A FLORISTIC SURVEY OF ORCHARD ISLAND.*

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In the development of a floristic survey of Buckeye Lake, it has been found advantageous to study in detail the flora, on an ecological basis, of certain typical areas. The banks of the lake are in large part artificial; marshes which have formed in shallow water have been destroyed through dredging, and the earth has been walled up with wood, stone and concrete. These alterations have entirely destroyed the former natural succession of plants, as they have suddenly introduced new edaphic conditions which give rise to new biotic relations. The building of docks and cottages has also largely interfered with the former vegetation. Other areas not thus disturbed remain in much the same condition as that which developed with the formation of the lake.

Orchard or Well's Island is a good example of an undisturbed area and also of one in which changes have taken place. It is one of a group of four wooded islands situated in the southwest portion of the old reservoir and close to the south shore. These islands were elevations in the Big Swamp of which Buckeye Lake is the successor, and were high enough to escape inundation, when the swamp was converted into the reservoir in 1832, and later, when the addition of the new reservoir, in 1836, occasioned the raising of the water level an additional four feet. The highest portions of these islands remain above water at the standard or high water level, which is twenty-three inches above the normal. They bear large forest trees, some of which are twenty-eight inches in diameter.

Orchard island is the largest of these. It has an area of 2.95 acres and is irregular in shape with the longest diameter from the southeast to the northwest. It lies about 200 feet from the south shore of the lake and is connected on the west by a marsh with State Journal Island. The entire surface has been apportioned into lots with an undivided area of common ground at the foot of the public dock, a narrow marginal area, and one in the center of the island. There are now, October, 1910, eight cottages and five docks.

Sixteen years ago Mr. Wells leased the entire island, cleared the center and planted peach trees. His orchard must not have prospered as not one living peach tree remains today. This area is now covered with young forest trees; Ulmus americana, Hicoria minima, H. ovata, Fraxinus nigra, F. americana, Tilia americana, and others

* Contribution from the Botanical Laboratory of Ohio State University, 58.

There is a sparse growth of shrubs, Rubus nigrobaccus, Rhus glabra, R. toxicodendron, Vitis vulpina, etc. The herbage is also poorly developed, it consists of a thin growth of grass and common weeds which have been frequently mowed and in some places burned. A narrow border of larger trees, remnants of the original forest, surrounds this central area. On the south and west this forest border is twenty to thirty feet wide; but to the north and east there is sometimes but a single tree, the lawns extending to the water's edge.

An interrupted zonation of swamp plants occupies the shallow water and the now exposed mud plain surrounding the island. The swamp is well developed on the west, south and southeast, but has been more or less completely cleared away in the vicinity of the docks on the north, northeast and east sides.

This island exhibits a striking example of the invasion of plants into new areas, successful ecesis, the resultant succession, the consequent filling of the lake and the upbuilding of new land areas along the margin; and in the center a secondary succession in a partially denuded area. A detailed floristic study was made of a belt sixty feet broad and extending directly across the island from the southeast to the northwest, from a–a′ to b–b′ on the map. This belt covers a representative area of the island, including a section of the well developed marsh on the southeast, and on the northwest the marsh disturbed and reforming; a section of the older forest zone and of the rejuvenated central area.

There are three distinct formations based on habitat and growth forms:

I. The marsh-herb formation.
II. The swamp-shrub formation.
III. The mesophytic-forest formation.

The first and third formations are well developed, the first exhibits a striking lateral and vertical zonation, the second is so fragmentary that it can scarcely be dignified by the name of formation; but it is of interest as an illustration of the intrusion and development of a zone between two previously existing ones.

I. The marsh-herb formation on the southeast:

1. Nelumbolutea Society.

Facies.

Nelumbo lutea.

Secondary species.

Potamogeton pectinatus.
Potamogeton var.
Ceratophyllum demersum.
Potamogeton natans.
Cladophora sp.
Spirogyra sp.

The society forms a zone 20–40 feet broad. At the outer margin the water is 4–4.5 feet deep at the inner about 8 inches.

In the deeper water it is a pure Nelumbo lutea family; in the shallower, the other plants, especially Potamogeton pectinatus and the variety are quite abundant. There is some evidence of vertical zonation or layering; in the deeper water the Nelumbo leaves float on the surface; and in the shallower rise 12 inches above the surface.

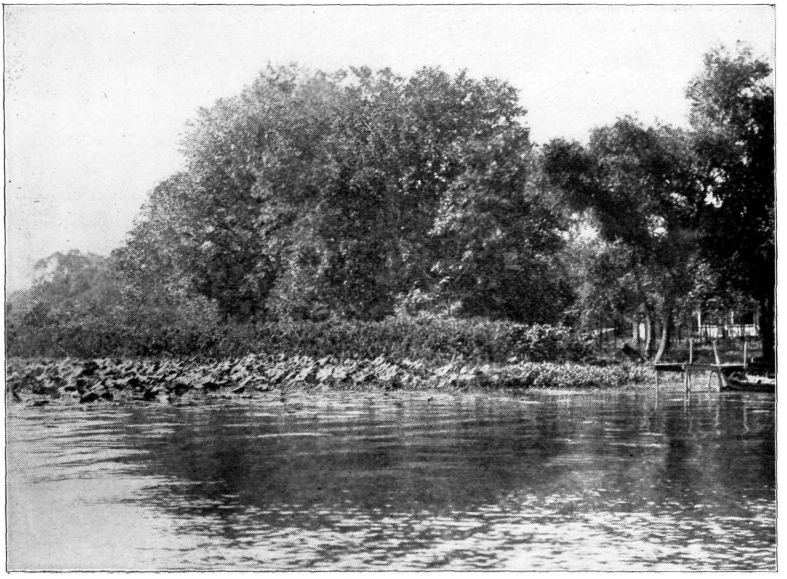


Fig. 1. View of the vegetation from the S. E. side of the island in belt transect a–a′, showing formation I, II and III; and societies 1, 2, 3, 4, 5, 6 and 7 of map.

2. Nelumbo-Polygonum society.

Facies.

Nelumbo lutea.	Polygonum emersum.

Secondary species.

Ceratophyllum demersum.	Brachythecium rivulare.
Spirogyra sp.	Riccia fluitans.
Lemna minor.	Riccia sp.
Cladophora sp.	Ilysanthes gratioloides.
Spirodela polyrhyza.	Sium cicutaefolium.

This society forms a dense zone 60 feet broad, and extends from water 8 inches deep to a wholly emersed surface. 35 feet of the zone covers a mud flat which is submerged at the normal water level. The Polygonum has advanced into the Nelumbo,

forming at the outer margin of the zone as dense a growth as the Nelumbo. Towards the inner margin the Nelumbo is 2 feet tall and fruiting freely.

A short distance west of the belt studied the Polygonum has entirely outdistanced the Nelumbo, replacing society one with a Polygonum zone external to a mixed Polygonum-Nelumbo zone.

Fig. 2. View farther west than Fig. 1. Polygonum emersum forms the outermost zone, then follow zones or societies 2, 3, 4, 5, 6 and 7 of map.

Of the secondary species Brachythecium rivulare is the most abundant, especially on the exposed mud surface, quite large patches of which are covered by a pure growth of the moss. The Riccias are also conspicuous members of the ground cover. The herbs are very sparse.

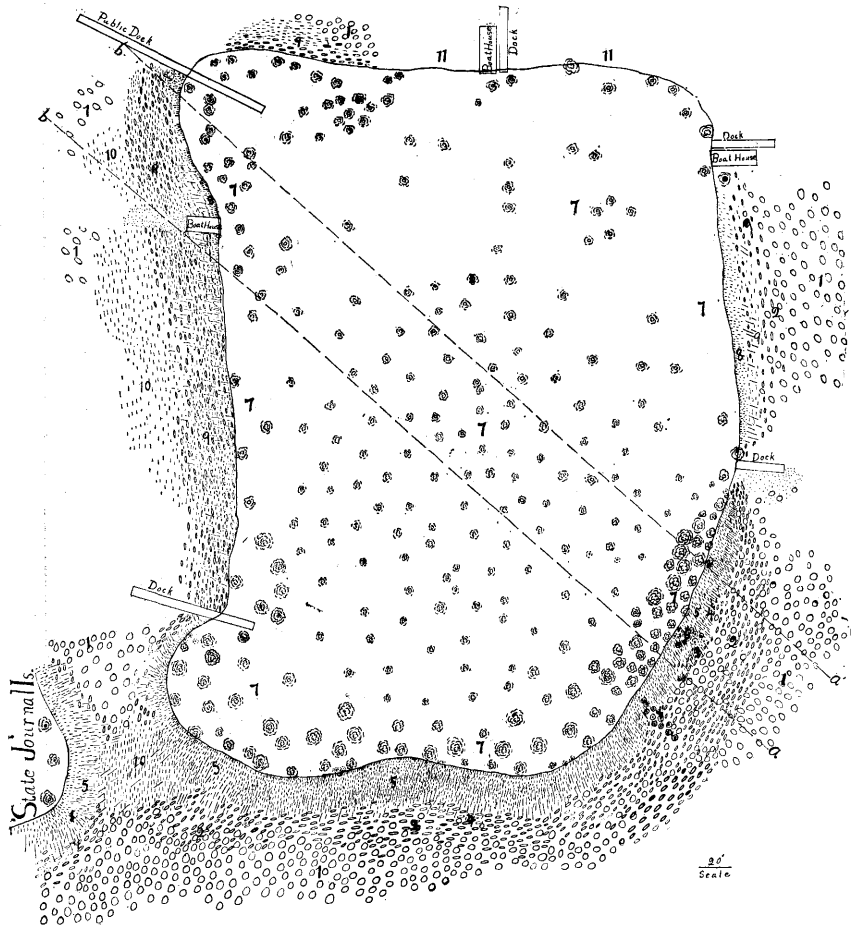
Towards the west of the median line of the belt is

3. A Polygonum-Nelumbo-Typha society.

Facies.

Polygonum emersum. Typha latifolia.
Nelumbo lutea.

OHIO NATURALIST. *Plate XI.*



MAP OF ORCHARD ISLAND.

LEGEND OF PLANT SOCIETIES.

1. Nelumbo society,
2. Polygonum-Nelumbo society,
3. Polygonum-Nelumbo-Typha society,
4. Polygonum-Typha-Bidens society,
5. Hibiscus-Typha society,
6. Shrub society,
7. Forest society,
8. Hibiscus society,
9. Polygonum-Scirpus society,
10. Sedge society,
11. Beach without vegetation.

Secondary species.

Spirodela polyrhyza
Lemna minor.
Cladophora sp.
Ceratophyllum demersum.

The secondary species, which are normally floating plants, are stranded on the mud and form but a thin covering. The society covers a narrow lens shaped area not more than 3 feet in its broadest portion. At the normal water level the surface is submerged, but now it is wholly exposed. The Polygonum is tall and vigorous with branches from 3–4 feet tall; the Nelumbo has large erect leaves and the plants are fruiting freely; the Typha is stunted in growth and sterile, the largest leaves are not more than 4 feet tall.

4. Typha-Polygonum-Bidens society,

Facies.

Typha latifolia.
Polygonum emersum
Bidens cernua.

Secondary species.

Cyperus strigosus.
Eleocharis acicularis.
Riccia fluitans.
Riccia sp.
Spirodela polyrhyza.
Brachythecium rivulare.
Cicuta bulbifera.
Bidens frondosa.
Roripa palustre seedlings.
Hibiscus moscheutos seedlings.
Polygonum emersum seedlings.

Society 4 occupies a narrow zone less than 3 feet in width. The Typha is larger and more vigorous than in 3, but not fruiting; Polygonum emersum is still conspicuous but not nearly so much as in the preceding zone, while the Nelumbo lutea has entirely disappeared and Bidens cernua, represented by a few large vigorous plants, has come in. There are but a few of the taller herbs of the secondary species; but an abundant ground cover of the Cyperus, Riccia and Eleocharis.

This zone merges into:

5. Hibiscus-Typha society.

Facies.

Hibiscus moscheutos
Typha latifolia

Secondary species.

Taller herbs.

Polygonum acre.
Triadenum virginicum.
Scutellaria lateriflora.
Cicuta bulbifera.
Solanum dulcamara.
Echinochloa walteri.
Homalocenchrus oryzoides.
Aster paniculatus.
Erechtites hieracifolia.
Impatiens fulva.
Galium claytoni.
Epilobium stricta.
Boehmeria cylindrica.
Agrimonia sp.
Acnida tamariscina.

Seedling trees.

Acer rubrum.
Gleditsia triacanthos.
Quercus palustris.

Ground cover.

Cyperus strigosus, small mat plants.
Riccia fluitans.
Riccia sp.
Phialea scutula on dead Hibiscus stems.
Spirodela polyrhyza.
Brachythecium rivulare.
Cladophora sp.

This zone is 40 feet wide and the ground surface is entirely above the water, but so recently exposed that the stranded Spirodela and Algae are still green. The Hibiscus roots form small hillocks on which the Spirodela and Algae become stranded and on which the Riccia is very abundant. The taller herbs form a sparse weak growth due to the density of the Hibiscus which forms a 7 foot wall difficult to penetrate. The Typha is confined to the outer portion of the zone and has here obtained optimum conditions of growth, the plants are not copious, but are tall, vigorous and fruiting freely.

II. Swamp-shrub formation.

6. Cornus society.

Facies.

Cornus stolonifera.

Secondary species.

Rosa carolina.
Sambucus canadensis.
Micrampeles lobata.
Polygonum acre.
Erechtites hieracifolia.
Scutellaria lateriflora.
Mentha canadensis.
Hibiscus moscheutos.
Solanum dulcamara.
Homalocenchrus oryzoides.
Galium claytoni.
Carex lupulina.
Convolvulus sepium.
Ulmus americana.

This society consists of nine Cornus stolonifera in the section studied and occupies an area 20 feet broad. About 10 feet to the west is another Cornus stolonifera far down into the Hibiscus-Typha zone; and about 40 feet still farther west is a group of 15–18 feet tall Cephalanthus occidentalis which extends through the Hibiscus zone to the water's edge. Just east of the eastern margin of the transect is another group of Cornus with Sambucus canadensis.

The swamp-shrub formation does not exhibit lateral zonation but alternations as it consists of isolated shrub societies of which Cornus stolonifera is the principal species in one and Cephalanthus occidentalis in another. The associated species are grouped closely around the Cornus, most of the herbs form a sparse growth in the shade of the shrubs and the Micrampeles and Solanum climb over them.

The two bordering formations the marsh-herb on the one side and the forest on the other, merge in the areas between the shrub societies. The presence of seedling Ulmus, Quercus and Gleditsia, in the Hibiscus-Typha society shows clearly that the forest is invading the marsh, and if the higher portion of the mud flat is not again submerged, the shrub zone may never become more complete than it is now; it may be formed farther down on the shore or it may be entirely replaced by the forest. The incompleteness of the shrub zone is due to the existence of the forest prior to the development of the marsh.

III. Mesophytic-forest formation.

7. Ulmus-Fraxinus society.

Facies.

Ulmus americana. Fraxinus americana.

Secondary species.

Trees.

Fraxinus nigra.
Hicoria ovata.
Hicoria minima.
Ulmus fulva.
Quercus palustris.
Celtis occidentalis.
Tilia americana.
Gleditsia triacanthos.
Morus rubra.
Salix nigra.

Lianas.

Rhus toxicodendron.
Vitis vulpina.
Parthenocissus quinquefolia.
Smilax hispida.
Solanum dulcamara.
Dioscorea villosa.

Shrubs.

Cornus stolonifera.
Rubus nigrobaccus.
Rubus occidentalis.
Rosa carolina.
Cephalanthus occidentalis.

Herbs.

Muhlenbergia diffusa.
Agrostis perennans.
Syntherisma sanguinalis.
Syntherisma linearis.
Chaetochloa glauca.
Carex tribuloides.
Carex vulpinoidea.
Carex frankii.
Rynchospora alba.
Solidago canadensis.
Aster paniculatus.
Aster sagittatum.
Nepeta cataria.
Teucrium canadense.
Carduus lanceolatus.
Arctium minus.
Helianthus decapetalus.
Urtica gracillima.
Erigeron canadensis.
Hedeoma puligioides.
Mentha canadensis.
Lycopus americanus.
Oxalis stricta.
Onagra biennis.
Solanum nigrum.
Epilobium strictum.
Verbena urticifolia.
Rumex obtusa.
Geum canadense.
Meibomia viridiflora.
Eupatorium ageratoides.
Eupatorium purpureum.
Bidens bipinnata.

Fungi.

Agaricus campestris. Lycoperdon wrightii.

The forest formation extends across the island from margin to margin and presents two distinct zones: 1. A border zone 20–50 feet wide, consisting in part of large trees, the remnant of the original forest. It is a very open border, not more than three trees deep, the tallest of these trees having attained a height of 60–65 feet. The shrub stratum is very poorly developed. It is represented on the south side by a few Cornus, Rosa and Cephalanthus, at the outer margin of the zone; these are wanting on the north side. The field stratum is composed almost wholly of grasses of which Muhlenbergia diffusa, Agrostis perennans and Syntherisma sanguinalis and linearis are the principal species. Associated with these is a scanty growth of herbs; and on the south side an abundant growth of Rhus toxicodendron, Parthenocissus quinquefolia and Vitis vulpina, trailing over the ground. The Rhus has also climbed two Ulmus americana. The grass and weeds have been mowed, so that the shrubs too are kept in a stunted condition.

Surrounded by the older forest zone lies a rejuvenated area clothed with young forest trees, among which Ulmus Americana predominates, fully nine-tenths of the trees are of this species. This is a part of the area which was cleared sixteen years ago; but the forest has again invaded the area and become established. The ground slopes gently toward the southeast and more abruptly toward the northwest. The elevation of the highest portion is not more than 4 or 5 feet above the standard water level. The gentle slope and the thin shade of the young trees, together with the loose light soil, provide a dry sunny habitat on which Carduus, Aster, Arctium, Hedeoma, Nepeta, Erigeron and other sun loving plants find a congenial environment. There were the remains of large Burdocks and large Rubus nigrobaccus canes. There are scarcely any grasses in this central area; and as it has been mowed and burned all the herbage is scanty.

On the northwest margin of the transect the forest formation is followed immediately by the marsh-herb formation. The marsh-shrub formation is wanting. The marsh-herb formation is represented by four societies:

8. Hibiscus moscheutos society,
9. Polygonum-Scirpus society,
10. Scirpus lacustris society, and
11. Nelumbo-Potamogeton society, none of which shows the development of the marsh zones on the south side.

8. Hibiscus moscheutos society.

Facies.

Hibiscus moscheutos.

Secondary species.

Hypericum mutilum.
Impatiens fulva.
Hedeoma puligioides.
Panicum walteri.
Bidens cernua.
Xanthium canadense.
Rosa carolina.

The society forms a narrow interrupted border, not more than 4 feet wide of mature fruiting but not tall Hibiscus moscheutos. Of the secondary species the Hypericum is quite abundant at the outer margin of the eastern portion of the zone. The other species are very sparse, of the Xanthium and Rosa there is but a single plant.

9. Polygonum-Scirpus society.

Facies.

Polygonum emersum. Scirpus fluviatilis.

Secondary species.

Typha latifolia.
Cyperus strigosus.
Ilysanthes gratioloides.
Hypericum mutilum.
Polygonum pennsylvanicum.
Polygonum acre.
Agrostis perennans.
Gratiola virginiana.
Erechtites hieracifolia.
Echinochloa walteri.
Eupatorium purpureum.
Roripa palustris.
Roripa americana.
Alisma plantago.
Amaranthus hybridus.
Arctium minus.
Acer rubrum seedling.
Ulmus americana seedling.
Hibiscus moscheutos seedlings.
Cladophora sp.
Scirpus lacustris.

This society is 40 feet wide, with the entire surface exposed at the present low water level. Hence the extremely heterogenous collection of plants among the secondary species. Dead Typha latifolia stalks are so abundant in the western portion of the zone as to warrant considering it a dominant plant; but the Typha is not at all abundant in the eastern portion of the zone. Arctium minus and Alisma plantago growing close together illustrates strikingly the submerged and emersed stages of the society and the rapidity with which a new habitat is adopted by plants. That the ground has been recently exposed is evidenced by the fresh masses of Cladophora.

10. Scirpus lacustris society. This is a fringing zone 40 feet wide and extending only about half way across the belt, the surface is partly emersed. There is a 20 foot wide sandy beach scantily clothed with the Scirpus.

Secondary species.

Potamogeton natans.
Potamogeton pectinatus
Potamogeton sp.
Nelumbo lutea.

11. Nelumbo lutea society. A small bed of Nelumbo lutea borders the Scirpus lacustris society to the N. N. E. The leaves are but few and widely scattered.

Fifteen feet east of the belt is a public dock, 4 feet wide and extending 78 feet out into the water and 54 feet up onto the shore. The marsh zones are not formed immediately on either side of the dock. On the upper portion of the beach close to the dock, the

Hibiscus zone is coming in. Twenty feet east of the western margin of the belt the marsh zones are interrupted by a boat-house on the beach with a runway for boats extending into deeper water. The development of the marsh formations on the north side has thus been interfered with; and the margin is also more exposed to storm winds and waves. A sandy beach 60 feet wide is building; it is occupied in part by the Polygonum-Scirpus and in part by the Scirpus lacustris zone.

At the south end of the section studied both lateral zonation and layering (etagen) are strikingly shown. There is a marked increase in elevation from one lateral zone to another, from the floating Nelumbo leaves to the tall Ulmus americana and Quercus palustris. This is well shown in the photographs. There is a poor development of etagen in the individual associations. In some there are the dominant plants and then the ground cover, in others a weak irregular growth of taller herbs, while in the forest the shrubs have either been cut or are young plants, and the vines generally trail over the ground.

I wish to take this opportunity of expressing my appreciation of and thanks for the favors shown me by Dr. Alfred Dachnowski, under whose supervision the survey was made, to Mr. Lionel King for the two excellent photographs and to Mr. Booton and Mr. Sawyer of the State Canal Commission for the map and information concerning the acreage and history of Orchard Island.