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# 02. My Career in Prairie Research and Restoration

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# My Career in Prairie Research and Restoration

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About a year ago, I got a phone call from a voice from the past, my good friend Roger Anderson, about presenting a brief talk to the 24th Prairie Conference on how it all got started. I hemmed and hawed and then he added they wanted to present me with an award for starting the North American Prairie Conferences. And, of course, then I agreed and immediately asked him how much time I would have. And then Roger hemmed and hawed because he knew from past conferences and workshops that Schramm always went over time limits in these meetings. Well, I attended the conference, gave my talk toward the end of the banquet, attended some of the papers, saw a number of old friends, and had some great visits. After attending most of the earlier prairie conferences with my students and presenting some papers on our field station work, I had not been to later-year conferences in ages because I was busy, on the road, planting prairies. So, it was great to be back to this conference, and I concluded that the North American Prairie Conference is alive and well. Then, Roger called me again and requested that I write up my talk for the proceedings. I hesitated for a moment and then agreed, thinking Oh Boy! Now I can get in *all* of the things I know and want to say about prairie at the end of my career.

## HOW IT ALL STARTED

Let me first tell you about all the people that got me interested in prairie. My parents are responsible for almost all my interests and hobbies, and their support and encouragement made possible my academic achievements. They were great conservationists, naturalists, and wilderness travelers. They took me on my first horse pack trip in the Bear Tooth Mountains of Montana at 5 years old. My father was a hunter, fisherman, and a good friend of Aldo Leopold. When I was in my early teens, Aldo Leopold introduced me to my first prairie plants, big bluestem and mountain mint, on my father's farm north of Burlington, Iowa. He also told me that if I was going into wildlife science, to always take good field notes and take all the math classes I could, advice I always had troubled living up to. I first read Aldo's book, *Sand County Almanac*, at the age of 16 and have reread it many times since. The next person that really got me interested in plants and prairie was Dr. Robert Livingston. I was going to Amherst College but took some courses at the University of Massachusetts in the same town. At the University of Massachusetts, I took Dr. Livingston's plant ecology course and his plant taxonomy course. We took

wonderful field trips in western Massachusetts where he showed me my first bog and helped me key out big bluestem and Indian grass growing in the Connecticut Valley and little bluestem in dryer parts of the Berkshires. He was a wonderful teacher, a great inspiration to me, and I used his notes in my teaching for the rest of my career.

After 4 years at Amherst and 9 years at University of California–Berkeley for a PhD and postdoctoral work, the job at Knox College came up in 1965 and I was hired. I could teach just about anything I wanted in the ecology-wildlife area and direct work on the 760-acre field station known as Green Oaks and continue the work of prairie restoration that had been started by Paul Shepard and George Ward in 1955. I jumped right into the prairie work with prairie burns, and some early hand plantings with a few forbs and prairie grass (too much grass at first) followed by some trips to visit other people in the Midwest working in prairie restoration.

The most notable of these people was Ray Schulenburg (Morton Arboretum, Lisle, Illinois), who became my first and most important guru in prairie restoration. I viewed his famous and amazing prairie “acre,” hand-planted and weeded, “labor of love.” Ray provided me with very complete lists of prairie plants of the Chicago region. He taught me which plants were the really high-quality “climax” species and which plants were the more successional species, to be used but appreciated for their role in the succession of a developing restoration. He also noted the “Don't Plant!” species such as the *Helianthus* sunflowers due to their aggressiveness and allelopathic nature. Ray was a great teacher, a gentle soul, and my good friend.

## THE FIRST PRAIRIE CONFERENCE

My next important prairie trip and connection was to the University of Wisconsin Arboretum to view their prairie restorations done during the 1930s and known to be the first and earliest restorations in the country. I met Dave Archibald, the director of the arboretum, and Jim Zimmerman, the head naturalist. We had a great visit and tour, and before I left I mentioned to them that perhaps we ought to have a meeting or symposium on prairie with all the people who are interested in or working on the subject. They both, almost in unison said, “Well that's a good idea, Pete, why don't you do it!” And so we did!

That first meeting, called “A Symposium on Prairie and Prairie Restoration,” held in early fall 1968 at Knox

First Midwest Prairie Conference



Photo 1. First NAPC (1968), a field to Green Oaks Prairie (Knox College). Ray Schulenberg is the person with the brown plaid shirt.

College, Galesburg, Illinois, was very special. We only had about 100 attendees, but one unique aspect of this gathering was the great diversity of people that attended: scientists from universities, professional botanists, wildlife people, rangers and naturalists from state parks and wildlife refuges, school teachers, and people who had planted a few prairie plants in their backyards. I believe this wonderful diversity of attendees has continued down to this day.

#### **EARLY RESEARCH ON GREEN OAKS, THE KNOX COLLEGE FIELD STATION**

The first thing that became very apparent to me was that I needed to learn how to machine-plant a prairie. Any significant establishment of the North American Prairie had to get beyond hand-planted efforts. So, we ordered a Nisbet rangeland grass drill, which we have been using ever since. We ordered it from Jim Wilson (Wilson Seed Farms, now Stock Seed Farms, Polk, Nebraska), who gave our keynote speech at the first prairie conference. Jim advertised the drill as being able to plant anything from pepper to feathers. And he was right. I found that with modifications, I could plant any of the prairie forbs and grasses in any combination and mixes that I wanted. Then the big challenge began: figuring out what the mixes and quantities should be. This kind of problem did not lend itself to careful experimentation. My approach was more of a “trial and error” approach. As it turned out, in the long run, it worked out, especially after I “took the show on the road.”

In the years that followed, I had my students working on small mammal and bird projects in both our prairies and forests while I was planting, over a period of years, the remaining open land on the field station. The effects of fire on small mammals dominated our animal studies and have been reported in the proceedings of various prairie conferences. Meanwhile, I kept working on restoration



Photo 2. Pete Schramm leading a field trip at the first NAPC at the Green Oak Prairie.

techniques with my drill and also some small, experimental plots.

#### **GOING ON THE ROAD: “HAVE DRILL – WILL TRAVEL”**

And then the calls for road trips began. The first request came from the Army Corp of Engineers for a planting at Lake Shelbyville. So, I loaded up grass seed, a few forbs, and my drill on a small snowmobile trailer and headed out. When I got back from that first job, I told my wife that was the last time I’d do a road trip prairie. But the requests kept coming in, especially from the Illinois state parks. After the first free jobs, I told them I had to start charging for this work. And the road trips and the plantings became easier and easier. *And it was becoming a passion for me.* The trial and error method began paying off. I was using more forbs and every prairie was getting better and better.



One of these days, I will take my records and figure out how many acres I've planted over the past 49 years, but for now I'll say it's at least several thousand. We've planted most of these acres in Illinois and Indiana, but also quite a few in Iowa and Missouri. These plantings have been on state parks; wildlife refuges; Army Corp lands; public parks; strip mine lands; sink basins over a large cave; industrial reclamation sites; university lands; community colleges; private farms (some Conservation Reserve Program projects); and other private yards, large and small, all over the above-mentioned states. The size of these projects has ranged from private, quarter-acre backyards to 150-acre state projects, all machine-drilled with my 6½-foot Nisbett drill. The details of how I did most of these prairies are described later in this paper.

### Early Lessons

I want to mention some early lessons that were learned and discussions and debates that arose about prairie restoration procedures. The first lesson I learned, one that most restorationists nowadays are well aware of, is that you can use too much of the big grasses, big bluestem and Indian grass, and these big grasses can suppress the forb establishment. Another lesson that was early learned was about the "Don't Plant!" species such as *Helianthus mollis*. Sunflowers are well known for their toxic allelopathy and aggressive, rhizomatous root spreading. Other species I found too aggressive for my plantings were the wet-adapted bottomland species such as prairie cordgrass (*Spartina pectinata*). There is a good reason why bottomland plant communities are lower in species diversity; these wet-adapted plants are aggressive competitors. Switch grass (*Panicum virgatum*) is another very competitive species that I rarely used in my restorations. Naturally occurring in bottomland prairies, it will do well in almost any kind of site including sand and is ideal in Pheasants Forever monoculture grass plantings.

Another important lesson learned early was to **never** fertilize a site before planting a prairie. My second year on the field station, I had a local farmer come and spread fresh cow manure on an acre site before planting. By late August, the site had a dense stand of lamb's quarter over my head. Bottom line: fertilizer all goes to the annual weeds, producing heavy competition for the first-year, struggling prairie seedlings. I was about to plow it up when my always wise wife advised don't plow, just go on to the next planting. Six years and six spring burns later, a nice prairie was coming along despite the fertilization. Prairie plants are amazing in that they can establish in almost any kind of soil site without fertilization. Due to their root stratification, some going deeper and others establishing more shallowly, prairie plants seem to seek out and acquire the moisture and nutrients they need. Given time, one will see adjustments of



Photo 3. Pete Schramm on the tractor pulling a Nisbett prairie seed drill.

different species to the variation in soil moistures and drainages if present on the site. New England aster will increase in the damper areas, whereas little bluestem will develop more quickly in the dryer sites. My approach was to let my mesic mixes (with some xeric species always present) just sort themselves out. And it seemed to work out in a relatively short time.

The legumes were particularly interesting in their response to site nutrients. I got amazing results from the prairie clovers and lead plant in the worst nutrient-poor soils, such as industrial sites and catch basins where the top soil (A horizon) was completely removed. Thanks to the nitrogen-fixing rhizobium bacteria in their root nodes, these legumes were easily outcompeting the weeds and prairie species that they usually had to compete with. To summarize what's going on here, all prairie restoration is a wild, underground, space-occupying, and successional root race of ultimate establishment.

Annual weeds in new restorations present interesting successional differences in weedy species responses. For example, velvet leaf (or button weed) comes on strong the first year because the seedbed is relatively empty of perennial roots. The second year it is practically gone, because it cannot take competition from the perennial roots of the developing prairie plants. The root zone is *no longer empty!* Little ragweed behaves quite differently. It persists for several years, reseeding itself in spite of the root competition from the developing, perennial prairie plants. By the sixth or seventh year, the little ragweed appears visually gone but still can be found as tiny "bonsai" plants tucked down in the developing prairie.

### The Ecotype Problem

At the second prairie conference, Jerry Schwartzmier brought up the topic of ecotype and the importance of using

local seed in local projects. Most of us jumped on that approach as gospel for a time, but I soon began to change my opinion on the subject as I thought about animals and wind moving through and over a formerly, almost-continuously connected tallgrass prairie. Bob Betz (North-eastern University), one of my most important gurus, and I started sharing ideas on seed dispersal and began to conclude that there was, at one time, a widespread gene flow over the areas we were working in.

One actual case in point I observed on the Knox field station involved bottle gentian (*Gentiana andrewsii*). It suddenly showed up in fair numbers in our south prairie, and yet I had never planted it. One very real possibility is the regular, annual fall visitation of sora rails into our prairies. I knew they were there because I could call (whistle) to them, and they would always answer me. I'm fairly sure that in their migration process, they island hopped their way down through Illinois, stopping in remnants such as Searles Prairie, Munson or Brownlee Cemetery, picking up the tiny, papery seeds of plants such as the gentians and obliged the Knox prairie with a generous inoculation and establishment. I wish that all prairie plant establishments would be so easy.

The wonderful little "postage stamp remnant" cemeteries that were our models are now very much isolated from one another and therefore ripe for inbreeding effects (genetic drift) and possible deterioration of plant vigor and adaptability. During my final 3 decades of restoration projects, this became a major concern of mine, and each year I drove hundreds of miles over Illinois picking up seed collections and mixing them together for the next year's plantings.

### My Restoration Process with a Drill

The following discussion describes how I planted most all of my prairies in the final years after I settled on the results I was getting from the trial and error approach of the earlier plantings. I wanted to drill into prepared ground. I don't believe in "no-till." It's ok for grass plantings, but you definitely do not get the forb results that I get with my prepared ground method.

*Ground reparation.*—My customers had to do their own ground preparation according to my specifications as follows. If there is perennial vegetation (sod, alfalfa, perennial weeds) on the site, fall plowing or deep disking is advisable so the freezing and thawing of winter can kill the perennial roots. Corn and bean stubble can be left until spring to begin the ground prep. If the fall plowing did not get accomplished, such sites can still be worked up, but the winter frosting makes it much easier. As soon as the ground is dry enough in the spring (usually in late March or early April), disk and harrow the site **smooth!** If a farmer is doing the work, tell the farmer you want the ground just like if he/

she was going to use his/her best planter to drill in corn or beans.

*Preplanting weed control.*—Some weed control is always desirable. I always planted my prairies in early summer. That allowed time to get some weed control during the spring. I never planted prairies in the fall. Ray Schulenburg and I agreed that fall plantings were always more weedy. After the spring ground working, let the surface weed seed germinate (various annual farm weeds such as foxtail, velvet leaf, pigweed, lambs quarter, and ragweed) and let it grow to 4–5 inches. Then, there are **two choices** on the next step: Round-Up treatment or scratch-out treatment.

*Round-Up treatment.*—You can spray with Round-Up, a nonresidual weed killer. Use a good strong solution (3–4%) for a good burn-down. This can usually be done by mid-to-late May, or sometimes into early June. Eight to 10 days later, I came in and planted the prairie. I went to whoever was ready first. If Round-Up was used, be sure the spray tank is clean and has no other kind of residual weed killer left over from some other operation.

*Scratch-out treatment.*—The weeds can also be *very shallowly* scratched out using a harrow, a cultimulcher, or a field cultivator set *very shallowly* so as not to bring up more weed seed (such seed is always present at the deeper levels of the soil). Deep-disking or roto-tilling at this stage will just bring up more weed seed. If, after the Round-Up treatment, the ground is hard from rains, a very shallow surface scratch to make a shallow seedbed might be necessary.

### Seed Preparation, Mixing, and Conditioning

Most grass species I used needed no cold-damp conditioning (stratification), except prairie dropseed (*Sporobolus heterolepis*). All legumes, except the *Desmodium* species and round-headed bush clover, needed scarification done in a sandpaper box with my feet. I can do 3 pounds of prairie clover or lead plant in 2–3 min. All the rest of the forbs I used were cold-damp conditioned in a walk-in cooler or refrigerator set at 34–38°F. Some forbs need more cold-damp conditioning time than others. Spiderwort needs 6 wk or longer, whereas butterfly weed, the *Silphium* species, and some other composites condition quite readily with 2–3 wk of cold-damp treatment. The forb seed mixes and prairie dropseed are placed in large, black contractor plastic waste bags; small amounts of water are added; and the contents are thoroughly mixed using my **ballooned-bag** technique. This technique is accomplished as follows. On a large, smooth tabletop open the bag wide and then close the top quickly with your hands to form a balloon. Hold tight and roll the ballooned bag back and forth on the tabletop for 2–3 min. Then, collapse the bag, tie off with a cord, and place into the cold storage. *You don't want the seed wet, just damp!*

## Seed Quantities

For years, people have asked me how many ounces or pounds of this species or that species should be used per acre. Using my methods, such questions are very hard to answer. My usual answer is to use as much of the good forbs as you can afford. The way you get good, forb-rich prairies is to go easy on the big grasses but use lots of forb seed. As I mentioned above, *planting prairies is a passion of mine*, and I wanted all the jobs I did to be the best my customers and I could afford. So, as an example, say my customer, on a 2-acre site, buys 3 ounces of lead plant as part of his/her order, I'll throw in 3 or 4 *more* ounces, just for good measure. On butterfly weed, the order may have 6 ounces, so I'll throw in 5 *more* ounces. Sounds crazy? Bad business? Yes, but that's the way I did it. I wanted forb-rich prairies and I got them. And I treated all my jobs the same, whether it was a nice old lady with a backyard up in the suburbs of Chicago or a big Army Corp job down near Alton, Illinois. In the final years of my planting prairies, I was using as many as 50 *prairie species* going through my drill and into the ground!

## The Actual Planting Process

Prairie restoration as I did it was more of an art than a science. I used what I call the *mosaic approach*. My models, the prairie remnants, were rarely uniform stands but rather mosaics of forbs and grasses. So, let me detail an actual planting and describe how I would do it. Say we are going to do a 6-acre site. It's early June, the ground is prepared, there's been some weed control, and the site is harrowed smooth. There is always a viewing side to a prairie plot—a side where you walk up to, or drive up to, or view from the house or yard—where I'll put my high-density forb mixture containing a liberal amount of little bluestem and side oats gramma (I call it my short grass mix, 50-50 of the two species), the companion grasses that will not outcompete the forbs. The short grass mix is *dry* and using my balloon-bag technique, I mix the cold-damp conditioned forbs and grass together. **One-half** of that mix goes into the drill, and I begin to drill the viewing side of the site, in this case 2 acres. I go round and round on those 2 acres, crisscrossing the drilled areas over and over again, using a low seeding rate on the drill, until all the seed is in the ground. Then, I drill the "back ground," 4-acre part of the site by using the other half of the short grass–forb mixture **plus** a *dry*, tallgrass mix of 50-50 big bluestem–Indian grass (probably 3 pounds on this 4-acre area). One could also do another mosaic approach on this 6-acre site, drilling the high-density forb–short grass mixture round and round as a boarder around the site and then placing the tallgrass-plus mix as a center planting backdrop. There are other possible variations, but you get the idea. All the areas drilled on this site ended up having lots of forbs and some short grasses planted. Only the backdrop areas had significant tall grasses. Once worked

out, I did this mosaic approach on virtually all my restorations. I hope you can see why I called it more of an art than a science.

## The Succession of the Developing Prairie

For more detailed information on the successional aspects of prairie restoration and expanded discussions on many of the topics discussed in this paper, see Schramm (1992), but a brief overview of successional stages detailed in Schramm's paper is outlined here. The first annual species making a showy appearance is the black-eyed Susan (*Rudbeckia*, Initial Downgrow, Weedy Stage, 1–2 years). The next stage (*Ratibida-Heliopsis* Intense Competitive Stand Establishment Stage, 2–5 years) includes yellow coneflower, oxeye sunflower, purple cone flower, and rosinweed, which show up and flower usually by the second or third year. They are followed by what I called the *Eryngium-Silphium* Closeout Stage where rattlesnake master, compass plant, prairie dock, pale purple cone flower, the prairie clovers, and stiff goldenrod come on strong in the 6- to 10-year period. And finally, what Bob Betz, Ray Schulenburg, and I used to call the really good stuff begins to show up, in my *Amorpha-Sporobolus* Long-term Adjustment Stage, and includes lead plant, prairie dropseed, butterfly weed, and the blazing stars. But then every restoration is somewhat different, and there were always the wonderful surprises like when a customer called me up in late August and asked me what those bright orange flowers were out in the middle of the prairie that I had planted just the late May before!!

## FINAL THOUGHTS

People have frequently asked me how long it will take before my restorations develop into the real thing, the remnant prairies. In the early years, I would answer maybe 50 or 100 years. In the later years, I answered probably never. They don't have *all* the forb species or the environmental history to become just like these marvelous little prairie gems that we can still walk through and enjoy. They would also ask me how long it will take for my prairies, planted on tan-colored timber soils, to develop that amazing black, deep, humus-rich prairie soil. That was an easy question to answer: about 7,000–8,000 years!

## Fire

The importance of fire needs no defense in this discussion, but let me comment on its use, timing, and frequency in restorations. I always burned in the spring, leaving the previous year's growth for winter cover for wildlife. Also, studies have shown that early warming of the ground is enhanced by the black ash left on the ground after a spring burn. This early warming appears to greatly

influence the obvious growth response and increased productivity of burned prairies. March is the best time in west central Illinois, and one must be ready and committed. The first burn, often carried by a robust growth of foxtail, is *so important* for a new restoration. New plantings need *annual burning* for several years, six or more years at least. Then, one can go on a 2- to 3-year interval. However, let me note my best prairie plots at Knox had been burned annually for 30 years, with lead plant, prairie dropseed, and Culver's root showing significant reproduction in these regularly burned areas. The *prairie remnants and fire* are a different matter. This subject needs more study, but I believe remnants can be over-burned, frequency-wise. Once every 4–6 years is a reasonable approach and then only half the site at a time, out of concern for overwintering, endemic insect pupae.

### Wildlife Cover

I used to tell my conference and workshop audiences, “Build it and they will come.” And that is so true of a good, forb-rich prairie planting. A good restoration, with grass and forbs, is one of the best grassland wildlife habitats one can plant. Game species and non-game species; migrating birds; small mammals such as microtine rodents, white-footed mice, eastern harvest mice, jumping mice; and least weasels all showed up in our Knox Prairies. Deer come out of the forests to bed in prairie grass in late July, August, and September to escape mosquitoes and other biting insects.

### Spring Species

There has long been a concern over the absence of spring blooming species in our prairie restorations. My restorations are as guilty as many others in this regard. Spring species are rarer and harder to come by; their seeds are trickier to

collect; and yes, we are addicted to seed gathering in the fall. If I had it to do all over again, yes, I would make more of an effort on those wonderful spring gems such as prairie phlox, shooting stars, puccoons, blue-eyed grass, and wild hyacinth.

### Weeds

There will always be weeds in the first few years of a restoration. Pre-planting weed control, described above, is always worth doing. If weed growth is substantial the field can be mowed with a rotary “brush hog” one or two times during the mid-to-late summer, setting the blades 12 to 18 inches above ground, well above the young prairie plants. The good news is if you burn in the ensuing years, the prairie plants will outcompete and eliminate the weeds. Remember, the root zone is no longer empty! As I use to tell my new customers. “Patience and fire is all that is needed after I get off the tractor.”

I planted my last prairie, a 2-acre plot near the entrance to Carl Sandburg Community College in Galesburg, Illinois, during June 2015. It looks like a successful planting with lots of the good stuff coming along; a nice project to end on, right here in my hometown.

My Nisbet drill, trailer, and a lot of leftover seed are for sale. Contact Peter Schramm at 309-351-9392 or [prairieps1@gmail.com](mailto:prairieps1@gmail.com).

### LITERATURE CITED

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