.D. from Colorado State University. When I finished my Ph.D., I wanted to work for the Forest Service but had no idea in what capacity. I was hired as a plant pathologist and started working with nurseries. One of my first tasks was problem solving. A nursery would call up and say, for example: "We're having a problem with weeds." In one case, I had to recommend methyl bromide fumigation because the weed problem was so bad; you literally couldn't see the seedlings in the field.

Then I was hired as assistant nursery manager at Mt. Sopris Nursery. I thought, "Man, this is really great!" That's when the lights went on and I realized what I wanted to do with my career: work in a nursery. Luckily, 3 years later, Mt. Sopris expanded to have a container program. I applied for the assistant nursery manager and got it. In 1980, I accepted a position as the western nursery specialist, based first in Denver, and then Portland. The two things that the Forest Service nursery program focused on were problem solving and technology transfer.

Being Responsive to Management Needs

When I started, many of the problems in our bareroot nurseries involved soil, such as soil compaction (due to the equipment use) and soil lifting. I worked with nurseries to hold trainings on soil management plans and then develop a map to categorize

each field in terms of its soil characteristics and what might grow best. Since I'm not a soil scientist, I needed some help. My colleague, Don Boyer, was the regional soil scientist in the Pacific Northwest; he understood soils and loved talking about them. When we'd visit a nursery, we would go out and dig a soil pit where he would explain the soil profile. All the employees really appreciated his down-to-earth perspective.

One of my jobs was to identify new technology. On a field trip in British Columbia, a group of us were visiting greenhouses, one of which grew tomatoes. The plants were trellised, with LED lighting going down between the trellises and all the way to the lower part of the plant. I thought, "Wow, how would that apply to our forest and conservation nursery?" So, I started doing research and wrote an article for my "Forest Nursery Notes" newsletter.

Because every nursery is different, I tried to stress "concepts, not cookbook." The "target plant concept" came from prescriptions for reforestation sites back in 1980s (figure 5). Another concept that I used was identifying factors that limit plant growth and keep them from reaching their genetic potential. All plants are limited by environmental factors, such as water or nitrogen availability. When I developed the "Container Tree Nursery Manual," I organized it around limiting factors and started with water and mineral nutrients, which were the questions I received the most.

Figure 5—Once a concept applied to tree seedlings grown in nurseries to determine suitability for planting at a site, the target plant concept is now applied to all plant material that will be outplanted. Image courtesy of Tom Landis.

The Origins of the Intertribal Nursery Council

When I hosted the annual nursery conferences, Tribal members would often attend but they always sat in the back. When I asked how they liked the meeting, they would say, "It was good." I got the feeling that the Forest Service wasn't serving this group very well.

In 2000, I held a nursery meeting in Durango, CO, and afterwards, there was a 1-day meeting just for Tribal members. That first year, cultural barriers made things a little awkward; I wanted to find a Tribal member to lead the meetings. Luckily, I found Jeremy Pinto who has done an excellent job of leading the Intertribal Nursery Council for the past 20 years.

The Value of Published Literature

When I started working with nurseries, I became isolated from the latest published research because I couldn't go to the library and look things up—this was well before the internet! Because of this, I started a quarterly newsletter called "Forest Nursery Notes," which highlighted new nursery research that I thought people would be interested in.

One question I received was from a Christmas tree grower who wanted to know what was causing his trees to have corkscrew roots. I didn't know the answer and put the question on the backburner. Then a couple years later while reviewing a 1958 issue of *Tree Planters' Notes*, I found an illustration of corkscrew roots (figure 6). It was caused by repeated frost heaving because the soil had no snow cover or mulch. The lesson is to consult published literature—even sometimes going way back—and the answer just might be there.

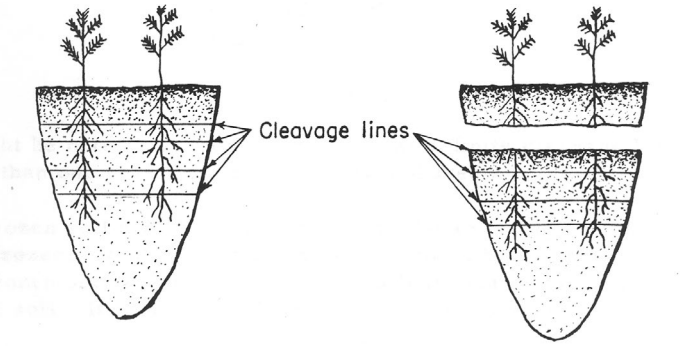


Figure 6—An article published in 1958 in *Tree Planters' Notes* explained the physical process for how trees developed corkscrew roots and answered a question that Tom Landis received decades later from a Christmas tree grower on why his trees had corkscrew roots: it results from repeated frost heaving. Image taken from *Tree Planters' Notes*, 1958.

Assisted Migration

During the question-and-answer portion of the presentation, the panelists were asked their thoughts on assisted migration. Here's what they had to share.

Kas Dumroese

We need to be cautious about how far we are transferring plants outside their seed zone. The best advice I heard was staying on the fringes of the seed zone and not get too far outside of it. We don't know the full plasticity of a lot of our species or what their limits are. Fortunately, most of the discussion, particularly in the literature, we're not talking about long-distance movements of material but tweaking plantings within either the current range or within a more appropriate range; for example, a southern source to a northern source. There's compelling data out from British Columbia about moving western larch (*Larix occidentalis*). Assisted migration is a cautious approach.

If you have an endangered plant and are worried about losing it on the landscape, there are climate model tools that estimate what the climate will be in the future. You can then find sites that have or are projected to have that climate in the future. Make some educated movements of material rather than willy-nilly decisions.

While we are gaining traction in assisted migration, we still have a long way to go. In the last decade, there's been a shift from talking about the pros and cons of assisted migration to getting results and evidence. This provides managers with concrete information about moving things and timing. There's still much to learn—so stay tuned.

Aram Eramian

I don't know enough about what variables are factored into decisions for assisted migration, but I follow the research because I'm curious about the outcome. Our clients make the decisions of what species to plant on their sites. From the nursery's perspective, we grow what our clients order, however, we already learned some things when looking at past reforestation activities in the 1920s and 1930s. Following the 1910 fire, we did a lot of moving of trees species around in the region, and it had to do with the availability of seed. At that time, we did not have the information we have today about seed zones, but we did the best we could to reforest.

One example was ponderosa pine (*Pinus ponderosa*), sourced from the Black Hills of South Dakota, the Bitterroot National Forest, and Wenatchee, WA. These sources were planted all over northern Idaho. The trees grew like weeds for about 50 years and then died because of root disease. Ponderosa pine doesn't normally die from root disease, but these sources were off site and not adapted to local conditions.

There was also experimental planting with hardwoods. There is a drainage outside of Wallace, ID, named Experimental Draw where hardwoods were planted. One guy found a red oak (*Quercus rubra*) in the St. Joe country (Idaho) during a stand exam; he knew it was a red oak because he went to school in the Midwest and keyed it out. Sequoias (*Sequoiadendron giganteum*) were also planted, and Japanese larch (*Larix kaempferi*) was planted on the Lolo National Forest. Eastern white pine (*Pinus strobus*) was also planted in northern Idaho in the 1930s but it did not survive. So, to put it simply, we have learned from our past.

We are very fortunate to have well-defined seed zones for all the conifer species we grow. We have been also working to define seed zones for native species. Where assisted migration takes us in the future will be interesting to see.

There's a lot of things that make me stare at the ceiling at 2 in the morning. How we proceed with assisted migration sometimes makes me do that but most of time, it's having to do with nursery management.

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