Proceedings of the Iowa Academy of Science

Volume 43 | Annual Issue Article 138

1936

A Study of Drouth Recovery, and Seasonal Succession in a Pond (Preliminary Study)

Malcolm McDonald
Parsons College

A STUDY OF DROUTH RECOVERY, AND SEASONAL SUCCESSION IN A POND (PRELIMINARY STUDY)

MALCOLM MCDONALD

A study was made comparing the fauna and flora of a southeastern Iowa pond during the years 1933 to 1935, inclusive; that is during a complete cycle from conditions of abundance of rain and ground water to a very arid condition of drouth and then back again. With this was combined a study of the development and change in fauna during the period from March to June, 1935.

The pond which forms the basis for this study is one of three shallow ponds found in the flood plain of Cedar Creek about three miles southwest of Fairfield, Iowa. The soil forming the beds for these ponds is a silt loam typical of the Cedar River bottom land in Jefferson County. The habitat where the three ponds occur is known locally as Fulton's Bottomland, Fig. 1. This area is about one-half mile in width and one mile in length and is typical marshland. For convenience the pond studied has been designated the North pond because of its location with respect to the other two. When full it is the largest pond of the group, measuring approximately seventy yards in length.

In 1933 when the writer began collecting plants for the Parsons College Herbarium he first began an investigation of the animal and plant life in this marsh. After the severe drouth of the summer of 1934 it was thought that a close study of the seasonal succession of biota in the North Pond might reveal some interesting facts. This was done in the spring of 1935 as a special project in Ecology. From the first melting of the snow in March until June the pond was visited every one or two weeks and seined carefully for both large and small animals. Notes were taken on the abundance and condition of the plants and animals.

The dominant plants of the marsh are slough grass and Canada blue-stem (*Spartina pectinata* and *Calamagrostis canadensis*), with tall bluestem (*Andropogon furcatus*) in the drier portions. It abounds in other prairie plants such as prairie violet (*Viola pedatifida*), wild indigo (*Baptisia leucantha*), rattlesnake master (*Eryngium yuccifolium*), wormwood (*Artemisia serrata*), the mountain mints (*Pycnanthemum*), lead plant (*Amorpha fruticosa*), closed gentian (*Gentiana Andrewsii*), and balsam groundsel

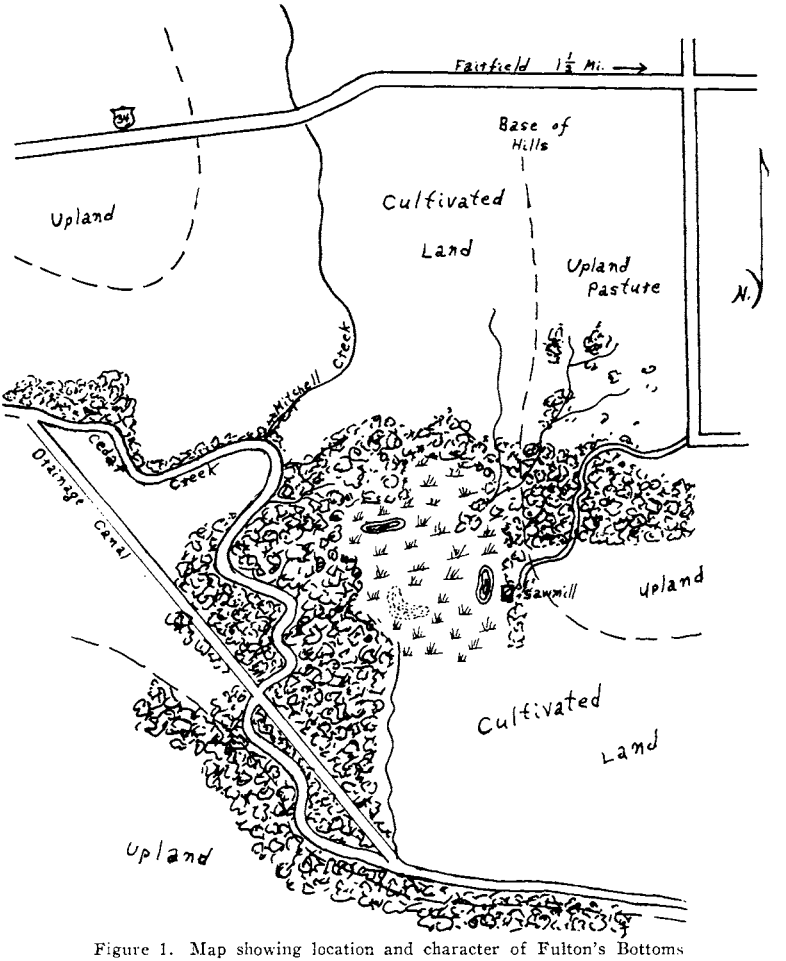


Figure 1. Map showing location and character of Fulton's Bottoms

(*Senecio balsamitae*). Altogether the writer has recorded about two hundred and fifty species of plants in this marsh. It is being invaded by forest; on the west and northwest by the pin oak-swamp white oak- shellbark hickory (*Quercus palustris, Q. bicolor, Carya laciniosa*) bottom forest, and on the northeast by the white oak-bur oak- shagbark hickory (*Q. alba, Q. macrocarpa, C. ovata*) upland forest. Hawthornes and honey locusts form the outposts for both invading forests. Unfortunately many of the best trees in the bottom forest are being removed at the present time for milling purposes.

The three ponds in this marsh each present a few peculiarities. Each has a few plants in it which are not found in the other two.

The north pond has the most peculiarities and the richest development. This pond is tremendously rich in both plant and animal life and is one of the most interesting natural ponds in Jefferson County.

During favorable seasons the plants of the north pond presented a perfect and complete zonation from the open water in the center to dry land around it. Toward the center were great mats of the blue-flowered pickerel weed, its glossy thick leaves rising out of the water. Farther in, masses of narrow-leaved *Sagittaria* flourished; then came zones of floating manna-grass, great bur-reed, sedges and bulrushes, water smartweed, *Boltonia*, and broad-leaved arrowhead. These bands were narrow and telescoped together in some places, and then at others one or another of the bands broadened out. Clumps of iris and water plantain were scattered around the edge, while in the water was bladderwort, hornwort, a small leaved pondweed, *Chara, Riccia*, and many other aquatic plants. At least three of the plants — *Pontederia cordata, Utricularia vulgaris* var, *americana*, and *Bacopa rotundifolia* are very rare in southeastern Iowa, the author believes.

In the midsummer of 1933 occurred a drouth which seemed severe at the time, although it was only a fore-runner of what was in store. It brought the depth of this pond down to six inches and eliminated the fish and most of the aquatic plants, but the pond soon filled up again, and it was hoped that the pond would be present the next year.

However during the winter the water level fell steadily and rapidly, and when spring came the pond was almost dry. In May there was a small puddle in the center which was filled up solidly with thousands of tiny tadpoles. None of them had any chance of surviving. In June a few tiny shoots of pickerel weed were still showing green, in the midst of a bare, sun-baked, hard, mud flat. The old tubers of pickerel weed crumbled to dust at a pinch. Around the edges fireweed and ragweeds were making their appearance.

In August the pond bed was again patchy with the green of vegetation. Now, however, it was mostly the vegetation of a dry waste ground, where weeds are allowed to flourish. Tall spikes of fireweed were abundant. In among them were a number of other weeds — buffalo bur, horse nettle, ragweeds, pigweeds, burdock, pursley and several smartweeds. Altogether twenty-seven species of plants were listed on this pond bottom, (Table I), only ten of which were even mudbank plants. Only five of them dated

back to the previous condition of the pond. There were even a few oak and elm seedlings. With the exception of the fireweed, practically all these plants were stunted.

Another month of record breaking temperatures and even the weeds were struck down. The pond was now a stretch of bare ground, the surface having been mashed into dust by the hooves of horses. Here and there a stalk of fireweed or smartweed still showed a little green. During the remainder of the year the place presented the same appearance. The weed stalks got browner and became cracked open, and the ground became more and more tracked by horses. Certainly it seemed as if the pond had been extinguished as a haven for rare plants and animals. It was with little expectancy that the writer saw this pond begin to fill up early in 1935 (Fig. 2).

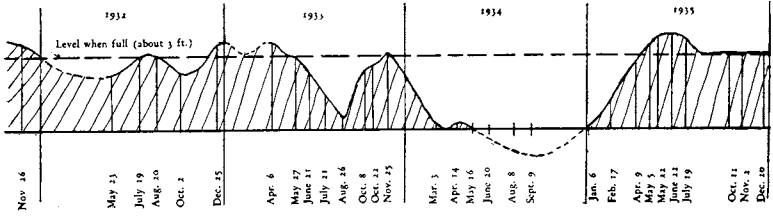


Figure 2. The Changing Water Level of the North Pond, Fulton's Bottom

With the melting of the ice careful observation of the pond was made and as the season progressed it was discovered that one after another the former aquatic plants were reappearing. Then came the others — *Sparganium, Pontederia, Iris,* and *Utricularia.* By the end of the summer only *Bacopa* and *Ceratophyllum* had not appeared (Table I). To take their place was water crowfoot, from one of the other ponds of this swamp, and *Riccia natans* which the writer had never seen here before. It appeared in two other ponds about ten miles away along Cedar Creek at the same time.

Most of these plants came up from seed, and the symmetry and zonation that had been shown before was largely destroyed. The pickerel weed, arrowhead and water plantain were scattered uniformly as isolated plants over the entire pond bottom. The other plants came up more thickly around the edge. Great mats of Algae, mostly *Spirogyra* and *Zygnema,* were very abundant of course. The plants gradually straightened themselves out as the summer went on, and by the end of the summer the pond had regained almost entirely the aspect it had in 1933. It was as if a

Table I. Comparison of Plants of North Pond during Pre-drouth, Drouth, and Post-drouth Periods.

Summer, 1933	Summer, 1934	Summer, 1935
Riccia fluitans	*Eleocharis palustris	Riccia fluitans
Potamogeton dimorphus	*Radicula palustris	*Riccia natans*
Glyceria fluitans	*Ludvigia polycarpa	Potamogeton dimorphus
Alopecurus carolinianus	*Ludvigia palustris	Glyceria fluitans
Eleocharis palustris	*Boltonia asteroides	Alopecurus carolinianus
Scirpus validus	Eragrostis hypnoides	Eleocharis palustris
Carex sp.	Ulmus fulva	Scirpus validus
Sparganium eurycarpum	Quercus rubra	Carex sp.
Iris versicolor	Polygonum lapathifolium	Sparganium eurycarpum
Sagittaria latifolia	Polygonum Persicaria	Iris versicolor
Sagittaria heterophylla	Polygonum acre	Sagittaria latifolia
Alisma Plantago-aquatica	Amaranthus retroflexus	Sagittaria heterophylla
Spirodela polyrhiza	Amaranthus hybridus	Alisma Plantago-aquatica
Lemna minor	Portulacca oleracea	Spirodela polyrhiza
Pontederia cordata	Mollugo verticillata	Lemna minor
Polygonum amphibium	Euphorbia maculata	Pontederia cordata
Ceratophyllum demersum	Euphorbia corollata	Polygonum amphibium
Ludvigia polycarpa	Verbena hastata	Ludvigia polycarpa
Ludvigia palustris	Solanum carolinense	Ludvigia palustris
Radicula palustris	Solanum rostratum	*Ranunculus delphinifolius*
Oxypolis rigidior	Vernonia sp.	Radicula palustris
Utricularia vulgaris	Erechtites hieracifolium	Oxypolis rigidior
Callitriche heterophylla	Bidens sp.	Utricularia vulgaris
Bacopa rotundifolia	Ambrosia trifida	Callitriche heterophylla
Gratiola virginiana	Ambrosia artemisiifolia	Gratiola virginiana
Boltonia asteroides	Arctium minus	Boltonia asteroides
	Cirsium lanceolatum	

* Plants existing in all three periods. *Italicized* aquatic plants are those that only occurred one year.

year of drouth and non-existence as a pond had never occurred. Life simply picked up where it left off before.

To a large extent this was true of the animal life as well, although previous knowledge of it was somewhat fragmentary. Out of a list of fifty-three animals the writer had noticed living in it before, all but six reappeared. These were *Ondatra, Chelydra, Ancylus, Sphaerium, Chlorohydra,* and *Dero.* Closer examination in the late summer may have shown that two or three of these were

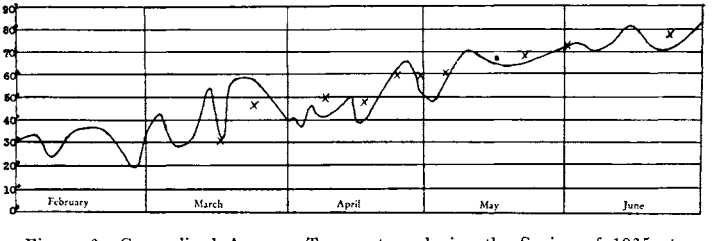
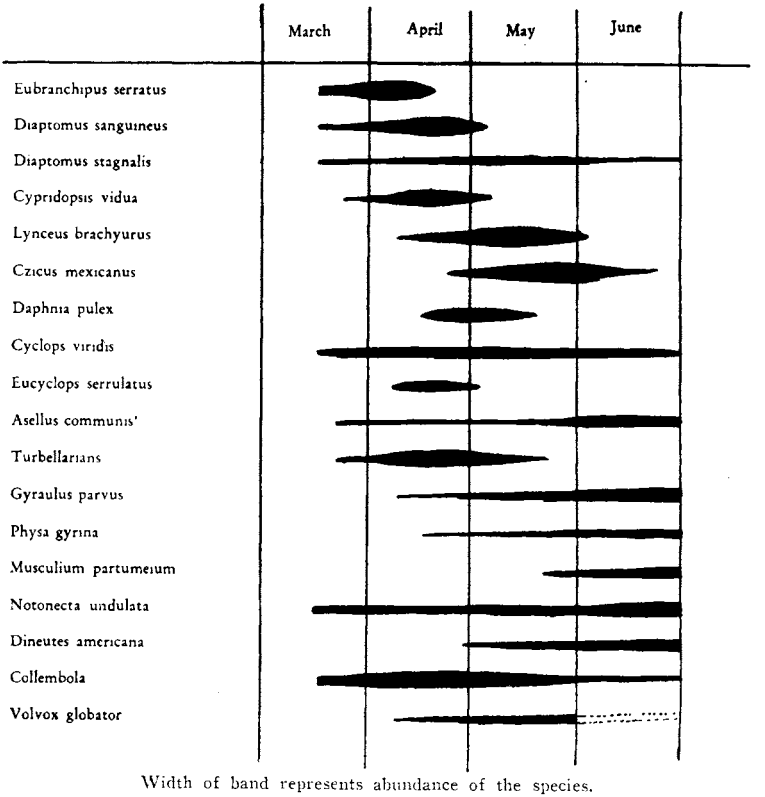


Figure 3. Generalized Average Temperature during the Spring of 1935 at Fairfield, Iowa. (Fahrenheit) — X - Temperature of water on days when collections were made.

present also. Three of the six were replaced by forms very closely related to them.

March 17, 1935 the pond was already swarming with animal life, although the temperature of the water was just barely above freezing. Small half-grown fairly shrimps, the first of the seasonal dominants, were already present in numbers. They grew rapidly, laid eggs, then all died. By that time several other Entomostracans had developed to take their place. There was a whole series of these, including *Diaptomus, Czicus*, and *Eucyclops*. (Table II). In the following November and December and in January this year, fairy shrimp were observed in the pond.

Table II. Comparative Abundance and Change in Numbers of Some Representative Animals in North Pond, Fulton's Bottomland, 1935.



Width of band represents abundance of the species.

It was discovered that there was quite a variety of vertebrate life. On March 17 there were a great many tree toads calling around the edge. Altogether the writer found eight species of

amphibians — three salamanders and five frogs and toads. The tadpoles of these could not be separated, except as they developed into the adults which occurred at different times. In 1933 a snapping turtle was seen here, but this year instead several specimens of Bell's terrapin were observed. The first of June a number of tiny sunfish were caught. Their size indicated that they were of recent appearance, but their presence was unexplainable. Late in the month Cedar Creek overflowed and added considerably to the fish population. One of the other ponds showed carp and bullheads at this time as well as sunfish.

Of the birds, eighteen species were observed in contact with the water. This included both those that swam or waded in the water, and those like the swallows that merely dipped down for a drink or an insect. Probably there were other birds, and also some mammals, that came down to the water to drink or feed, but none were seen except for a group of horses. These were accustomed to come down every day, paw up the bottom, and roll around in the water. By their actions in stirring up the mud they considerably deepened the central part, which had become very shallow during the drouth.

A great many miscellaneous animals appeared as the season progressed, (Table III). In this table are listed the majority of the animals that were found. The identifications were made entirely by the writer, with the exception of the insects. Many of these animals such as the snails, hibernated over the dry spell in the ground. Others, as the insects and vertebrates, came in under their own power. A few, such as some leeches which came in on turtles, were carried in by other animals. The occurrence of a few, the first fish for example, was not accounted for. From a study of Table II and III it may be seen that the earliest invertebrates to return after the drouth and winter were of two types; insects such as Collembola, Hydrophilidae, *Corixa verticalis*, and *Notonecta undulata* which occur throughout the four months, and Entomostraca, such as *Eubranchipus serratus, Diaptomus vidua* and Turbellarians which are temporary seasonals.

In conclusion, it may be said that the drouth of 1934 had little permanent effect upon the North Pond of Fulton's Bottomland.

The writer wishes to acknowledge his thanks to Professor Carter and Professor Dolley of Parsons College for much counsel and suggestions, and to Professor Jacques of Iowa Wesleyan College for his identification of the insects collected.

Table III. Animals of North Pond, Fulton's Bottomland, Spring of 1935.

	MAR		APRIL				MAY		JUNE	
	17	24	9	17	23	30	5	22	1	22
Volvox globator			X	X	X	X	X	X		
Pelmatohydra oligactis										
Stenostemum grande				X	X	X	X			
Dalyellia dodgei		X	X	X	X	X				
Conochilus hippocrepis				X	X	X				
Sinantherina socialis					X					
Lepidoderma squamata					X					
Chaetonotus brevispinosus				X	X					
Plumatella punctata						X			X	X
Chaetogaster limnaei						X	X			
Limnodrilus claparedianus				X	X	X		X	X	X
Placobdella parasitica									X	
Herpobdella fervida										X
Gyraulus parvus			X	X	X	X	X	X	X	X
Menetus exacuous					X	X	X			
Helisoma trivolvis						X				
Physa gyrina				X	X			X	X	X
Musculium partumeium								X	X	X
Aplexa hypnorum										
Lymnaea megasoma							X	X		
Physa heterostropha				X	X					
Deroceras gracile				X						
Eubranchipus serratus	X	X	X	X	X					
Lynceus brachyurus			X	X	X	X	X	X	X	
Lynceus mucronatus						X				
Czicus mexicanus					X	X	X	X	X	X
Pseudosida bidentata						X				
Daphnia pulex				X	X	X	X	X		
Daphnia pulex var. obtusa			X	X	X	X				
Daphnia longispina						X				
Simocephalus serrulatus			X	X	X	X				
Eurycerus lamellatus						X				
Ceriodaphnia megalops						X				
Diaptomus stagnalis		X	X	X	X	X	X			
Diaptomus sanguineus	X	X	X	X	X	X	X			
Cyclops viridis	X	X	X	X	X	X	X	X	X	X
Eucyclops serrulatus			X	X	X	X				
Canthocamptus northumbricus			X	X	X	X		X	X	X
Eucypris virens			X	X	X	X				
Cypridopsis vidua	X	X	X	X	X	X	X	X	X	X
Asellus communis		X	X	X	X	X	X	X	X	X
Cambarus diogenes				X	X	X	X	X	X	
Gammarus fasciatus		X	X	X						
Notaspis		X		X	X	X				
Hydracarina					X	X	X			
Arachnida	X	X	X	X	X	X	X	X	X	X
Chrysops sp. (larvae)					X		X	X		
Phryganea sp. (larvae)	X	X		X						
Dytiscus fasciventrus				X	X					
Agabus taeniolatus		X	X							
Dytiscidae					X	X	X	X	X	X

	MAR		APRIL				MAY		JUNE	
	17	24	9	17	23	30	5	22	1	22
Dytiscidae larvae			X	X	X	X	X	X	X	X
Peltodytes pedunculatus		X	X	X	X	X	X	X	X	X
Haliplus										
Dineutes americanus						X		X	X	X
Gyrinidae										X
Hydrous triangularis								X		
Hydrophilus obtusatus	X									
Hydrophilidae	X	X	X	X	X	X	X	X	X	X
Dytiscidae			X			X				
Hydrophilidae								X		
Hydrophilidae					X	X	X	X	X	X
Hydrophilidae larvae						X	X	X	X	X
Belostoma fluminea								X		X
Buenoa margaritacea					X	X	X		X	
Corixa verticalis	X	X	X	X	X	X	X	X	X	X
Corixidae	X	X	X				X			X
Gerris marginatus	X	X	X	X	X	X	X	X	X	X
Notonecta undulata	X	X	X	X	X	X	X	X	X	X
Hydrometra								X		X
Collembola	X	X	X	X	X	X	X	X	X	X
Lestes						X		X	X	X
Zygoptera (nymph)						X	X	X	X	X
Anax junius						X		X		X
Anisoptera (nymph)									X	X
Chironomidae (larvae)			X	X	X	X	X	X	X	X
Diptera adults	X	X	X	X	X	X	X	X	X	X
Culicidae			X	X	X	X	X	X	X	X
Ephemeridae								X		X
Salamander eggs	X	X	X	X						
Rana pipiens		X	X		X	X		X		
Hyla crucifer	X	X	X	X	X	X	X	X		X
Triturus viridescens		X		X	X					
Cricket frog eggs.		X	X		X					
Rana eggs		X	X			X				
Pseudacris triseriatus						X	X		X	X
Acris gryllus						X	X	X	X	X
Hyla versicolor					X			X		
Ambystoma tigrinum							X			
Ambystoma jeffersonianum										X
Lepomis humilis										X
Chrysemys picta bellii								X		
Rana tadpoles			X	X	X	X	X	X	X	X
Salamander tadpoles		X	X	X	X	X	X	X	X	X

BIBLIOGRAPHY

BRITTON, NATHANIEL L. AND BROWN, ADDISON — Illustrated Flora of the Northern United States, Canada and the British Possessions. Vols. 1-3. Charles Scribner's Sons, New York, 1898.

COMSTOCK, JOHN HENRY AND ANNA BOTSFORD — A manual for the Study of Insects. Comstock Publishing Co., Ithaca, New York, 1897.

MORGAN, ANN HAVEN — Field Book of Ponds and Streams. G. P. Putnam's Sons, New York and London, 1930.

NEEDHAM, JAMES G. AND LLOYD, J. T. — The Life of Inland Waters-Comstock Publishing Co., Ithaca, New York, 1916.

PRATT, HENRY SHERRING — A Manual of the Common Invertebrate Animals Revised Edition. P. Blakiston's Son and Co., Philadelphia, 1935.

PRATT, HENRY SHERRING — A Manual of Land and Freshwater Vertebrate Animals of the United States. Second Edition. P. Blakiston's Son and Co., Philadelphia, 1935.

ROBINSON, BENJAMIN LINCOLN AND FERNALD LYNDON — Gray's New Manual of Botany. Seventh Edition. American Book Co., New York, Cincinnati, and Chicago, 1908. 926 pp.

WARD, HENRY BALDWIN AND WHIPPLE, GEORGE CHANDLER. Fresh Water Biolgy. John Wiley and Sons, New York, 1918.

LUTZ, FRANK E. — Field Book of Insects. Second Edition. G. P. Putnam's Sons, New York and London, 1931. 562 + iv pp.

DEPARTMENT OF BIOLOGY,
PARSONS COLLEGE,
FAIRFIELD, IOWA.

