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PIONEER PLANTS ON A NEW LEVEE.—IV.

FRANK E. A. THONE.

The present paper is the fourth of a series of brief notes on succession in the vegetation invading the slopes of a new levee in Des Moines, first populated with plants in the spring of 1914.¹ The first three papers recorded the events of the first three seasons, the present will note very briefly the conditions during the fourth.

The record of the first season noted the presence of the pigweed, *Amaranthus retroflexus*, as the dominant plant over the greater part of the area in question, with the exception of certain arid sand-heaps on the opposite side of the river, on which practically nothing grew. During the second season, it was noted that the position of the pigweed was completely usurped by the goosefoot, *Chenopodium album*, and that the tall ragweed, *Ambrosia trifida*, was invading the levee from its originally restricted area at the eastern end of the levee. During the third season the *Chenopodium* in its turn gave way to the wild lettuce, *Lactuca scariola*.

During these seasons also there were changes in the terrain itself. The river, tearing through its new and narrow channel at high water, was eating a wider course for itself, so that by the end of the third season the sand heaps originally noted on the opposite shore had almost wholly disappeared, as had also part of the upper, or southwestern, end of the levee, necessitating certain regrading operations there. In addition the flat ground between the base of the main part of the levee and the lip of the channel was largely engulfed, together with a small part of the main embankment itself.

The high water preceding the season of 1917 was especially severe, and the erosion was correspondingly great, so that the river carried away not only the last vestige of the sand heaps mentioned above, and a great part of the southwestern end of the levee, but a great portion of the main embankment itself. The remaining portion was regraded and in many places filled in with entirely new material, so that as a matter of fact the vegetation of 1917 can not really be said to represent at all a true stage in the succession described in previous papers, but

rather the beginning of a new succession resulting from the break-up of an old one.

It might be interesting to follow the fortunes of this new succession, but the changed occupation of the writer prevents. Moreover, it is a bit discouraging to trace the changing dynasties in a kingdom where rivals for supremacy are so interested in securing a "place in the sun" that they neglect the important matter of securing a place in the earth, and let the very ground crumble under their feet as they struggle with each other. A few short notes on conditions during the season of 1917 will therefore serve the present purpose, and bring the series to a close.

It was noted above that most of the southwestern end of the levee disappeared and was replaced with new material. This was in part earth, but mostly garbage and manure from the city, and the vegetation here was therefore extraneous and unnatural. Mushrooms were very plentiful, most conspicuous being two or three species of *Coprinus*. In several patches there were thick stands of watermelon seedlings, and elsewhere scattering plants of field corn. The dominant in this "artificial" vegetation was common oats.

In the third paper of this series mention was made of a portion of the levee which was regraded in the spring of 1916, and on which a stand of *Amaranthus retroflexus*, the dominant of the first season, made its appearance again as dominant. During the season of 1917, while the succession was not nearly so sharply marked nor the replacement nearly so complete as was the case with the original cycle, the pigweed was again driven out by its old rival, *Chenopodium album*.

The rest of the levee had been almost completely regraded, and here everything was chaos and anarchy. In only one place was there any trace of the old succession. Here patches of wild lettuce alternated with horseweed, *Erigeron canadensis*, which was evidently in the process of crowding out the lettuce just as the latter had crowded out the goosefoot. The invasion made by the tall ragweed during the earlier seasons was pretty completely wiped out by the grading operations and the weed driven back to its original terrain.

For the rest, the vegetation was rather a hodge-podge, consisting mostly of *Amaranthus retroflexus*, *Chenopodium album* and *Achytion theophrasti*, the plants being mixed together indis-

criminally, with many bare patches of ground in between. Only in a few places were there any foci of possible new formations, these mostly grasses. In one such spot *Panicum Scribnerianum* was the dominant, in another, *Panicum dichotomiflorum*, in a third, *Ambrosia artemisaefolia*. An occasional thornapple, *Datura stramonium*, made itself conspicuous.

Thus in downfall and crumbling ruin ends the age of the weeds. They were given a little corner of the earth to possess, and they failed to hold it, even for themselves. Men will build a new embankment, and will cover it with grass or some other serviceable plant. It would seem that in any place such as this, where a tenacious root is required as well as a braggart top, organisms dedicated to the survival-struggle as frankly as are the actors in the little drama we have been watching, are after all not fitted to survive.

Following is a list of species noted during the season of 1917. Those marked with an asterisk are species which were noted during the first season and which have survived throughout.

<i>Zea mais</i>	<i>Trifolium repens</i>
<i>Panicum Scribnerianum</i>	<i>Trifolium hybridum</i>
<i>Panicum capillare</i>	<i>Melilotus alba*</i>
<i>Panicum dichotomiflorum</i>	<i>Phaseolus sp.</i>
<i>Echinochloa crus-galli</i>	<i>Vitis vulpinus*</i>
<i>Setaria glauca*</i>	<i>Abutilon theophrasti*</i>
<i>Muhlenbergia mexicana</i>	<i>Ipomoea purpurea*</i>
<i>Avena sativa</i>	<i>Convolvulus arvensis*</i>
<i>Poa pratensis*</i>	<i>Verbena stricta*</i>
<i>Carex sp.*</i>	<i>Lycopersicum esculentum</i>
<i>Salix sp.*</i>	<i>Datura stramonium*</i>
<i>Populus deltoides*</i>	<i>Plantago major*</i>
<i>Cannabis sativa*</i>	<i>Citrullus vulgaris</i>
<i>Humulus Lupulus</i>	<i>Solidago serotina*</i>
<i>Rumex crispus*</i>	<i>Aster salicifolius*</i>
<i>Polygonum pennsylvanicum*</i>	<i>Erigeron canadensis</i>
<i>Chenopodium album*</i>	<i>Ambrosia trifida*</i>
<i>Salsola tenuifolia</i>	<i>Ambrosia artemisaefolia*</i>
<i>Amaranthus retroflexus*</i>	<i>Xanthium commune*</i>
<i>Amaranthus blitoides*</i>	<i>Helianthus annuus*</i>
<i>Stellaris media*</i>	<i>Helianthus tuberosus*</i>
<i>Lepidium virginicum*</i>	<i>Bidens sp.</i>
<i>Brassica nigra*</i>	<i>Arctium minus*</i>
<i>Brassica oleracea</i>	<i>Lactuca scariola.</i>
<i>Trifolium pratense*</i>	