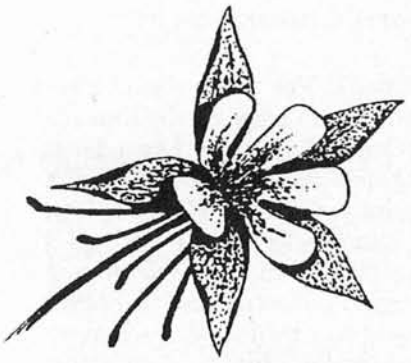
Aquilegia



Newsletter of the Colorado Native Plant Society

". . . dedicated to the appreciation and conservation of the Colorado native flora"

Volume 15, Number 1 **January/February 1991**

The Mystery of Thamnosma texanum in Colorado

Dr. William A. Weber

Thamnosma texanum Torrey (Rutaceae) was first reported by Rydberg, Flora of Colorado, 1906, from "Soda Spring Ledge, Cañon City, Brandegee". Harrington (1954) listed the plant, but stated that he had never seen material from Colorado. Actually, there have been two collections from the same place. Brandegee's specimen is at the University of California, Berkeley: "Cañon City, Colorado, 1875." In my studies of the collections made in Colorado in 1877 by Sir Joseph Hooker, I found the species listed in his holographic field list. I have examined the specimen from the herbarium at Kew: "N of Cañon City, August 10, 1877". Evidently Brandegee, who was living in the area at the time, showed the plant to Hooker and Gray. It has not been seen nor collected in Colorado since.

Thamnosma texanum is a look-alike for another species, *Menodora scabra* (Oleaceae) that grows in the same area. Both are sparingly branched perennials, somewhat woody at the base, with gynoecia that are deeply two-lobed and inflated. Both species have linear, alternate, simple leaves, yellow or purplish flowers with 5 petals in *Menodora*, 4 in *Thamnosma*. The species are almost identical in stature. *Thamnosma* differs in having the entire plant covered with aromatic glands, lacking in *Menodora*. In fact, the specimen at Berkeley still is odoriferous even after being in the herbarium over a hundred years.

Thanks to some expert help from Cara Fisher, historian at the Cañon City Public Library, we now know where the Soda Spring of these collections was. It was at what is now the southwest corner of the State Penitentiary. The Ledge mentioned by Rydberg, but not listed on the collection labels, was probably the steep rock wall making the present backdrop of the prison. Mention of the ledge was probably just an expansion of the locality, since *Thamnosma* is not an inhabitant of such sites. According to several newspaper articles from the Cañon City Daily Record, copies in Herbarium COLO), the spring long pre-dated Cañon City and was used by the Utes. In 1864 the white residents placed stones around the spring, and in 1877 a little wooden pavilion was erected. Early stage coaches sometimes stopped to let passengers try the mineral waters. In 1872 the springs received publicity in the CHICAGO TRIBUNE. Unfortunately, the entire spring site was completely destroyed in the re-routing and widening of Highway 50.

Undoubtedly the *Thamnosma* once existed on the site of the spring, and now must be presumed to be extinct. The larger question is whether it was native here. The known range of the species is from Chihuahua north to southern Texas and east central New Mexico. The nearest localities are in Bailey Co., Texas (Atlas Great Plains Flora) and Quay Co., New Mexico (Martin Flora of

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SpecialConservation Issue

Inside . . .

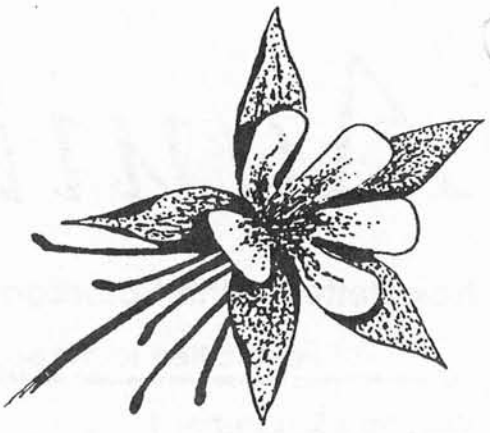
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Thamnosma, *continued from front*

New Mexico). "For years, the Ute Indians had winter camps on the banks of sand creek near Soda Point. Legend says the [Ute] medicine men used the waters for curative treatment." (Canyon City, History, Landmarks #3706). Perhaps it is entirely possible that the *Thamnosma* was brought in, planted, and thereafter encouraged as a medicinal. Such questions are never closed by negative evidence, however. Perhaps some member of the Colorado Native Plant Society will find a similar spring, or remnant of one, in the upper Arkansas Valley, and eventually rediscover *Thamnosma texanum*.



Centennaria rosea



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Aquilegia

Aquilegia is published six times per year by the Colorado Native Plant Society. This newsletter is available to members of the Society, and others with an interest in native plants. Contact the Society for subscription information.

Articles from *Aquilegia* may be used by other native plant societies if fully cited to author and attributed to *Aquilegia*.

The Colorado Native Plant Society is a non-profit organization dedicated to the appreciation and conservation of the Colorado native flora. Membership is open to all with an interest in our native plants, and is composed of plant enthusiasts, both professional and non-professional.

Please join us in helping to encourage interest in enjoying and protecting the variety of native plants in Colorado. The Society sponsors field trips, workshops and other activities through local chapters and statewide. Contact the Society or a chapter representative or committee chair for more information.

Schedule of Membership Fees

Life	$250.00
Family or Dual	$ 12.00
Supporting	$ 50.00
Individual	$ 8.00
Organization	$ 25.00
Student or Senior	$ 4.00

Membership Renewals/Information

Please direct all membership applications, renewals and address changes to the Membership chairperson, in care of the Society's mailing address.

Please direct all other inquiries regarding the Society to the Secretary in care of the Society's mailing address.

Newsletter Contributions

Please direct all contributions to the newsletter to:

Peter Root
4915 West 31st Avenue
Denver, CO 80212

Deadlines for newsletter materials are February 15, April 15, June 15, August 15, October 15 and December 15.

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Workshops	Bill Jennings	666-8348

Announcements

Special Lecture

Dr. Barry Prigge will deliver a special lecture on Friday, March 22nd while he his in town to present the weekend's workshops on *Mentzelia*. The lecture will be at the Morrison Horticultural Center, at the Denver Botanic Gardens.

Seating is limited, so please contact Carol Dawson at 722-6758 to confirm your attendance.

Free Books!

Just a reminder that *The Hepaticae of Utah* (Seville Flowers, 1961) is still available to CONPS members, thanks to the earlier donation of several copies by Dr. William Weber. If you would like a free copy of this small monograph on liverworts, contact Bill Jennings at 666-8348.

Rediscovering Home: 2nd Bioregional Conference

Restoration is the theme of the 2nd *Rediscovering Home* Bioregional Conference, to be held in Boulder April 19-21.

On Friday evening, the conference opens with a dance, theater, music, poetry, and visual arts show at the Space for Dance at 3204 Walnut St. Saturday, on the CU campus, will be spent on speaker and workshop sessions. The conference is co-sponsoring an evening talk by Wes Jackson of The Land Institute. There will also be a display area where regional environmental groups and businesses involved in restoration can present information. Field trips and ceremonies will be held on Sunday, and the conference activities will be carried into the following months with volunteer participation in ecological restoration projects.

A major focus of the conference is restoring an understanding of and appreciation for the immediate bioregion, bringing general environmental information home to specific applications in the Boulder Valley. At the personal level, reestablishing our connection with home, community, and the other residents of the bioregion is fundamental to harmonious living. For more information about the conference, contact Alison Peck (443-0284).

Boulder Chapter Meetings

March 12 Prairie Gardens

Wildflower/prairie gardens are beautiful but often difficult to establish (. . . I know I planted something other than weeds). Those who have appreciated Rick Brune's articles in *Aquilegia* will enjoy his talk and slide show on prairie gardening.

April 9 Native Plants and Bird Populations

We use native plants in our landscapes because they are beautiful, adapted to this climate, and we wish to preserve them. However, their importance extends far beyond this. Native plants provide food and shelter for native insects and animals. In contrast, non-native plants have been found to adversely affect the diversity of bird populations in riparian areas. Fritz Knopf, with the US Fish and Wildlife Service, will present his research on this topic.

May 14 Annual Picnic

Our annual opportunity to enjoy spring beauty together and discuss upcoming activities. We will meet at the Foothills trailhead, where we can walk up into the recent burn area to observe the first spring's regrowth. The Foothills trailhead can be reached by driving north on Hwy 36 (28th St.) and turning right 0.1 mi. north of its junction with Broadway. You will then be on a dirt frontage road headed north; the trailhead parking area is to the west. We will meet at 6:30 p.m. – bring a sack supper.

All meetings are held on Tuesday evenings at 7:30 p.m. at the Foothills Nature Center, 4201 North Broadway, unless otherwise noted. For more information, call Alison Peck at 443-0284.

Denver Chapter Meetings

March 27

Phil Dittberner will discuss the BLM plan for monitoring of special status plants.

April 24

Mary Lou Rottman and Dr. Emily Hartman will discuss their research on alpine plants. [tentative]

May 22

Election of officers; speaker to be announced.

Meetings are held at 7:30 p.m. Wednesdays at the Morrison Horticultural Center unless otherwise noted. Contact Carol Dawson (722-6758) for more information.

Second Class Endangered Species

Elizabeth Otto, Sally White
CONPS Conservation Committee

Once again, plants came in second when the score on additions to the federal list of endangered and threatened species was released. In 1989, only 19 plant species were added to the federal list, much fewer than in previous years, none of which were that impressive. Since the authorization of the Endangered Species Act in 1973, only 219 plant species have been added to the federal list of endangered and threatened species. Another 900 or more species deserving of protection are still unlisted. And with the glacial speed at which plants are awarded protection under the Endangered Species Act, many of these may become extinct before they can be saved.

The United States Department of Interior, Fish and Wildlife Service (FWS) was mandated the authority over the Endangered Species Act in 1973. A recent "inspection" of the Endangered Species Act by the Department of Interior's (DOI) Inspector General revealed that during the past ten years, lax administration of the Act has resulted in the extinction of 34 species. Only 50 species of animals and plants are added to the list each year. This year less than half were plant species.

The Center for Plant Conservation (CPC) estimates that of the 25,000 species of native plants in North America, more than 3000 are threatened in their wild habitat and 700 or more will disappear in the next ten years unless protective measures are taken. At the rate the FWS is adding plant species to the Endangered Species federal list, the outlook for plants is rather bleak.

Two rare species of particular concern to Colorado are *Astragalus ousterhoutii* (Ousterhout milkvetch) and *Penstemon penlandii* (Penland beardtongue). Both of these species are restricted to Middle Park, a sagebrush-dominated habitat. Mineral exploration and off-road vehicle use has been excessive in Middle Park, even further limiting these species.

There are about 5000 individuals of the penstemon occurring in one area approximately one-and-a-half miles long and one-half mile wide. Ninety percent of the 50,000 individual plants of the milkvetch grow on the 132-acre site of the proposed Muddy Creek Reservoir. Luckily these two species made the federal list this year, but there are many more in Colorado that also need protection.

What can be done about this sad state of affairs? On a national level, the Natural Resources Defense Council's (NRDC) Plant Conservation Project is studying the trade in wild-collected North American wildflowers. The NRDC also monitors the Convention on International Trade in Endangered Species (CITES) which offers some protection to a meagre few North American wildflowers that are traded internationally. For more information about what NRDC is doing, and to support their efforts, contact NRDC, 1350 New York Avenue NW, Washington, D.C. 20005.

Several national conservation groups are working together to legally challenge the FWS and to force it to list Hawaiian plants in an expeditious manner. If successful, this will have positive ramifications throughout the country.

On a local level, there is lots that we can do here in Colorado. We can support the work of national groups and write to the Fish and Wildlife Service in Denver requesting information on the status of rare plants in Colorado. Thank the FWS for its past efforts, but urge them to strengthen their plant program for Colorado. Write to the FWS at Denver Federal Center, Denver, Colorado 80225.

Other things we can do:

- Join the Adopt-a-Rare-Plant program sponsored by The Nature Conservancy (see Workshop listing on page). Attend the workshop and follow-up with field work on behalf of a rare plant. It's a great way to get out for a little botanizing – while protecting Colorado's natives. There's no substitute for on-the-ground knowledge of a species and its habitat, especially when it comes to speaking out for a plant against potential threats.

- Read your copy of the Rare Plants of Colorado by the Colorado Native Plant Society. (You don't have a copy? Why not?) Get acquainted with the rare plants in your area. Contact your local city and/or county government planning office for information on proposed projects that may endanger these species. Local planners and decision-makers can easily remain ignorant of plant-related issues if they don't hear from you.

- Join the Adopt-an-Agency program of the CONPS Conservation Committee. Take on your local Forest Service Ranger District or Bureau of Land Management Resource Area and keep informed of management plans affecting plants. Get out in the field to see whether they're doing what they said they would. Monitor proposed projects and speak out for the rare plants in the area. Contact Elizabeth Otto at 567-2384 (Idaho Springs) for more information on this program.

- The Legislative Subcommittee of the Conservation Committee is in the preliminary stages of exploring state plant protection legislation. The federal Endangered Species Act only protects the few plant species on the list from activities by federal agencies on federal property. Although most of Colorado is federally owned, many rare plant species are found on state or privately owned land. This provides an enormous loophole through which rare plants often go to extinction. We need state legislation to

–continued next page

tighten this loophole. Contact Gayle Weinstein at 333-3024 (Denver) or Elizabeth Otto if you have ideas, experience in the legislative arena, or time to contribute.

- Water projects often result in the destruction of rare plant habitat. The Colorado Environmental Coalition (CEC) has produced a revised edition of the Colorado Water Almanac which lists most of the water development projects proposed for Colorado. Although the focus of this publication is water conservation and sound use of water supplies, it is an excellent resource for monitoring proposed plant habitat destruction. Obtain a copy of the Water Almanac for $5 from CEC, 777 Grant Street, Suite 606, Denver, Colorado 80203-3518.

- The indiscriminant use of chemical pesticides, both in secticides and herbicides can have a devastating effect on rare plants. Non-selective insecticides too often kill beneficial pollinating insects. Many plants depend upon one species of pollinator. If pollinators become extinct, so do the plants. Herbicides, needless to say, can outright kill plants. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) con tains a section dealing with endangered species. The Environmental Protection Agency (EPA) which oversees the implementation of FIFRA has encouraged states to initiate plans that tailor endangered species protection measures to the circumstances of each state. The Colorado State Assembly has yet to tackle that topic, but letters to your state representative and senator encouraging them to support legislation that would protect plants from indiscriminant pesticide use wouldn't hurt.

- Protect rare plants yourself by respecting localities where they occur. Never collect rare plants except for truly scientific use. Personal herbaria should be a thing of the past. Let's be sure we're not part of the problem of plant extinction in Colorado.

If that's not enough to keep you busy, you'll find more suggestions throughout this issue of *Aquilegia*, which focuses especially on conservation issues. Look for additional specific information from the Conservation Committee in future issues.

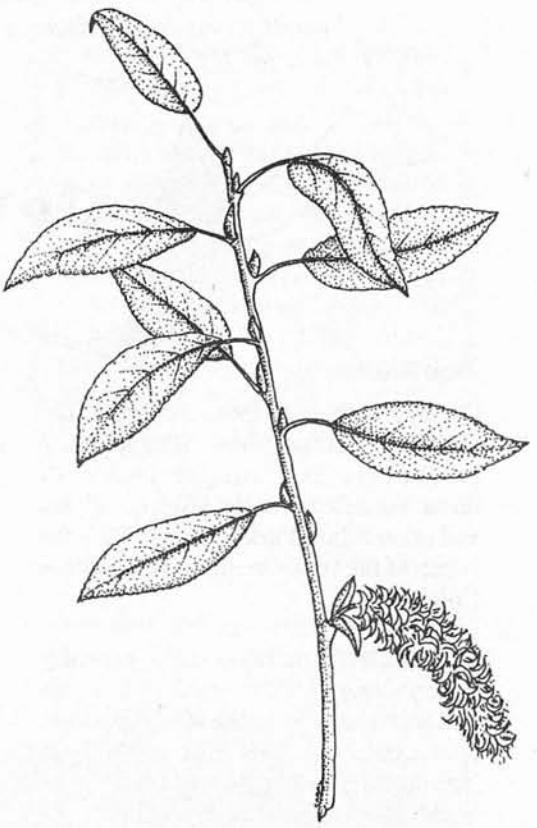
Adoption Program Success

Colorado's Adopt-a-Rare-Plant program, initiated in 1988 by The Nature Conservancy, is a demonstrable success, with about 14 species officially adopted, and several more rare plants found incidentally last year. More than 40 sites, including about 10 new sites, for adopted species were visited in 1990. In 1988, just a few volunteers began looking for plants; in 1989, the program continued with 18 volunteers and populations of 8 plants found successfully. In 1990 populations of 11 species were located.

The 1991 program will be co-sponsored by the Colorado Natural Areas Program and CONPS. Bill Jennings will be coordinating this year's program, and plans to offer two sessions of the volunteer training workshop on April 13th and 20th. Contact Bill at 666-8348 to register for plant adoption training.

A goal of the program is to have as many people as possible looking for historical and new populations of rare plants in Colorado. Volunteers from all backgrounds are welcome – membership in the Native Plant Society is not a prerequisite for success as a rare plant finder! Members are encouraged to participate, however, and will find this program a great way to focus their field efforts on a worthwhile goal.

So, adopt – for responsible plant parenthood!



Reopen for Comments!

The comment period on the proposed listing of *Spiranthes diluvialis* has been reopened by the U.S. Fish and Wildlife Service at the request of Adolph Coors Co. in Golden. Coors has not given any reasons for the request, and the additional opportunity was provided "as a courtesy" according to USFWS botanist Larry England.

Two known locations of this rare orchid are in Clear Creek Canyon. One is in Prospect Park, part of which is Coors property leased to the City of Wheatridge. Other locations are in Boulder Co. and in Utah.

Comments may be sent to USFWS until March 15th at the following address:

Field supervisor, Fish and Wildlife Enhancement
US Fish & Wildlife Service
2078 Admin Bldg.
1745 West 1700 South
Salt Lake City, UT 84104

Can The Nature Conservancy salvage one of Colorado's most floristically diverse wetlands?

Fen for Sale

With the help of supporters, High Creek Fen could be protected! Here's a field trip report, and description of this unique environment . . .

Rick Brune

On September 1, 1990, ecologist Dr. David Cooper led a fascinating field trip to explore the unique and very threatened plants of the High Creek fen and other South Park wetlands. This fen is one of the best remaining wetlands in Colorado.

Many CONPS members have probably driven along U.S.285 south of Fairplay and noted an interesting stand of spruce trees about one mile east of the busy highway. If we had explored this area we might have discovered the High Creek fen that Dr. Cooper discovered in 1989.

High Creek fen is a wetland on the edge of an outwash fan produced by melting glaciers. West of the highway, High Creek sinks into the calcareous fill of this fan. It flows within the alluvial fan until it emerges in a group of springs which form the fen. The water in the springs is rich in nutrients, especially calcium and magnesium, making this a 'rich fen.' This water contains about 120 ppm Ca^{++} compared to nutrient poor fens such as those in Rocky Mountain National Park which have about one ppm Ca^{++}. Plants such as muskgrass *(Chara* sp.) and bladderwort *(Utricularia)* sp. growing in the springs are encrusted with calcium salts. More rare plants are found in this 1200-acre wetland than in any comparably sized area in Colorado. Dr. Cooper has found many species new to the state here. Many are disjuncts far outside their known range.

Rare species in the sedge family are well represented here. Growing on hummocks in the fen we found *Trichophorum (Scirpus) pumilum.* This is a very rare disjunct species from the arctic region of North America. First discovered in 1862 in Colorado, it was not seen again until 1984. It is only three inches tall and not conspicuous to the untrained eye. The spikes were topped by shiny, black achenes when we found the plant.

Wetter areas around the hummocks contain the bright green moss *Scorpidio scorpioides*. This is the first known occurence south of Glacier National Park.

Carex scirpoidea is a dominant sedge here. In Colorado it is found only here and on wetlands on limestone in the nearby mountains.

Pale blue-eyed grass (*Sisyrinchium pallidum*) is a very rare member of the iris family first described as a species in 1984. This endemic species is endangered throughout its range. It is a candidate for federal listing.

Greenland primrose (*Primula egaliksensis*) was in fruit and inconspicuous when we found it. It is critically endangered in Colorado, but apparently secure globally. It is threatened by the draining of wetlands in South Park.

Two distinctive rare willows are also found here. Hoary willow (*Salix candida*) is a disjunct species from much farther north. It is recognized by leaves that are beautiful silvery white beneath. It is secure globally, but critically imperiled in Colorado. This is only the second known location for it in Colorado.

Also here is the myrtle-leaf willow (*Salix myrtillifolia*). This recent discovery is the first record for the western U.S.

Cottongrass (*Eriophorum angustifolium*), although not rare, is distinctive because of its cottonball-like heads.

Slender cottongrass (*Eriophorum gracile*) is very rare in Colorado and occurs in other wetlands in South Park, but has not been observed at High Creek yet. In addition to rare species, many of the common gentians were seen in bloom on this field trip. A beautiful display was put on by marsh felwort (*Lomatogonium rotatum* ssp. *tenuifolium*), bottle gentian (*Pneumonanthe affinis)*, and especially fringed gentian (*Gentianopsis thermalis*).

In addition to getting everyone excited about the High Creek fen, Dr. Cooper showed us interesting species on the salt flats around Antero Reservoir. Here we saw a glasswort *Salicornia europea* ssp. *rubra*, salt meadow. Acres of drying salt flats are covered with the succulent rusty-red stems of glasswort. The intense brilliant color produces a surreal effect. This plant community, although secure globally, is known in Colorado only from South Park. It is considered critically imperiled in the state.

In spring and seep areas we also found alkali cordgrass, (*Spartina gracilis*) which looks like a small version of prairie cordgrass (*S. pectinata*). Also here are sea milkwort (*Glaux maritima*), *Amphicarpus (Scirpus) nevadensis* , and the arrowgrasses, *Triglochin palustris* and *T. concinna*.

Although somewhat muddied and wet by days end (the expression "whoops" was heard more than once), we were all ready to camp out in Fairplay and continue this interesting trip the next day. Unfortunately this most educational trip was scheduled for only one day. Hopefully Dr. Cooper can be enticed into showing us more wetlands in this area next year.

Threatened Peatlands

The peatlands of the High Creek fen and elsewhere in Colorado are severely threatened by water "development" (read drainage) and peat mining. The cities of Aurora, Denver, and Thornton own most of the water rights in South Park. Some ditches have been dug and wetlands destroyed. One drainage channel already exists right next to High Creek fen. Dr. Cooper showed us sites that had been drained and the wetland vegetation replaced by fringed sage (*Artemisia frigida*). Much of the peat mining destroying these wetlands is marginally economical. The peat being mined accumulates at rates of only about 20 cm (about one foot) per 10,000 years. It is not a renewable resource. These peat ecosystems are the oldest ecosystems in Colorado and the most stable in the United States.

Peatlands are important for water purification. Sediments are trapped by these wetlands and removed from streams in large amounts. Some heavy metals are also removed in addition to sulfate, nitrate, and chloride. Water quality below peat mines is significantly degraded.

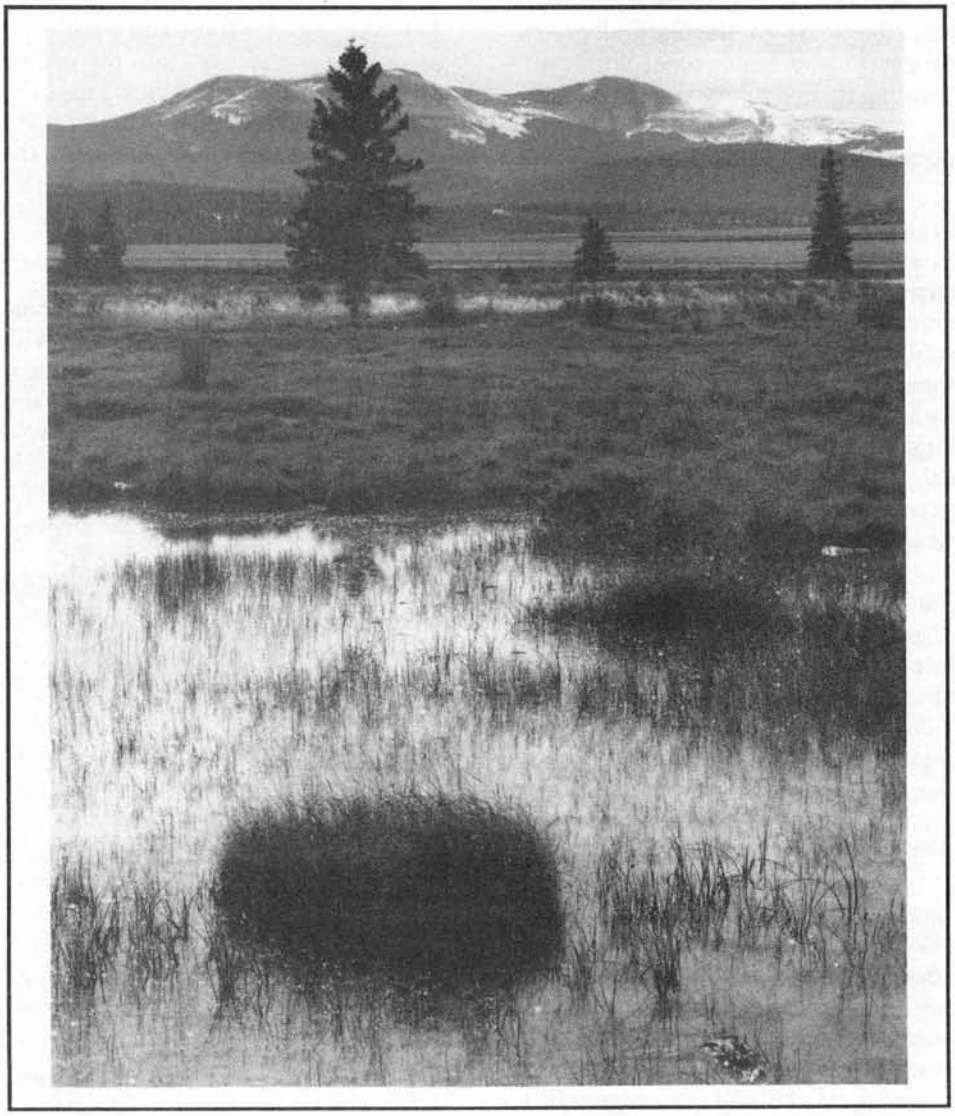
Unfortunately, limited time did not permit a visit to a peat mine. Dr. Cooper's studies have shown that there is essentially no vegetation on these abandoned mines. The sedges which dominate these wetlands are not known to reproduce by seed. It's possible that large areas of sedges are really a single clone (and perhaps a threat to creosote bush as the oldest living organism)!? Reclamation of these sites appears to be impossible at this time.

Saving the Peatlands

Although selected wetlands can be protected by purchase, reduced demand for Colorado mountain peat will limit mining in all of these peztlands.

The peat sold in garden centers, nurseries, etc. as Colorado peat comes from mines like those in South Park. It contains no sphagnum peat, but is composed of sedges and willows. Colorado peat is alkaline and contains 50 to 80 percent inorganic sediment. We add peat to our soil to reduce alkalinity and add organic material to break up clay. This is just the opposite of the effects obtained with most Colorado peat. Thus, buying Colorado peat destroys wetlands and does not help your plants very much. Buying sphagnum peat destroys wetlands outside of Colorado. We can all help protect these peatlands and their rare plants by choosing plant materials appropriate for our existing soils and climate to reduce the need for such soil supplements, and by conserving water.

High Creek fen will be mined for peat if it is not protected. The Nature Conservancy needs our help to raise $700,000 by April 1, 1991 to purchase and endow this preserve. With a matching grant already in place, each dollar is doubled! Tax deductible contributions should be sent to: The Nature Conservancy, 1244 Pine Street, Boulder, CO 80302.



View of the High Creek Fen, a rich calcareous fen in South Park. Photo by John Fielder, courtesy of The Nature Conservancy.

The Prairie Garden, Part VI: Maintenance

Rick Brune

After the initial year or two of work establishing the prairie garden, the amount of maintenance needed decreases with each passing year. A shortgrass prairie garden with noxious weeds under control requires about one hour of maintenance (mostly weeding and mowing) per year per 200 square feet. This does not include time for adding and tending new plantings which will vary with each gardener.

Maintaining the garden should be done with an eye toward replicating the natural activities occurring on the prairie. In most cases, our activities will be only a crude approximation of natural activity. The following sections describe some of the natural prairie processes and some ideas for incorporating them into our prairie.

Grazing (mowing)

Prairie plants evolved with adaptations to survive and meet the demands of large herbivores such as bison, elk, and antelope, and smaller ones such as jackrabbits and grasshoppers. Together these produced a year-round demand for forage. Because the addition of most large and small herbivores is impractical, we must improvise. The best improvisation is the lawnmower or weed-eater.

Summer grazing stimulates the spread of grasses by tillers and stolons. It stimulates sprouting of dormant buds on shrubs to produce a denser habit. Winter grazing of dormant plants affects growth much less. Every few years the prairie garden should be mowed several times during the growing season with the grass clippings collected.

Grass cover on unmowed buffalograss (*Buchlöe dactyloides*) and blue grama (*Bouteloua gracilis*) prairie recreations begins to thin out after three to four years worth of litter (mulch) accumulation. This litter also slows the spring warming of the soil and regrowth of prairie plants. It also probably reduces self-sowing of prairie plants and weeds. Fall mowing removes the maximum amount of litter-producing grasses.

I mow my prairie garden in mid-November. This allows time to appreciate all of the attractive seed heads and the nice fall colors. Even after mowing, much of the warm fall color remains. I set my gas-powered bison to graze at a height of two and one-half to three inches. The clippings can be used for mulch in the garden, although this results in some buffalograss seed germinating in the garden. If it snows and you can't mow, don't worry about it. When mowing, try to mow around most of the prairie plants, especially shrubs, to provide some variety in height during the winter. This also allows shrubs and wildflower seeds to disperse back into the prairie garden. Each fall when I mow I have the brilliant revelation that I should leave enough space between plants for the mower when I plant. Unfortunately, this is usually forgotten by spring. I hope you'll do better.

Another suggestion is to plant in some sort of grid to facilitate mowing. With care and attention to orientation it should be possible to do this and maintain a natural appearance. Simply avoid planting any one species in a straight line. The grid concept is only needed for species you don't want to mow anyway.

Mowing and collecting the clippings from six inch tall grass is slower than normal mowing, but goes surprisingly fast. Remember how much time you would spend mowing and watering the same area once per week all summer!

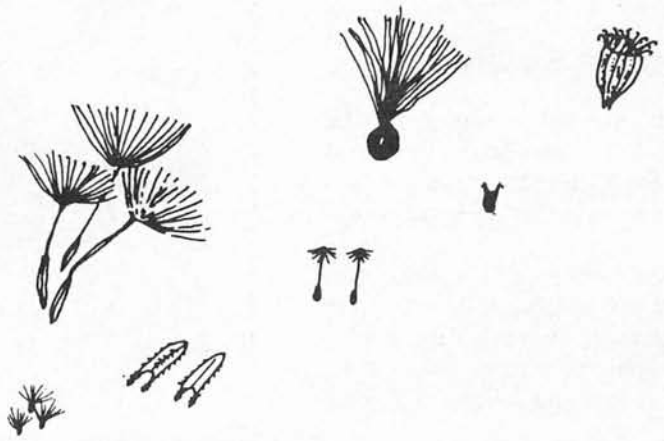
Fertilizing

Removing grass clippings removes an unknown amount of nutrients from the prairie garden each year. The most significant is probably nitrogen. In the case of a bluegrass lawn, about 30 percent of the applied nitrogen is removed when clippings are collected. Nutrients historically removed by herbivores on the prairie were recycled back to prairies as waste (buffalo chips) and, eventually, carcasses.

The addition of nitrogen fertilizer has been studied at the Central Plains Experimental Range in northeast Colorado. This study was done on a blue grama shortgrass prairie growing on sandy loam. The rate of fertilization was 0.5 pounds of nitrogen per 1000 square feet which was broadcast annually in October. Ammonium nitrate fertilizer was used.

Nitrogen fertilization temporarily mobilizes carbohydrate reserves in grasses, which may stimulate growth too early in the spring, and reduce carbohydrate reserves in the grass. Apparently because of this, fertilizing blue grama reduces drought hardiness. This report states for fertilizing blue grama that "the practice is potentially disastrous to blue grama stands." The general conclusion

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of this report with regard to other species studied is that nitrogen "fertilization was primarily deleterious to the stands of perennial species and beneficial to the annuals". Other people have also reported that fertilizing increases weeds in prairie plantings. Significant research on this subject could be done in a prairie garden. Before you fertilize, experiment to determine the consequences and remember that the effects may not be apparent until a dry year. I don't fertilize. Rely on lots of legumes and rainfall for your nitrogen.

Watering

By the second year, one or two deep supplemental waterings are all that is required for most prairie grasses to remain green season-long. Areas with poor grass cover (usually because of weeds the first year) will fill in if given two or three waterings. By the third year you can essentially forget about watering the grasses.

Wildflowers in their second and third years can be encouraged to outcompete grasses. Give them a few slow, deep soakings using one gallon plastic bottles with pin holes in the bottom for a slow drip. Again, cutting back grasses very short next to flowers reduces competition for light and water.

During 1990, none of the species I planted in 1989 got more than two supplemental waterings. Many got none. Nothing planted in 1988 was watered in 1990. All plants that were healthy in the fall of the year that they were planted survived.

Trampling

Besides grazing, large mammals also disturb soil with their hooves. This stimulates vegetative reproduction by grasses. It buries and possibly scarifies seeds. It has been suggested that old, thinning buffalo grass lawns might be invigorated by very lightly going over them with a rototiller. Gas-powered dethatchers, which damage bluegrass lawns, might also work since they rip up a lot of grass. Any experimenting you do here will be original research.

Pruning

Most or all shrubs on the prairie are palatable to one herbivore or another. Pruning by browsing animals usually occurs at the ends of branches and creates a denser habit. Shrubs may be pruned to ground level by very heavy browsing, girdling by small mammals, or by fire. The prairie species of rabbitbrush (*Chrysothamnus* species), *Prunus* species, rose species, and sage species can be cut off near the ground without ill effect. In general, pruning will injure none of the shrubs which threaten to outgrow the scale of your garden.

Weeding

The battle with exotic weeds seems never ending in our disturbed environment. In the prairie garden, our battle with annual and biennial weeds is usually reduced to small skirmishes once good grass cover is in place. Blue mustard (*Chorispora tenella*) is nearly completely eliminated by preventing seed set for one year. Knotweed (*Polygonum aviculare*) is a persistent annual apparently from seeds in the soil since it reappears in the same place each year. It requires several years to eliminate and it competes quite well in a thick buffalograss/blue grama turf. Prickly lettuce (*Lactuca serriola*) appears randomly each year. Whether seeds blow in or are in the soil, I don't know. It is easily controlled and usually appears after a rainy period. Cheatgrass (*Bromus tectorum*) and Japanese brome (*B. japonicus*) are controlled readily by preventing seed set. Again, annual and biennial weeds are rarely a problem after good grass cover is established.

Perennial weeds can be especially pernicious. Among the worst are bindweed (*Convolvulus arvensis*), Canada thistle (*Cirsium arvense*), and quackgrass (*Agropyron repens*). All are quite tenacious.

Canada thistle is the easiest to control. Spot spraying or painting with Roundup® as soon as new shoots appear may eliminate it. If not, it will weaken it so that by the second or third year it will be killed by cutting off new sprouts several inches underground as soon as they appear.

Quackgrass is more tenacious. You know you have quackgrass (or its close relative western wheatgrass, *Agropyon smithii*) when you see green grass shoots appearing in your dormant prairie in late March or early April. If very little is present, the rhizomes can sometimes be dug out successfully. Any undug or unpulled leaves you neglect are feeding spreading rhizomes underground. Recently, I noticed that rhizomes of quackgrass in five year old parts of the prairie garden are very shallow, often just beneath the accumulation of litter. These can be effectively removed by careful pulling and cutting with a knife. It's a satisfying feeling to extract a 12-inch-long quackgrass rhizome.

Quackgrass is often too abundant to dig. When warm season grasses are dormant, but quackgrass is green and growing, you can spray small areas of warm season grasses lightly with Roundup® and selectively kill quackgrass. It is *imperative* that warm season grasses be **dormant** or you will kill them also. Mid-April is usually about the latest for this approach, but each year is different. This also kills bluegrass (*Poa pratensis*).This technique cannot be used on wildflowers without disastrous results.

Jim Borland reports that his former buffalo-grass/wildflower planting, which contained a seemingly innocuous amount of western wheatgrass, was taken over by wheatgrass last year even though no supplemental watering was applied. With wheatgrasses present, an unmowed prairie garden or lawn may not meet some weed control ordinances restricting the height of unmowed grass.

Bindweed, in my opinion, is the toughest of all perennial weeds to eliminate. Pulling or mowing it often has little effect. Gather the vines on a thick layer of newspaper or cardboard to protect the grass beneath and spray with Roundup®. After the herbicide dries, remove and discard the paper. After the leaves dry up or severely wilt, pull them up and discard them also. If it rains or if you water, the herbicide will wash off and kill the grass underneath. It will grow back or you may use the bare spot for a wildflower. Again, this is most effective

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Prairie Garden, *continued from page 9*

about two weeks before frost, but you cannot leave noxious weeds unchecked to spread during the growing season. At least pull them to keep them from increasing in vigor even if it does not reduce them.

Mallow (*Malva neglecta*) is a persistent weed on bare soil. Pulling it out or cutting it off below ground will control it eventually. It is usually not a severe problem once grass is established.

Smooth brome (*Bromopsis inermis*) is another noxious, cool-season exotic grass you may get. It forms nearly solid colonies to the exclusion of most other species and spreads rapidly by rhizomes. It is controlled with difficulty by digging or Roundup®. Unfortunately it is used widely as a reclamation and pasture grass to the detriment of most native plant communities.

Native grass seed usually contains a few surprises with some potential to become weeds. I find I get some native, early successional prairie species such as tumblegrass (*Schedonnardus paniculatus*) and dropseed (*Sporobolus* species) when I plant. Although these have never been a problem, I am always a little suspicious of these species adding to my collection of weeds in the vegetable garden when I pull them occasionally for good measure.

Fire

The importance of fire in the shortgrass prairie is a subject for debate. It is without a doubt very important for healthy tallgrass prairie. The general restriction of trees and shrubs on the shortgrass prairie to rock outcrops where they are protected from fires indicates fire is a fairly important prairie influence. The presence of the growing points of prairie plants at or below the surface of the ground is both a fire and grazing adaptation. The prairie was regularly burned by native Americans to produce an early spring green-up that attracted bison.

Burning removes litter, recycles some nutrients back to the soil, discourages cool season plants at certain times of the year, and kills annual weeds. Most shrubs are killed back to the ground.

Prairie Garden, *cont. from previous column*

Buffalo-grass is discouraged by fire because it spreads by above-ground stolons; blue grama is encouraged.

Tall, dry prairie grasses burn very fast and hot. Short, mowed grasses burn more sedately. Prairie burning is a hazardous task for the inexperienced. Open burning is also illegal in most municipalities. Two of my favorite slides show the effect of prairie burning at the Denver Botanic Gardens. One shows the Garden's sandhills blackened and burned almost to the ground. The other shows the same area one month to the day later, with grasses and flowers nearly two feet tall and in full bloom.

Our shortgrass prairie gardens will survive, for better or worse, without burning. With the intimate knowledge of your prairie you will gain from weeding, planting, and general enjoyment, you will develop a sense for what your prairie needs and the effects your activities have on it.

Recordkeeping

Keep a record of what you do and what results. We know very little about the life histories of most prairie plants. How long do they live and under what conditions? What pollinates them and how? Why do they set seed in only certain years? Do plants grow every year or is a "dead" plant only taking a year off? Do different pollinators appear after a few years and cause plants to set seed for the first time? How do you get seeds to germinate? A prairie garden can begin to answer many questions and it will generate even more. It will also help to dedicate others "to the appreciation and conservation of the Colorado native flora".

1. D.N. Hyder, R.E. Bement, E.E. Remmenga, D.F. Hervey, Ecological Responses of Native Plants and Guidelines for Management of Shortgrass Range.Technical Bulletin No. 1503, U.S. Dept. of Agriculture and Colorado State University, May 1975.

Ed. Note: This marks the last in Rick Brune's series on The Prairie Garden. For further discussion of weed control on prairies, please see page 11.

A Reader Questions . . .

Dear editor,

I was amazed to see a recommendation to use a chemical herbicide in a recent *Aquilegia* article ("The Prairie Garden, Part III: Planting Grasses", volume 14, number 4). Mr. Brune suggested using 2,4-D to control broadleaf weeds or Roundup for larger weed plants.

2,4-D was the herbicide responsible for the widespread damage in Colorado late June 1989 to 20,000 to 30,000 acres of dry beans. 2,4-D is persistent, volatizes at summer temperatures and can drift 5 to 10 miles. It is also almost always contaminated with dioxins and is a component of Agent Orange. It is certainly not an herbicide that should be taken lightly and used by the average homeowner.

I question, however, why an article in the newsletter of the Colorado Native Plant Society is recommending the use of chemicals at all, regardless of which ones. Almost all chemical herbicides are non-specific, hence they have the potential to damage native as well as exotic species. A much better way to control introduced species is manual handpulling, cultivation or biological controls. Hadn't we better recommend those methods rather than suggesting the use of chemicals?

Elizabeth Otto

Editor's Note: We rarely edit submissions to *Aquilegia* for content to this extent, trying to maintain the original author's intent. Most of us would agree with Elizabeth's concerns, and appreciate her expressing them. The alternatives she suggests are helpful in many cases, but bindweed and Canada thistle are, as Rick points out, difficult. If readers can suggest alternatives to eliminate particularly noxious species, we will print them in future issues.

On the Use and Abuse of Herbicides

A response from Rick Brune:

Pesticides and herbicides are indeed used indiscriminately, too frequently, and without regard for the environment. I am appalled by the number of people subscribing to "lawn maintenance" contracts which regularly spray lawns with unnecessary herbicides, pesticides, fungicides,etc. An excellent discussion of problems in the lawn-care industry may be found in The Amicus Journal (1), a publication of the Natural Resources Defense Council.

I assume most people do not have large quantities of noxious weeds requiring the use of herbicides. The purpose for describing the use of herbicides is to provide a procedure for planting a prairie garden under most conceivable conditions, not to promote their use. As I stated in *Aquilegia*, herbicides cannot generally be used in the prairie garden without serious consequences. A prairie garden should reduce the need for herbicides because the xeric environment won't support many weeds.

I believe the alternatives to herbicide use such as hand-pulling and cultivation were adequately discussed. I am not aware of biological controls for quackgrass (*Agropyron repens*), bindweed (*Convolvulus arvensis*), or Canada thistle (*Cirsium arvense*). A weevil is available to control bull thistle (*C. vulgare*), a biennial. It eats the developing flower buds and prevents fruiting. Bull thistle is rarely a problem in yards. The weevil is unlikely to do serious damage to Canada thistle which spreads vigorously by rhizomes.

At the Denver Botanic Gardens we literally spent thousands of hours handweeding to recreate a prairie from a former weedfield without the use of herbicides. Annual, biennial, and perennial weeds were removed by the ton. The discussion on the use of herbicides is based in part on this experience. We noted the following:

1. Bindweed and thistle could not be controlled even by intensive handweeding if more than a few plants were present. We tried to dig out bindweed. At a depth of three feet, the rhizomes showed no sign of thinning. Also, bindweed growing outside the conservatory sent rhizomes deep below the foundation which then emerged in the conservatory!

2. Most other weeds can be controlled by handweeding if prevented from seeding. This often means concentrating on a single weed species at a time, such as mallow (*Malva neglecta*), day after day to prevent seed set. Herbicides are not needed to control most annual and biennial weeds.

3. You need to have the mental capacity of a gnat to spend that much time weeding.

Regarding the use of 2,4-D, it was indeed one of the ingredients of Agent Orange, but today it's found in about 1500 over-the-counter herbicides. 2,4,5-T was the other and even more hazardous component. Aerial spraying of any herbicide or pesticide seems irresponsible because of the lack of selectivity and drift. One of Colorado's finest sandhills prairies was sprayed with herbicides several years ago to control weeds. Unfortunately, for some of the agricultural community, weeds are *any* non-grass plants. I have observed herbicide damage in other prairies where you and I would not see any "weeds."

2,4-D is available in two forms: amine and ester. The ester form is highly volatile and causes much damage. I believe, but am not sure, that it is used primarily in agriculture. The amine form is far less volatile and is the only one that should be used, if any. The label must state that the herbicide contains the "dimethylamine salt of 2,4-dichlorophenoxyacetic acid" or the equivalent.

Glyphosate (Round-Up®) kills or damages most vegetation it contacts. Because of this and a cost of $40 per quart, use must be very selective. It is reported to decompose very rapidly on contact with the soil and not to be absorbed by roots when properly used. Cactus and other species with thick skins and slow metabolism are generally little affected. Likewise with dormant or drought-stressed plants. This may be the herbicide of choice because it forces the user to be seriously conscious of its contact with other plants.

Are herbicides safe? This question is unanswered for some. Round-Up® is reported to be slightly toxic on an acute basis and 2,4-D slight to moderate(1). Both of these and others are considered possible human carcinogens. There is evidence of other health effects as well. I have an excellent report (which unfortunately I can't locate at the moment) describing how politics may override science when it comes to labeling and classifying herbicides and pesticides. The report appeared in an environmental-oriented publication several years ago. If anyone knows of it, let me know and it can be referenced in a future *Aquilegia*.

Should we use herbicides? Is the cure worse than the disease? No doubt herbicides are toxic and have been and continue to be used irresponsibly. We should all be concerned what the previous owners of our properties poisoned our yards with, just as we are concerned with lead-based paint in our homes.

How do we deal with noxious weeds such as Canada thistle which severely degrade the environment by choking out native plant communities and rare plants? Many mesic areas near wetlands are infested with Canada thistle to the exclusion of most native species. Some tallgrass prairie relicts near Boulder have serious thistle infestations. In short, it's everywhere and getting worse. Those who think an infestation can be controlled by handweeding or cultivation need only attempt it for five minutes to change their minds. Existing herbicides are not the best solution either. There is no perfect solution but it is irresponsible to let noxious weeds grow unchecked anywhere, including your garden.

1. Shute, Nancy. 1987. *Toxic Green*. The Amicus Journal 9(3):10-16.

Back-to-back Workshops!

This year's workshop schedule is beginning to sound like something straight from Hollywood. Unprecedented demand for satisfaction of botanical curiousity and growing recognition that botanical knowledge is a bargain at CONPS workshops have resulted in double (+) scheduling for this season's offerings.

Dates are listed here; see *Aquilegia* 14:6 for full descriptions or contact Bill Jennings, coordinator extraordinaire, for more information at 666-8348. Be advised that workshops offered are already booked, but cancellations do create openings, and demand may encourage more opportunities.

Mar 2	Weed Seeds I Arnold Larsen	CSU
Mar 9	Weed Seeds II Arnold Larsen	CSU
Mar 23	Mentzelias I Barry Prigge	DBG
Mar 24	Mentzelias II Barry Prigge* (*talk Fri Mar. 22, p. 3)	DBG
Mar 30	Grasses II Bob Shaw	CSU
Mar 30	Grasses III Jan Wingate	DBG
Apr 6	Grasses IV Jan Wingate	DBG
Apr 13	Grasses V Jan Wingate	DBG
Apr 13	Adopt I Jennings et al.	FNC
Apr 20	Adopt II Jennings et al.	FNC
Apr 27	Illust I Carolyn Crawford	FNC
May 4	Illust II Carolyn Crawford	FNC

Key to Locations:

DBG	Denver Botanic Gardens Herbarium
FNC	Foothills Nature Ctr. Boulder
CSU	Colo. State Univ. Ft. Collins

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