and Schwamberger Prairies, occurring on lake sands. At Killdeer, the prairie plants presumably began growing only during the last, or lowest, stage of the ancient lake that once occupied the site. In contrast to earlier water depths that might have been 20-30 ft (6-9 m), the water at the time of this last stage was probably only about 3 ft (0.9 m) deep during the spring, while, in late summer, this old clayey lake bottom was probably dry and brick-hard. Farther north, Irwin and Schwamberger Prairies developed on sand that represented the broad offshore deposit of an early, ice-dammed, higher level of Lake Erie known as Lake Warren. Here again, the prairie species obviously appeared only after the lake waters had drained away from the area because of the lowering of the lake level as the glacier that had held in the lake waters retreated. Flowering and other phenological phenomena are regularly later at areas on sand substrates, like those at Irwin and Schwamberger Prairies, because rain water that has soaked quickly down into the sand remains cool (un-sun-warmed), retarding related plant development.

Probably the best and most extensive remnant of Ohio prairie is that at Castalia in the Resthaven Wildlife Area. It contains both wet and mesic prairies, developed in an area made wet by seepage from springs of water emanating from solution openings dissolved in the limestone that forms the higher land to the south. Another wet prairie in Ohio occurs at Cedar Bog, which is not a true bog, but a sedge fen and wet prairie surrounded by swamp forest, where water from the

shallow water table in glacial outwash gravel wells up to the surface because of a strong local addition of water from an adjacent higher level of outwash gravel nearby to the east (Forsyth, 1974).

Thus, despite Ohio's un-prairie-like climate, many small prairies do occur in the state. And, whatever questions may be raised about their origin or floristics, there is no question about the significance of geology's critical role in making these prairies possible by providing the essential substrates, sites such as dry south-facing slopes and soggy clay plains, and a history that made prairie propagules available. Clearly, no ecologic study of any prairies is adequate unless it includes a meaningful understanding of the geologic setting of the prairies.

LITERATURE CITED

Cusick, Allison W., and K. Roger Troutman. 1978. The prairie survey project — a summary of data to date. Ohio Biol. Surv. Inform. Circ. No. 10. 60 p.

Forsyth, Jane L. 1974. Geologic conditions essential for the perpetuation of Cedar Bog, Champaign County, Ohio. Ohio J. Sci. 74(2):116-125.

Gordon, Robert B. 1966. Natural vegetation of Ohio at the time of the earliest land surveys. [Map.] Ohio Biol. Survey, Columbus, Ohio.

THE PRAIRIES OF ADAMS COUNTY, OHIO: 50 YEARS AFTER THE STUDIES OF E. LUCY BRAUN

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In 1928 Dr. E. Lucy Braun published her now classic work, *The Vegetation of the Mineral Springs Region of Adams County, Ohio*, in which she described several stands of dry prairie vegetation. It is appropriate that this conference convenes on the fiftieth anniversary of her publication. Braun's conclusions still appear substantially correct, and her research remains an inspiration and a challenge. Since this work was published, no comparable studies have been done. No one has attempted to survey the changing prairie communities since 1928, although hundreds of nature enthusiasts, botanists, and especially Braun's own students have tramped Adams County and observed the vegetation that she so thoroughly described.

Two of the prairie sites surveyed by her, Agave Ridge and Lynx Prairie, are still extant. A third, Prairie Ridge, seems to have been altered beyond redemption by quarrying and cultivation. Agave Ridge is a portion of the Edwin H. Davis State Memorial, a preserve owned by the Ohio Historical Society; Lynx Prairie is administered by the Cincinnati Museum of Natural History. Thus, these sites are readily accessible to researchers. The opinions expressed in this paper are based upon extensive field observations in these preserves, as well as in other prairie situations throughout Adams County.

More prairies probably are present today in Adams County than existed 50 years ago; more prairies may have existed in the 1920's than occurred prior to European settlement of this region. Very few primary or historic prairies seem to have existed before the advent of the Europeans. This paper will not discuss the origins of these primary prairies, but some of the evidence in favor of their historicity will be recounted.

Braun cited (1928:425) a possibly exaggerated account of prairies from a pioneer's recollections. However, the best source is Dr. John Locke (1838), a geologist who in 1837 surveyed a broad portion of southwestern Ohio for the Ohio Geological Survey and who also noted prairie vegetation. He referred to Adams County as "terra incognita" even to Ohioans. His observations were detailed and accurate, and his prose remains eminently readable. Locke ascended Buzzardsroost Rock, which he termed "Split Rock," and listed the

plant species growing on this isolated exposure; for example, hazel, (Corylus americana Walt.), three-leaved sumac (Rhus aromatica Ait.), sandwort (Arenaria stricta Michx.), and garlic (Allium cernuum Roth.). These prairie species are typical of the region and yet grow on the rock, or grew there until recently. Sadly, overuse of Buzzardsroost Rock by nature lovers and others have degraded the area severely; many of the plants have been trampled out of existence. The Cincinnati Museum of Natural History, however, is trying to correct this abuse.

It is worth quoting Locke (1838) on other historic prairies in Adams County. In his description of the "Great Marl Stratum," which today is called the Crab Orchard Shale, Locke noted:

When it is left in conical mound-like outliers, the marle is often almost barren of trees, and produces some peculiar prairie like plants, as the prairie docks, wild sunflowers, scabish, rudbeckias, etc. These places are called 'bald hills' and 'buffalo beats'. Several occur within a mile [1.6 km] of West Union, in a northerly direction, and would be quite a paradise for the botanist.

A touch of prophecy is here! In this description it is easy to recognize numerous sites in the vicinity of West Union today. An especially fine example is the Adams Lake Prairie Nature Preserve with its abundance of prairie dock (Silphium terebinthinaceum) and scabish (Liatris spp.)

A third piece of evidence for the historicity of the Adams County prairies may be added to those cited above. This account was not mentioned by Dr. Braun, probably because it referred to a portion of the county beyond the limits of her Mineral Springs survey. In August 1807 Dr. F. Cumming walked the Zane Trace from the Ohio River at Aberdeen to Sinking Spring at the Adams-Highland County line. His recollections are quoted in Evans and Stivers (1900:127-131). Cumming's most significant observations refer to the land about present-day Locust Grove in Franklin Township in northeastern Adams County. The property owner's names in the quote below can be identified in Evans and Stivers as being in that area along the Trace, approximately the modern State Route 41.

The land here is the worst I had seen since I had left the banks of the Ohio: it had been gradually worse from about two miles [3.2 km] behind Squire Leedom's, and for the last two miles [3.2 km] before we came to Marashon's it had degenerated into natural prairies or savannas, with very little wood, and none deserving the name of timber, but well clothed with brush and low coarse vegetation.

These historic prairies must have been the seed source for the secondary prairies that rapidly expanded as man devastated the original vegetation of the county. It should be noted that Braun (1928:426) believed that it was difficult to distinquish between primary and secondary prairies and that the flora of both is equally diverse.

In the early nineteenth century, the forests of Adams County were ravaged for lumber and charcoal. Bark was stripped from trees for tanning and the trunks were left to rot in place (Braun, 1928:383). Such destruction opened up large areas for colonization by prairie species as the resulting erosion stripped away the thin forest soils and re-created the xeric, rocky conditions of the historic grasslands. Following the financial panics of the 1830's and 1840's, the population of Adams County declined, allowing land to revegetate for a few decades. After the Civil War (1861-1865), a second wave of destruction ensued. Tobacco became a staple product, as it remains today, but sensible agricultural practices were not followed. Tobacco fields blanketed whole hillsides. The furrows were run vertically and no slope was considered too steep for planting. Such methods quickly destroyed what little soil had accumulated in previous decades. By 1920 the population again declined, farms were abandoned, and the prairies began again to flourish. In the 1970's, this pattern is commencing for a third time. The land is being developed for vacation homes and campgrounds, the lumber industry is small but thriving, the population is once more increasing, and the prairies are endangered. The eventual results of this current surge of development may prove as harmful to the prairies as the destruction of previous decades. The time for research and preservation is now, before the trend is irreversible.

The alternation of use and abandonment of these prairies in Adams County provides great opportunities for the study of community succession. The rapidity of the transformation of cultivated land into secondary prairie can be remarkable. Durrell and Durrell (1975:23) recounted tales of corn fields and gardens that have become excellent secondary prairies in only a few decades. In one case, only three years was required. Moreover, these secondary prairies, such as those near Lynx, are virtually indistinguishable from prairies on older sites, and their flora is equally diverse. In Lynx Prairie itself, furrows are still visible. In Green Township, the former Cedarville School property is a grassy secondary prairie, although it was abandoned less than 50 years ago. The recent origin of this prairie is readily apparent from the air; the outlines of the school's baseball diamond can easily be discerned within its limits.

Given suitable soil conditions, the abandoned land succeeds into prairie, which in turn becomes woodland. This change to woodland also can be relatively rapid, although the process is slower than the former one. On the dolomite promontories, such as, Red Rock and Buzzardsroost Rock, invasion by tree species has been slowed by the dry, exposed conditions. Although the arid nature of the secondary prairies during the summer has retarded growth of woody species, this has not checked their encroachment entirely. A cursory examination of the sites surveyed by Braun (1928) will confirm this.

For example, Braun (1928:419-421) recorded over 50 herbaceous species on Agave Ridge, and most of these still can be located there. Additionally, a few species, some quite common, are present today which Braun did not list; two outstanding examples are ground pine (Lycopodium flabelliforme (Fern.) Blanchard) and scrub pine (Pinus virginiana Mill.). Other species which had a low frequency in the 1920's are now much more common. Persimmon (Diospyros virginiana L.) appears to have increased significantly on all sites since 1928 and is an important invader of prairie openings. Other woody species that seem to have increased are red-bud (Cercis canadensis L.) and red cedar (Juniperus virginiana L.). In the shade of these woody species, rosettes of prairie-dock (Silphium terebinthinaceum Jacq.) bear leaves which are much less robust than similar specimens growing in full sun. This seems to indicate that the woody species have invaded the prairie openings recently and that their growth is detrimental to the shade-intolerant prairie plants.

Any doubts as to the continuing diminution of the Adams County prairies are eliminated by Braun's photographs of the Lynx Prairie 1928:423-424) which showed extensive openings where only small, narrow prairie patches now exist. Although much of the destruction

of the prairies around Lynx has resulted from pasturing and home construction, much more may have been lost due to natural succession. Even the largest opening in the Lynx Prairie Preserve today is considerably smaller than those shown in the photographs. This change is likewise confirmed by co-workers of Braun and by those fortunate enough to have accompanied her in the field. For instance, she told one companion with whom I spoke that scrub pine, now well-established in Lynx Prairie, was rare or nonexistent during her original survey. Without management, Lynx Prairie probably will become a series of shrinking prairie islands amid the sea of pines and junipers.

Unfortunately, no substantive vegetational studies have been conducted in Lynx Prairie during the past decades against which to measure the rate of succession. This void of knowledge reaffirms the necessity for such research today.

Those of us who love the prairies and their beauty are faced with a seeming paradox. We wish to maintain natural conditions; yet, the very condition we treasure is transient. How can one preserve successional stages? We must accept the necessity and the obligation of management. To preserve assemblages of species in various successional stages, one must disrupt the dynamic flow of nature.

The type of management required to maintain prairies is a controversial subject. In some cases, fire is used to reduce woody competition, but simple cutting of trees also may be successful. The best method to be used depends on the individual prairie site. A method which maintains one type of prairie community may not preserve other types. The local conditions which were present during the origination of a particular prairie and which also have maintained it must carefully be considered. Four basic types of prairies occur in Ohio: wet, mesic, dry, and the prairies of Adams County. Unique in this latter case are both the peculiar condition of unglaciated dolomite, occurring only in this area of Ohio, and the prairie communities native to it. Unique, too, is the almost desert-like environment of this region during summer, with thin sod over soil that is nearly bare and often cloaked with crusts of lichens (Cladonia spp.) and blue-green algae (Nostoc sp.). After a rain the clayey earth becomes slippery and waterlogged, but this state soon vanishes as the sun bakes the clay into brick-like hardness. The lichens and algae become brittle and crackle underfoot. These cryptogams probably play a vital role in the health of the prairie by protecting the soil from wind and rain erosion and by fixing atmospheric nitrogen.

Management by fire has become widely accepted as a prairie maintenance technique and prairie lovers have acquired a reputation, not entirely undeserved, as pyromaniacs. Certainly in more hydric or mesic prairies the sod is thick enough to recover from burning. However, the sod is thin in Adams County prairies, and fire probably would have a disastrous effect on the lichens and algae. Natural fires appear to be uncommon in the county. No reports of large-scale prairie fires, such as those that occurred in the tallgrass prairies, are known to the author. It would be rash to use burning uncritically to manage these unusual sites in Adams County; however, experimental burning might be tried on a small secondary prairie as a test of this management technique.

Perhaps a more straightforward approach would be the use of that ecological tool, the chainsaw. Indeed, desultory efforts already have been made to cut down cedars and pines in the Lynx Prairie. Dr. Jane Forsyth (personal communication) can well remember Dr. Braun's threat to sneak into Lynx Prairie and cut down the invading trees. Systematic, selective cutting on Lynx Prairie probably would provide the safest management on this important site.

Certainly some control on invading woody species is urgently required on the Adams County prairies. As Durrell and Durrell (1975:23) said, "Without management the secondary prairies stand on the threshold of extinction." We must not only save the prairies, we must save the prairies from themselves.

LITERATURE CITED

Braun, E. Lucy, 1928. The vegetation of the Mineral Springs Region of Adams County, Ohio. Ohio Biol. Surv. Bull. 15:375-517.

Durrell, Lucile, and Richard Durrell. 1975. The Wilderness. Cincinnati Mus. Nat. Hist., Cincinnati, Ohio. 70 p.

Evans, N. W., and E. B. Stivers. 1900. A history of Adams County, Ohio. E. B. Stivers, West Union, Ohio. viii + 946 p.

Locke, John. 1838. Geological report on southwestern Ohio. Ohio Geol. Surv. Second Annu. Rep., Columbus, Ohio. p. 201-274.



1820 Ohio Map by Alexander Bourne and J. Kilbourne

One of the earliest maps of Ohio showing natural features, including those areas with extensive prairie vegetation (From Amos Bourne, 1820, Archaeologia Americana 1: opposite p. 104.)



Members of the Department of Botany, The Ohio State University, about 1922-23

In the preceding papers by Thomas, Sears, Stuckey, and Gordon, reference was made to the quality Department of Botany developed by Professor Transeau. First row, left to right: Edgar N. Transeau, Lewis H. Tiffany, Ruth White, Wilmer G. Stover, Adolph E. Waller, Jasper D. Sayre. Second row: Lois Lampe, John H. Schaffner, Homer C. Sampson, Ernest L. Stover, Sylvester S. Humphrey, Harmon A. Runnels, Mary E. Wurdack. Third row: Donald B. Anderson, Bernard S. Meyer, Raymond A. Dobbins. (From the Department of Botany, The Ohio State Univ.)



Transeau's Plant Ecology Class, 1935

The field trips were conducted by Robert B. Gordon, who is standing and has his left hand on a large sycamore tree located north of Highbanks along the Olentangy River, Delaware County, Ohio (From a glass lantern slide, collection of R.B. Gordon and currently in the possession of R.L. Stuckey. Photograph by Luther L. Baumgartner, 26 Oct. 1935.)