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Prairie establishment at the Field Station

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PRAIRIE ESTABLISHMENT AT THE FIELD STATION

A PROGRESS REPORT

Early in the development of the Cedar-Sauk Field Station it was decided to attempt establishing a sample of prairie vegetation as an experimental and demonstration project. Although none of the field station land had prairie soil and the nearest site of original native prairie was probably at least twenty miles distant, we felt that this area was close enough to the original prairies climatically so that most of the prairie species native to southeastern Wisconsin should be able to survive. If even moderately successful, it would provide an additional habitat for studies of animal life at the station, a demonstration area and species collection convenient for educational use, a gene pool for prairie plants for the future, and a test of direct seeding methods and treatments for prairie re-establishment.

In 1965 Arthur Ode had started the seeding of prairie species at Whitnall Park in a cooperative project for his M.S. at UWM (Ode, 1968, 1972) which was one of the first major projects of its kind in Wisconsin. At that time, there was little information in the literature to draw on, but we decided to proceed with help from Mr. Ode and from Dave Archbald, then Manager of the U.W. Arboretum, even though the results of the Whitnall Park project were not yet known.

The logical choice of site at the field station was on the south 1/2 of the old field (about five acres) adjoining the public road at the south-central part of our property where the slope is generally south and southeast for a good sunny exposure. The soil was originally gray-brown podzolic forest soil mostly of Hochheim series, but most of it was badly eroded and gravelly by this time. The lower part of the field had last been cropped in grain and had in 1965 a cover of mostly annual and biennial weeds while the upper part had a rather dense cover of alfalfa and brome grass mixture which had been used for hay. Plans were made to seed a series of roughly contoured strips early in the spring of 1966 following plowing and discing. Seed sources were limited so that a total of about 1/2 acre was all we could plant at this time. The main source was from the U.W. Arboretum which very kindly donated nearly 50 lb. total seed of 11 species collected on their prairie and stratified in damp sand over winter. Small amounts of seed totaling less than 10 lb., but including 25 species for greater diversity were gathered by hand, mainly by Paul Matthiae and myself during late summer and fall of 1965, from several previously studied prairie remnants in southeastern and central Wisconsin (Whitford, 1958 and 1972).

The strips to be planted were staked out to include the lowest and moistest part of the old field near St. Augustine road and parallel to it, a strip somewhat higher, one in mid-slope and one much shorter on the ridge top to provide

the maximum range of soil moisture conditions within the site. The two higher strips were in the alfalfa-brome sod area. We felt that the range of moisture conditions might eventually show some selective effect in differential success of wet-prairie vs. mesic-prairie or dry-mesic species; no part of the site is sufficiently steep and shallow-soiled to be suitable for most species of Wisconsin dry-lime prairies as described by Curtis (1959). We expected further that at least some of the species would eventually colonize the areas between strips and that this would provide an opportunity to study the rates and comparative success of different species in self-establishment in competition with existing plant cover.

The strips were laid out in early spring of 1966 and prepared by shallow cultivation followed by discing several times to reduce weed and sod competition. Seeding was done by hand broadcasting of thoroughly mixed wet sand and seed mixture. Unfortunately spring weather and dependence upon equipment rented from neighboring farmers delayed operations and also resulted in less than ideal preparation of the seed bed. The seed should probably have been in the ground by mid-April, but planting was held up until May 8, by which time some of the stratified seeds were already sprouting. (Further, the weather thereafter turned unusually warm and dry, resulting in the probable loss of many seedlings). Each strip was approximately 1/2 rod wide as prepared by 8' disc and the length of strips varied from 40 rods on the lowest strip to 7 rods on the ridge top. Each was staked to form two-rod segments as subplots, thus each plot was equal to one square rod (or about 2½ x 30m = 75m^2 in area), for a total of 84 plots. Two plots were mulched with grass clippings, 35 with straw and the rest no mulch, assigned randomly.

Weed growth provided heavy shade and competition for the seedlings by mid-summer of the first year. Therefore, the seeded strips were mowed in mid-August with a tractor-mounted sickle-bar set 4-6" above the ground to provide more light and growing space for the young prairie plants. The heavy "hay" was removed with a hay rake to avoid smothering the seedlings. Very few prairie species were large enough to be identifiable in the stubble and new growth at the end of the growing season and no quantitative study was attempted.

The following summer, 1967, a cursory survey of the seeded strips was made from which we concluded that either a) seedling success was very poor or b) that the seedlings were still too small to be readily found and identified among the vigorous hay plants and weeds. Therefore, no detailed counts were made for this season, but plans were made for seeding another long strip on the lower part and a short strip on the ridge top in the fall of 1967. Also it was decided to try an early spring burning the following spring to weaken the re-established alfalfa-brome sod and remove the litter, which was heavy in some places. Both the fall seeding and the spring burn were accomplished. Burning was also carried out the following year, 1969, and in 1971 and 1972, planning generally for alternate years, but excessive moisture resulted in so light and spotty burning in 1971 that it was re-burned in 1972. In each of these controlled burns, the Aldo Leopold Conservation Club contributed the needed man-power which we acknowledge gratefully.

By the summer of 1969, the flowering of yellow coneflower, *Ratibida pinnata,* was evident in scattered portions of all strips but few other prairie species were visible without careful search. Time did not permit quantitative study in that year or the next two, although increasing success of the coneflower and a few other species was evident. Meanwhile several of the more aggressive and wide-ranging species found in native prairies and prairie border had invaded the area in places adventively, probably from roadsides, marsh borders, etc. Among these were notably New England Aster, black-eyed susan, common yarrow and both whorled and common milkweeds. A few wide-ranging semi-weedy native species, not typically of prairie affinity, were also common both in seeded and non-seeded areas by this time; these included tall goldenrod and common asters, *(A. sagittifolius* and *A. pilosus).*

In September of 1972 a summary list based on about one hour's inspection revealed that at least 16 of the species of prairie plants seeded were established, at least locally, in the seeded strips. Yellow coneflower was the most obvious and widespread, being abundant in most plots and showing some spread into unseeded areas. Purple coneflower was common in some plots, a number of them of flowering size, and stiff goldenrod was abundant on some of the high and mid-slope plots. Blazing star, bergamot, prairie dock *(Silphium),* and the common and saw-toothed sunflowers were also listed as common. Prairie grass species were generally less widespread, but four species had scattered vigorous clumps established and some were flowering in their fifth or sixth year from seeding; these included big and little bluestem, Indian grass and switchgrass. A few plants of prairie dock had reached flowering size this year and many smaller ones were noted. Evidently the successful burn the previous spring had increased the vigor and flowering of the prairie species as noted by other investigators (Kucera and Ehrenreich, 1962; Cottam and Wilson, 1966). It appeared that a quantitative survey would be justified in 1973.

On July 12 and 13, 1973, Paul Matthiae and I carefully retraced each strip, pacing off the length of individual plots and recording both prairie species and other vegetation, on separate data sheets, for both frequency and relative abundance. Of the more than 40 species seeded, 21 were recorded in at least one plot but only seven had a frequency of 20% or more. The most common were:

Ratibida pinnata, yellow coneflower	82%
Monarda fistulosa, bergamot	76%
Silphium terebinthinaceum, prairie dock	57%
Helianthus grosseserratus, sawtooth sunflower	56%
Echinacea pallida, purple; coneflower	53%
Solidago rigida, stiff goldenrod	27%
Andropogon gerardi, big bluestem	20%

The remaining prairie species had frequencies of 1 to 12%. The two highest strips had only six of the 21 species present and the midslope strip (#4) had only nine; apparently the success of seedlings was inhibited both by competition of

the rather dense alfalfa and by the relative dryness of these sites. The lowest strip had only eight species, but this probably reflects the fact that it had the heaviest weed cover and competition. Most successful was the second strip above the road with mesic gentle slope and fall-seeded, where 17 species were established (10 of them over 20% frequency for that strip), followed by next mesic strip with 12 species. Several species, apparently less tolerant of weeds and sod or of drouth and eroded soil, were found only on the mesic strips #2 and 3; these included heath aster, smooth aster, spiked blazing star, whole-leaved Silphium, Missouri goldenrod, dick trefoil, rattlesnake master and both the purple and the white prairie clovers. The two coneflowers, bergamot and stiff goldenrod were the only species represented in all strips from low to ridgetop.

Weed and hay-plant cover remained heavy on most parts of the seeded strips six and seven years after seeding, in some plots nearly excluding the prairie species. This reflects, in part at least, the inadequacy of rented equipment and less than optimum seed bed preparation. In the future it may pay to use an herbicide such as Atrazine to eliminate sod and weeds before seeding since this seems to be a major problem in other prairie establishment projects as well as in ours (Schwartzmeier, 1972). The commonest plants in the "weed and sod" category were sweet clover, red clover and quack grass in the lower strips (former grainfield) and alfalfa and brome grass in the upper strips (former hayfield). Continued alternate-year spring burning should further reduce these plants in the future, but as of 1973 they still dominate large parts of the seeded strips as well as the remainder of the site.

A number of prairie species also have been established by transplanting either hand-raised seedlings in peat pots or clumps dug from prairie relicts. In the fall of 1967 we attempted to salvage sods including 41 known species from a site at Zion, Illinois, similar to Chiwaukee Prairie, which was under construction for a new power plant. We obtained permission and went down on November 8th with the field station pick-up truck to save all we could carry in one trip. This was late in the season, but the earliest we could manage after learning of the opportunity. These sod clumps were all planted in areas outside the seeded strips during the following week, their relative positions on the slope according to known preferences for wet, mesic, or dry sites in general. Apparently moving sod clumps so late in the fall does not allow sufficient establishment of new roots before the ground freezes and many of the species did not survive; frost heaving may have been a critical factor. Only ten of these species were found on July 12, 1973, and only four of these were species not also established in the seeding project, namely prairie pussy willow *(Salix humilis)*, mountain mint *(Pycnanthemum)*, needle-and-thread grass *(Stipa spartea)*, and slough grass *(Spartina pectinata)*. However, we have flourishing clumps of several others from this operation which were sparse or rare in seeding, plus the advantage of different genetic stock of those species which succeeded in both seeding and transplants. As a result of this venture, we would recommend fall transplanting only between late September and October 15, when dormancy is setting in and drouth is less likely to be a problem than earlier in the season, yet allowing a few weeks before freeze-up for new root growth.

We plan to do further checking on these plantings next summer and to present a more detailed paper on it at the fourth Prairie Symposium to be held next August in North Dakota. Also we plan to continue controlled burning at two or three year intervals and to seed another 1/4 acre next fall if it can be arranged. Next summer also we will try to assess the rate of colonization of the various prairie species in the unseeded portions of the tract and vegetative increase from transplants.

In summary, a number of things have been learned in this project which may be of help to others:

1. Seed bed preparation is of utmost importance; existing sod and weed species should be eliminated as completely as possible by chemical treatment, soil sterilization, repeated tillage or a combination of these. The soil surface should be in fine crumb structure and moderately loose, but firmly packed below to provide capillary moisture; if plowed or deep tilled at least a month with a good rain or two intervening must be allowed to settle the soil and avoid large air spaces which dry out soil and roots. Use of a roller or cultipacker is advisable.

2. The timing of seeding is important. Generally fall seeding (September 10 - October 15) is best in the upper Midwest as this allows natural stratification (cold treatment to break dormancy), firms the seed into contact with soil by freezing and thawing action and weight of the snow, and allows an early start in spring determined by temperature and daylength requirements of each species instead of by the time at which soil can be worked. Spring planting is practical as late as early June if seed is dry-chilled through winter to avoid the early sprouting which we found in damp-stratified seed by May. Late spring seeding allows extra tillage to reduce early sprouting weeds, but runs the risk of hot, dry weather after sprouting which would increase losses. (Recent work by Schwartzmeier, 1972, indicates that a "nurse crop" of oats or shorter-lived native grasses such as wild rye may help reduce weed problems and protect young seedlings).

3. There are problems in getting an adequate variety of species since commercial sources for many species do not exist, and particularly those species which fruit and drop seeds early in the season are difficult to collect. There are commercial sources now for a number of the showy midsummer wildflowers of the prairies and for major grass species, but other species are typically absent or under-represented in prairie re-establishment, ours included (Zimmerman, 1972).

4. Despite the problems in our experimental prairie, after six years we have at least 25 native prairie species established and some are flourishing. The seeded strips in July and August are beginning to resemble real prairies.

5. Several of the prairie species such as yellow and purple coneflowers, blazing star, bergamot and stiff goldenrod are fairly easy to establish from seed in sunny sites and offer variety for natural landscaping uses and possible roadside vegetation of a self-maintaining perennial type.

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