

NOTES ON THE SALT MARSH PLANTS OF NORTHERN KANSAS.¹

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All through the central part of Kansas salt marshes and salt springs are quite common, and small salt licks are found in most parts of the state. Perhaps the largest of these marshes is the Big marsh, which stretches along Big Marsh creek from the northwest part of Cloud county through the southwest corner of Republic county, and for several miles into Jewell county. The writer visited this marsh in August 1897 in order to study the vegetation of the region. It is about seven miles long, and varies from a quarter to a mile in width. The marsh proper is a malodorous black bog, and large stretches are absolutely without vegetation. In the lower part of the marsh, in Cloud county, where the main observations were made, it is over a mile wide and there are places where one may walk for half a mile without finding a shoot of any kind. The salt, at a distance, looks like a light covering of snow. Although the weather had been very dry for a long time before my visit, a small stream of water was flowing through the shallow bed of the creek, and the surface of the marsh was quite moist and even muddy in places, being springy under foot. A beautiful mirage appeared in the distance over the marsh, which looked like a most inviting lake of pure water with green patches of vegetation. So complete was the resemblance that it was very difficult to believe that the phantom lake was not real water.

In Big marsh the conditions are still quite natural, large areas having never yet been fenced. However, it is said that the saline area has diminished much since the settlement of the country. The most striking feature is the utter barrenness of the district when compared with the surrounding country, and the

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absence of belts of trees and shrubs along the banks of the creek. The only woody plant seen growing on the outside of the marsh was *Amorpha fruticosa* L. Along the stream which flows through the marsh there are here and there patches of deposits somewhat raised above the general level and rather free from salt. These contain some plants which could not otherwise grow in the marsh. There are also sedges growing along the stream, and its muddy bottom is covered with a brown deposit of diatoms. The greater part of the marsh proper is entirely barren, but in some places there are isolated patches of salt marsh plants. On the outer portion beyond the barren area, there are often well marked zones of vegetation, especially where the ground rises gently from the marsh. Here the zones are very distinct, while in other places they may be crowded close together, and some zones may be omitted entirely.

The three sedges which grow in and along the stream are *Scirpus pungens* Vahl., *S. campestris* Britton, and *S. lacustris* L.

In the higher patches of alluvial deposit along the stream the following plants were collected: *Distichlis maritima* Raf., *Panicum Crus-galli* L., *Elymus Virginicus* L., *Spartina cynosuroides* Willd., *Rumex Britannica* L., *Polygonum Hydropiper* L., *P. Persicaria* L., *P. ramosissimum* Michx., *Amarantus chlorostachys* Willd., *Iva ciliata* Willd.

In the barren portion away from the stream, where the ground is a little higher and less salty, there were patches of *Polygonum ramosissimum* Michx. and *Distichlis maritima* Raf., or often both these plants were growing together, the *Polygonum* usually occupying the center, and the *Distichlis* forming a border around it.

On the outer margin of the barren area, where there was a gentle rise of the ground from the marsh outward, the following seven zones were determined.

FIRST ZONE: A few yards wide and composed entirely of *Distichlis maritima* Raf. On the inner side the grass was evidently having a hard struggle for a meager existence, and was mostly dead.

SECOND ZONE: A narrow strip a few yards wide composed of *Distichlis maritima* Raf., *Polygonum ramosissimum* Michx., and *Suaeda diffusa* Watson. The *Polygonum* grows vigorously and forms the characteristic plant. This zone seems to be just above the outer limit of the ordinary inundations of the salt brine. *Distichlis* was abundant, but *Suaeda* was only thinly interspersed, and there were many dead and dry specimens.

THIRD ZONE: This is a wide dry zone, with the following plants: *Distichlis maritima* Raf., characteristic and rather stunted in its growth; *Polygonum ramosissimum* Michx., quite rare, probably because of dryness; *Suaeda diffusa* Watson, interspersed, quite common; *Iva ciliata* Willd., rare.

FOURTH ZONE: Usually about as wide as the last, and with the following plants: *Distichlis maritima* Raf., characteristic; *Polygonum ramosissimum* Michx., not very common; *Suaeda diffusa* Watson, occasional; *Iva ciliata* Willd., not very common; *Sporobolus heterolepis* Gray, characteristic; *S. Texanus* Vasey, abundant in some places; *Atriplex expansa* Watson, rare; *Aster multiflorus* Ait., occasional.

FIFTH ZONE: A rather wide zone in which plants less characteristic of halophyte regions are trying to gain a foothold. *Iva ciliata* Willd. is the prominent plant of this zone. The following plants were collected: *Distichlis maritima* Raf., abundant; *Polygonum ramosissimum* Michx., not common; *Iva ciliata* Willd., characteristic; *Sporobolus heterolepis* Gray, common; *Sporobolus Texanus* Vasey, in some places; *Atriplex expansa* Watson, occasional; *Aster multiflorus* Ait., occasional; *Scirpus pungens* Vahl., common; *Hordeum jubatum* L., occasional; *Panicum virgatum* L., sometimes in patches; *Gaura parviflora* Dougl., occasional; *Ambrosia psilostachya* DC., rare.

SIXTH ZONE: The outer margin of the salt marsh proper, usually accompanied by a rise in the ground. Much like the fifth zone except that here *Ambrosia psilostachya* DC. is abundant, and gives the character instead of *Iva ciliata* Willd. The following plants were collected: *Distichlis maritima* Raf., *Polygonum*

ramosissimum Michx., *Iva ciliata* Willd., *Sporobolus heterolepis* Gray, *Hordeum jubatum* L., *Scirpus pungens* Vahl., *Panicum virgatum* L., *Gaura parviflora* Dougl., *Ambrosia psilostachya* DC. (abundant), *Glycyrrhiza lepidota* Nutt.

SEVENTH ZONE: The transition zone on the outer margin of the salt marsh proper where, beside occasional representatives of most of the plants found in the inner zones, the following plants are present: *Iva ciliata* Willd., *Sporobolus heterolepis* Gray, *Panicum virgatum* L., *Gaura parviflora* Dougl., *Ambrosia psilostachya* DC., *Glycyrrhiza lepidota* Nutt., *Aster multiflorus* Ait., *Helianthus annuus* L., *Erigeron Canadensis* L., *Xanthium strumarium* L., *Grindelia squarrosa* Dunal, *Desmanthus brachylobus* Benth., *Amorpha fruticosa* L., *Cenothera biennis* L., *Physalis lanceolata* Michx., *Euphorbia glyptosperma* Engelm., *Euphorbia marginata* Pursh, *Amarantus blitoides* Watson, *Elymus Virginicus* L., *Spartina cynosuroides* Willd., *Scirpus pungens* Vahl.

THE SEAPO, OR TUTHILL'S MARSH.

About eighteen miles east, and a little north of Big marsh, in the southeast part of Republic county, there is a salt marsh, on Little Marsh creek, which is commonly called Tuthill's marsh. This was visited the last of August 1897. It has suffered much from the cultivated soil on the high ground around it. Its margin is very irregular, both as to surface and vegetation. At present it is fenced and in pasture, and, although there are several hundred acres still without vegetation, it is much smaller than formerly and natural conditions are much disturbed. There are many irregular barren spots along the border, and no well marked zones as in the Big marsh.

In the stream flowing through the marsh diatoms were very abundant, but none of the green algæ common to the region were found. Along the stream *Scirpus campestris* Britton and *S. pungens* Vahl. were present, but *S. lacustris* L. was not seen.

On patches of overflow deposit were found *Distichlis maritima* Raf., *Polygonum ramosissimum* Michx., *P. Persicaria* L., *P. Hydro-*

piper L., *Amarantus chlorostachys* Willd., *Panicum Crus-galli* L., *Xanthium strumarium* L., and a single small willow, probably *Salix nigra* Marsh.

In isolated patches along the margin of the barren portion *Distichlis maritima* Raf., *Polygonum ramosissimum* Michx., and *Suaeda diffusa* Watson, are usually the only plants present, but in some places *Hordeum jubatum* L. and *Sporobolus Texanus* Vasey come close to the border of the main barren. A little farther out *Iva ciliata* Willd. and *Atriplex expansa* Watson are common. Irregular patches, more or less inclosed by barren ground, contain *Distichlis maritima* Raf., *Polygonum ramosissimum* Michx., *Suaeda diffusa* Watson, *Atriplex expansa* Watson, *Polygonum Hydro-piper* L., *Solanum rostratum* Dunal, *Hordeum jubatum* L., and *Sporobolus Texanus* Vasey. In the next zone *Aster multiflorus* Ait. and *Ambrosia psilostachya* DC. are added.

In the south end of the marsh, where there seemed to be much overflow deposit, although the greater part was still quite salty, the following plants were found: *Helianthus annuus* L., *Ambrosia psilostachya* DC., *Euphorbia marginata* Pursh., *Polygonum ramosissimum* Michx., *Iva ciliata* Willd., *Suaeda diffusa* Watson, *Ambrosia trifida* L., *Polygonum Persicaria* L., and *Datura Stramonium* L.

Euphorbia marginata Pursh, *Datura Stramonium* L., and *Chenopodium hybridum* L. were found as perfectly isolated plants in the barren portion.

In the outer part of the marsh much the same vegetation is present as in the Big marsh. *Solidago Canadensis* L., *Iva ciliata* Willd., *Ambrosia psilostachya* DC., *Helianthus annuus* L., *Atriplex expansa* Watson, *Hordeum jubatum* L., *Sporobolus Texanus* Vasey, and *Sporobolus heterolepis* Gray are the plants characteristic of the transition zone.

SUMMARY.

1. The salt marshes of northern Kansas are characterized by large areas absolutely destitute of vegetation; by the paucity of species around their margins; and by the entire absence of all woody plants.

2. The vegetation of the streams flowing through them consists of diatoms and the three sedges, *Scirpus pungens* Vahl., *S. campestris* Britton, and *S. lacustris* L.

3. The three characteristic plants in and about the barren portion are *Distichlis maritima* Raf., *Polygonum ramosissimum* Michx., and *Suaeda diffusa* Watson, of which the *Suaeda* is by far the least abundant.

4. The plants which may be regarded as successful invaders are the following: *Iva ciliata* Willd., *Sporobolus heterolepis* Gray, *Sporobolus Texanus* Vasey, *Atriplex expansa* Watson, *Aster multiflorus* Ait., *Ambrosia psilostachya* DC., and *Hordeum jubatum* L. *Sporobolus Texanus* Vasey has never been reported, I believe, beyond the southern part of Kansas. Its abundance in the northern tier of counties of Kansas extends its northern limit nearly two hundred miles.

5. Among the less successful invaders which are quite common are the following: *Panicum Crus-galli* L., *Panicum virgatum* L., *Euphorbia marginata* Pursh, *Euphorbia glyptosperma* Engel., *Chenopodium hybridum* L., *Polygonum Persicaria* L., *Polygonum Hydropiper* L., *Amarantus chlorostachys* Willd., *Datura Stramonium* L., *Solanum rostratum* Dunal, *Xanthium strumarium* L., *Helianthus annuus* L., *Oenothera biennis* L., *Gaura parviflora* Dougl., *Elymus Virginicus* L., and *Spartina cynosuroides* Willd.

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