

## A PRELIMINARY STUDY OF THE BUFFALO WALLOWS IN THE VICINITY OF NORMAN, OKLAHOMA\*

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During the summer of 1933, study of the buffalo wallows\* in the vicinity of Norman, Oklahoma, was undertaken by the authors, after the discovery by Dr. Sears in 1929 of *Isoetes melanopoda* in several wallows. Although common throughout the prairie region of Oklahoma, mostly on hilltops, little or no work has been done on their vegetation.

For this study of buffalo wallows, two stations were selected. The first station was one mile west of the east highway entrance into "Johnson's pasture" in McClain county. The second station was one mile north and two miles east of Norman, in Cleveland county.

The upper three inches of soil of the prairie adjacent to the wallows in Johnson's pasture are of gray sandy surface soil (4 per cent humus) merging into eight inches of red subsurface sandy loam soil. Near some wallows (I and II\*\*) hard gummy red clay was reached at fifteen inches, while near others (III) the soil is hard brown soil for twenty-six inches, before the clay was encountered.

Johnson's pasture is typically clay hills, covered with a sparse vegetation\*\*\* (due to overgrazing), intersected by small brooks in deep ravines. Buffalo wallows are very abundant on the hilltops and are almost never found in the valleys of the pasture.

*Baptista bracteata* and *B. australis*, *Vernonia baldwinii*, and *Plantago purshii* are the outstanding components of the vegetation on the hillsides. On the hilltops *Opuntia humifusa*, *Ambrosia psilostachya*, *Petalostemum purpureum*, *Plantago purshii*, *Psoralea tenuifolia*, and *Cirsium* sp. are the conspicuous plants. On the prairie only the surface soil was moist.

Three wallows were selected as typical of different types of wallows found in Johnson's pasture.

**WALLOW I:** Size 22 by 32 feet, oval; depth 12 inches; 8 per cent soil moisture (June 20); 6.5 per cent humus. Surface soil gray sandy loam merging into sandy clay at 4 inches, which in turn merges into red gummy clay at 7 inches. The vegetation of the floor of this wallow is sharply delimited from that of the surrounding prairie. It is covered with a rather heavy stand of a sedge (*Eleocharis*), with an occasional plant of joint weed (*Polygonum douglasii*) and hairy running water fern (*Marsilea vestita*). A sedge (*Stenophyllus*) was peculiar to the prairie rim of the wallow.

**WALLOW II:** Size 10 by 10 feet, round; depth 12 inches; 4.5 per cent soil moisture (June 20); 7.75 per cent humus. Surface soil gray loam, moist, sandy, and of loose texture for 5 inches, below which a 2 inch layer of very hard red sandy clay occurred. At 7 inches red gummy clay was encountered. The vegetation of the floor of this wallow is sharply delimit-

\*"Buffalo wallow" is a colloquial expression used to designate the many depressions in the prairie that the pioneers found which had been formed (supposedly) by buffaloes. The term is now used to designate those which are being formed by cattle, as well as for those already formed when the region was settled. These vary in depth from the usual few inches to several feet, and vary in diameter from the usual few feet to over a hundred and fifty feet, forming small ponds.

\*\*These Roman numerals refer to the buffalo wallows described in this paper.

\*\*\*For a discussion of the ecology of this prairie see Percy Lee Welch's, "A Reconnaissance of a Typical Central Oklahoma Prairie." Unpublished thesis. University of Oklahoma, 1929.

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ited from the surrounding prairie. It is covered with a heavy stand of hairy running water ferns (*Marsilea vestita*), with a few plants of joint weed (*Polygonum douglasii*) and short-capsuled primrose (*Oenothera triloba*). a sedge (*Stenophyllus*) was peculiar to the prairie rim of the wallow.

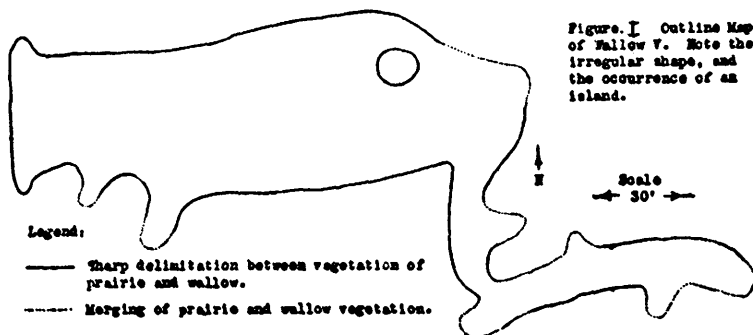
**WALLOW III:** Size 16 by 16 feet, round; depth 11 inches; 3 per cent soil moisture (June 20); 6.5 per cent humus. Surface soil very black, merging at 5 inches into reddish black soil. Below 10½ inches very gummy red subsoil was encountered. Nut grass (*Cyperus*) and running water fern (*Marsilea vestita*), in a sparse stand, were peculiar to the wallow. A sedge (*Stenophyllus*) was in the wallow and on the prairie near the rim, as was grama grass (*Bouteloua*). (In a nearby wallow, similar except much larger and more irregular, short blue stem (*Andropogon scoparius*) is conspicuous, although, due to overgrazing, it is rare in the rest of the prairie.)

The prairie northeast of Norman is rolling, with tops of the hills rather flat. The soil is quite fertile. The flora of this station is almost identical with that of Johnson's pasture, although there is a much heavier growth of buffalo grass here and the ground is thoroughly covered with vegetation. The wallows in this region were all either conical floored or very irregular in outline.

Two wallows were selected as typical of these types.

**WALLOW IV:** Size 16 by 16 feet; depth 12 inches; outline round; floor conical. Surface soil rich, merging at 8 inches with the brownish clay layer which underlies the rest of the prairie. Several *Marsilea vestita*, and *Oenothera triloba* plants were growing in the wallow. *Isoetes melanopoda* was relatively abundant. Colonies of *Nostoc* were liberally placed on the floor. The most abundant plant is a sedge (species undetermined).

**WALLOW V:** Size approximately 210 by 60 feet; more or less rectangular in outline, with several short arms and one long one. No de-



tailed description of the soil has been attempted due to its variation from place to place in the wallow. In the arms the prairie plants have been almost exterminated, so that their floor which is only a few inches below the surrounding prairie, is sparsely populated with prairie species mingling with a generous stand of sedge\*, with occasional plants of *Oenothera atriloba*, *Marsilea vestita*, and *Isoetes melanopoda*. The floor of the wallow proper is sharply delimited from the surrounding prairie, and typical prairie species are lacking there. A sedge (*Eleocharis*) is the predominating species, with another sedge\* which forms a very heavy mat on the floor of the wallow. *Isoetes* occurs at the water-line (when water is standing

\*This is the same sedge as was found in Wallow IV. It has not been identified.

in the wallow), while *Marsilea* is well represented in the floor of the wallow. The "island," which stands about 12 inches above the floor of the wallow, is covered with a dense vegetation rather typical of the surrounding prairie.

The location of wallows on hilltops seems to result from the chance location of the cattle herds when they resort to dirt pawing in a fight against insects, and is not due to a geological formation, as cross sections showed that the subsoil was practically level with that of the surrounding prairie.

At their first appearance, the wallows studied are almost the same level as the prairie. The typical prairie vegetation is gradually trampled and cut by the cattle's hoofs until a denuded spot results. A depression soon appears as the loosened dirt, thrown into the air in the cattle's fight against insects, is carried away by the wind. When the depression becomes deep enough to hold water after rains, the trampling and wallowing of the herds puddles the soil, and leads to the formation of a more or less water-impervious layer. Eventually water is retained in the wallows several weeks during the year. At this stage they are usually round and their flat floor, several inches below the level of the prairie, is covered with a mat of *Marsilea* (II) even in the most arid portion of the summer (except where trampled out during the course of the summer by cattle.) As time goes on the level of the bottom tends to become lower and the area increases. At the same time sedges become plentiful (I) and *Marsilea*, while not disappearing, is not the predominant plant in the wallow. Either of two courses seem to follow as the ultimate fate of the wallow. First, it may be abandoned by cattle as a wallow. In which case its floor becomes conical as it gradually fills in (IV) and the prairie vegetation, following a prolonged succession, migrates onto this floor, which by then is very rich, so that one finds a mixed prairie and buffalo wallow flora in old abandoned wallows (III). On the other hand the wallow may become more "popular" with cattle and as a result gradually increases in size, usually irregularly so that long arms spread out. These often merge so that "islands" are formed, and eventually the wallow is drained, by the extension of an arm to the crest of the hill, after which the prairie vegetation migrates into it and mixes with the wallow vegetation. It is interesting to note that as long as the depressions of the wallow last, vegetation that requires better conditions than the prairie offers, is able to persist.

An interesting fact that came to light in this study, is the wide distribution of two seldom reported species of ferns. *Marsilea vestita* Hook. & Grey,\* was found in all wallows studied, while *Isoetes melanopoda* J. Gay., was found in all of the wallows studied northeast of Norman, but in none of those studied in Johnson's pasture. Such water-loving plants are certainly typical of the prairie.

As the title implies, this paper has not attempted a detailed or complete analysis of the vegetation of buffalo wallows. Careful taxonomic and ecological studies of both the micro- and macro- population must be carried on over a considerable area and for a number of years, in order to understand the vegetation of buffalo wallows.

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\*This species was also observed by the authors in wallows in the Wichita National Forest.