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An Open Winter—So Far

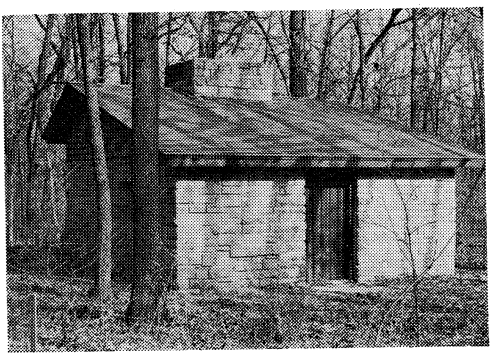
At the time this is written, in mid-January, there has been as yet no snowfall of any consequence in the Madison area in the winter of 1960-61, although sizeable snows have occurred to the south of us. What the situation will be when this issue of the Arboretum News reaches our readers is, of course, anybody's guess. It is too early to say with any certainty what effect the lack of snow cover will have on our last fall's plantings. As soil moisture conditions were highly favorable at that time, it is to be hoped that there has not been too serious a loss, even from the comparatively loosely packed and exposed soil around the new plantings. There has existed a considerable fire hazard from the standing tall grasses in the prairie areas of the Arboretum. These are usually knocked down by snows. Supt. Jacobson has carried out rather extensive mowing operations around the borders of the prairies, both to cut down on present fire danger and to facilitate burning planned for next spring.

New Parking Area at Grady Tract Entrance

Our parking facility at the northwest corner of the Grady Tract, on Seminole Highway just south of the intersection with the Beltline Highway, has been completely revamped, so as to provide adequate off-highway parking outside the fence, instead of inside as formerly. The fence has been moved back to form a rectangular lot sufficient to accomodate 10 cars. Instead of a single gate there are now two gates of a size sufficient to admit large vehicles, at the north and south ends of the lot. In addition to this a completely new feature has been installed, a so-called "people gap", a permanent opening in the fence near the southeast corner of the lot, constructed so as to allow free passage of pedestrians, but to prevent access of any vehicles from the size of bicycles on up. This was accomplished by building the opening in the shape of an "L", producing an angle that is too abrupt for passage of vehicles. It is anticipated this will be a great improvement over our former system of leaving the gate on a "long chain", as, what with the passage of various authorized vehicles in and out, someone was sure, now and then, to pull the chain tight as he locked up, thus temporarily shutting out pedistrians, contrary to our policy, and occasionally causing considerable annoyance and inconvenience to those excluded.

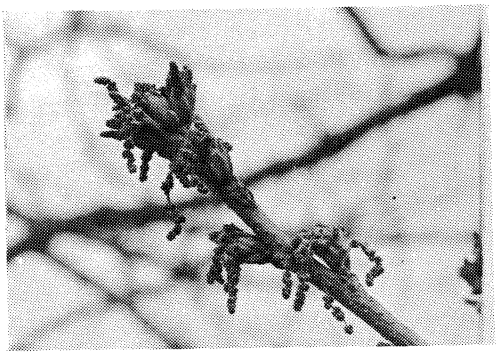
Instrument Building in Gallistel Woods

The former stone shelter house, erected in the thirties by the CCC at the southwest corner of the Gallistel Woods, has now been converted into a small closed building, about 14 x 20 feet, which will be used to protect valuable recording instruments to be employed in microclimatic studies in the woods. The original shelter had a central stone wall with fireplaces on either side. The north half of the building has been removed, the fireplace on that side bricked up, and the former central wall now serves as the north outside wall. Heavily shuttered windows have been installed and a very stout door has been hung, in order to make the building as vandal-proof as possible. The structure has also been reroofed. Under study will be 1) soil temperatures at different depths, 2) air temperatures at various levels to the top of the tree canopy, 3) relative humidity of the air, 4) soil moistures, and 5) light measurements. Leads attached to the recording devices will be run from the building to desired points in the woods. The instruments which must be exposed are small, inconspicuous, and relatively inexpensive. The leads in most cases will probably be strung overhead, but might also be fully buried for some purposes. The recording devices will be of a type electrically operated on 110 volts, so power will be brought to the building. The south fireplace remains and can be used for heating, if desired, or electric heaters could also be employed. It is contemplated that the the building will be used by staff members of both Botany and Zoology Departments. The photograph of the converted shelter house was taken January 19, 1961 by Fred Swan, Arboretum Botanist.



Early Flowering of White Oak

The large, spreading, open-grown white oak at the northeast corner of the Arboretum Prairie—the same tree represented on the masthead of the Arboretum News—has, presumably, set some sort of record by flowering—as shown in the accompanying photograph of a twig end—in mid-January, following a long, sunny period of mild weather which duplicated the conditions usually prevailing in late May. As all readers who live in the Madison area are aware, the timing of this flowering was unfortunate to say the least as the coldest weather of the winter followed immediately after the opening of the buds. The effect of this premature flowering on the next acorn crop is uncertain at this time, but it seems likely that it will be markedly reduced.



Arboretum Serves in Study of Fish Migration

Arthur D. Hasler, Department of Zoology, Univ. Wis.

A tower platform (Fig.1) over dry land would seem an unlikely spot for the investigation of the homing mechanisms in fishes. Yet this is just the purpose for which the new wooden tower in the Arboretum was constructed. As can be seen from the photo, the tower was erected east of the barracks on a site chosen for the absence of high landmarks in the vicinity.

The platform is used to train fish to directions in which they use the sun for orientation. In order to eliminate all landmarks (visual cues) the fish trained in the tank on the platform must not be able to see either trees or the horizon. Our training-testing tank at the Hydrobiology Laboratory on Lake Mendota does not provide us with a cueless horizon, hence we built this high platform in the Arboretum.

Another advantage for operating in the Arboretum is that a fish's "clock" mechanism, which is involved in direction orientation, may become conditioned or disturbed by regularized cues occuring at the University such as whistles, deliveries and bells. The seclusion of the site at the Arboretum circumvents these difficulties.

How does this relate to the problem of fish migration? It is part of a study which attempts to find out how a salmon uses the sun in orienting itself at sea on its homeward migration.

While home-finding in a stream system may depend upon the recognition of an odor, as our early studies indicate, and on other yet undiscovered guideposts, it seemed to me that the olfactory hypothesis was inadequate to explain the movements of salmon in the ocean. Certainly other cues are used.

Since it was abundantly clear that a Wisconsin team would have difficulty in conducting field studies in salmon at sea, I then asked myself the question: Is there a fresh-water fish which must find its spawning ground from open water? If so, then the mechanism of open-lake orientation in such a species might give us a clue as to how the salmon accomplishes these feats at sea.

Our initial attack on this problem consisted of a study of a less complex type of homing than that in salmon. For a number of years my co-workers and I have studied the natural history of the white bass (*Roccus chrysops* Raf.) in Lake Mendota, Wisconsin; we have been able to locate only two major spawning sites in the entire lake, and these are of very limited area. These spawning grounds, Maple Bluff and Governor's Island, are both on the north shore of the lake and are separated by a distance of 1.6 kilometers. Here the white bass congregate at spawning time in late May and early June, when temperatures range from 16° to 24°C.

During three different spawning seasons (1955, 1956, and 1957) white bass were captured in fyke nets, marked with numbered disk tags, and transported in open tanks to the different release stations in the lake for daytime releases.

From the start, we observed that a large percentage of the displaced fish returned and were recaptured in nets. They returned to their original spawning site from a release point located 2.4 kilometers from the spawning grounds, in a lake having an area of 30.4 square kilometers and a shoreline of 32.4 kilometers. For tagged fish released on the spawning ground without being displaced the percentages for recapture and for time lapse between release and recapture were of the same order of magnitude as those for fish that were displaced. This would indicate, therefore, that there was an almost complete return of the displaced fish to a spawning ground.

Subsequently, the "take-off" direction of displaced white bass was observed. To the fish was attached a plastic float which could be followed as the fish towed it along. More refined methods of tracking are currently being tested in our laboratory. The releases reported by my co-workers and me in 1958, and many additional releases since then, continue to convince us that the course taken upon release is generally north, toward the spawning grounds, on sunny days. On cloudy days, however, the fish swim randomly. It would appear that this tendency to take off toward the north serves the purpose of bringing the fish promptly to shore in the general vicinity of the spawning areas. Once there, they appear to locate their specific spawning areas by other cues.

How might this mechanism of orientation be explained? While we were investigating the field aspects of this problem, the classical studies of von Frisch and Kramer on sun orientation had been published. I considered it important to explore the possibility that a sun-compass mechanism could be helpful to fish in open-water migration. To expose this notion to laboratory and field tests, new methods and apparatus had to be developed. In addition, we had to determine what fish were most suitable for this type of laboratory experiment.

The principal method which we developed to test for sun orientation relied upon an escape, or cover-seeking, response, which was used for scoring. The fish were tested under the open sky in a specially designed tank (Fig. 3). During training the fish usually attempted to seek cover and found it in only one of the 16 small compartments, within 360°, the others having been covered by a metal band. The arrangement of the small containers was such that they could not be seen by the fish from its starting point in the middle of the large tank. Training tests were conducted at frequent intervals. In this process the fish was removed from the small container and placed in a cage in the center of the tank. Upon release it was given a small electric shock to frighten it. This resulted in the fish's seeking cover again in the small open container, which was always in the same compass direction.

Tests were then conducted with all 16 of the boxes open and available to the fish. When it was determined that the fish had learned the location of the box which lay in the same compass direction as the training compartment, the critical tests were begun. All 16 small containers were available for entry, but usually the fish chose those which lay in the compass direction in which it had been trained to seek shelter.

The trained fish were disoriented when tested under completely overcast skies, at times when the experimenter could not detect the presence of the sun. This demonstrates that the sun was the fish's point of reference and that the fish had learned to seek cover in the same direction at different times of day—that is, to allow for the movement of the sun (see Fig. 4).

The crucial and definitive test was then conducted—namely, substitution of an artificial "sun," indoors, for the actual sun. A sun-compass fish responded as though it were responding to the real sun out-of-doors at that time of day, choosing a hiding box at the appropriate angle to the artificial sun. Hence, the existence of an orientation rhythm which is associated with the so-called "biological clock" has been established.

It now becomes imperative that field studies be made of migrating salmon at sea. Sexually mature salmon should be captured in purse seines near the mouth of a home river, equipped with tracers similar to those described above for the white bass, and displaced several kilometers out to sea, and their "take-off" and swimming direction should then be charted.

III. Native Woody Plants of the Arboretum. The Willow and Wax-Myrtle Families

John T. Curtis

SALICACEAE (Willow family)

Populus balsamifera L. Balsam-Poplar. Fig. 7. The only specimen on the Arboretum is growing just north of the Duck Pond Springs. This individual is very close to the variety *subcordata* Hylander, with slightly heart-shaped leaves that have sparse pubescence on the veins beneath. The Balsam-Poplar differs from the other poplars in Wisconsin in that the petioles are round in cross-section and hence do not permit the easy trembling so characteristic of the other species. In Wisconsin, this plant is abundant only in the extreme northern counties, where it commonly grows in company with spruce and fir in the boreal forest relics of the of the region. (Map 14)

Populus deltoides Marsh. Cottonwood. Fig. 8. The Cottonwood is found throughout Wisconsin along rivers and lake shores. On the Arboretum large specimens are to be seen around the Teal Pond and at the eastern edge of the Lost City Woods. In addition, large areas of young trees are springing up on the East Marsh and the Wingra Marsh near Ho-Nee-Um Pond. The largest tree on the area is 13 feet in circumference at breast height and is the third largest tree in the Arboretum. The Cottonwood grows with great rapidity when young, but the mature trees are very subject to wind and lightning damage, so much so that it is rare to find an intact specimen. It has great promise as a pulp producer on the drained peat lands of southern Wisconsin. (Map 15)

Populus grandidentata Michx. Large-toothed Aspen. This species is sparingly represented in the forest areas of the Arboretum, as is usually the case in southern Wisconsin. The largest specimens are in Noe Woods. The tree can be readily identified by its leaves, which are very coarsely toothed. In northern Wisconsin, the Large-toothed Aspen is often a pioneer, seeding into treeless areas which have recently been burned. In the south, however, it is usually confined to small openings in the forest. Thus, it is an excellent example of a "gap-phase" tree in the sense of the English ecologist, A.S. Watt (1947). (Map 14)

Populus tremuloides Michx. Trembling Aspen. As its common name implies, the leaves of this species are almost constantly in motion. The slightest breeze will cause the blades to wave back and forth from their pivot, the flattened base of the petioles. The tree is found throughout Wisconsin, but is most common in the north where it forms pure stands covering thousands of acres. On the Arboretum it is an agressive pioneer, especially in the low grounds of the East Marsh, around the Teal Pond and in the Wingra Marsh. It has been successfully planted as a screen in the Duck Pond area and also as a partial border around the Leopold Pines. The stands on the deep peats are very subject to fungus diseases, especially the aspen canker, which causes the stems to break off. Since this tree can reproduce by underground rhizomes and suckers, it manages to hold to an area, but the stands are of very ragged appearance. Good trees are found only on the uplands. (Map 16)

Salix L. Willows. The willows are a confusing group due to the great range of variability in some species, to the tendency of many species to hybridize with with each other, and also to the confusion reigning in taxonomic circles concerning the proper names to apply to the various forms. The Arboretum is very rich in willow species, which are a dominant feature of the shrub-carrs (lowland plant communities dominated by shrubs 5 to 10 feet tall) along Lake Wingra and also in the area to the north of the Teal Pond. They have received detailed attention only in recent years, when examples of all of the obviously different forms were transplanted to the nursery, ultimately to be re-transplanted to the new willow collection in the strain Garden. As a result of this inadequate understanding, the following treatment is to be considered tentative, with additions and corrections likely to appear in the future. (See University of Wisconsin Arboretum News, Vol. 8, No. 3, July 1959).

Salix bebbiana Sarge. Long-beaked Willow. Fig. 9. A wide-ranging species found throughout northeastern North America, this species is exceedingly variable in growth form. It may form either a many-stemmed shrub or a single-stemmed tree. On the Arboretum it is found on all of the low grounds along Lake Wingra and also in the Teal Pond area. Its common form here is that of a small tree, up to 10 feet or so in height. (Map 17)

Salix candida Flugge. Hoary Willow. This transcontinental shrub is characterized by a heavy, white, wooly covering on the leaves and the young branches. It is rarely but widely distributed in the Wingra shrub-carr and in some places on the Gardner marshlands in the eastern part of the Arboretum. It prefers wet, calcarious soil and may not make a desirable horticultural plant for uplands because of this. (Map 18)

Salix cordata Michx. Dune Willow. The section *Cordatae* of the willow family is in taxonomic confusion. The differences between *S. adenophylla, S. cordata, S. glaucophylloides* and *S. syrticola* are very slight and they all hybridize with *S. rigida.* In addition, their ranges are almost identical–all are found on the beaches and dunes of the Great Lakes. We think we have both *S. adenophylla* Hook. and *S. glaucophylloides* in the Arboretum nursery, as transplants from the coast of Lake Michigan in Manitowoc County. The leaves and stems of the plants we are calling *S. adenophylla* are permanently covered with a heavy layer of gray hairs and so are very attractive at all seasons of the year. Although originally growing in the pure sand of a large sand dune, the plant is doing very well in the heavy loam soil of our nursery. The plant resembling *S. glaucophylloides var. glaucophylla* has hairy stems like *S. cordata* but has glaucous leaves. The regular *S. cordata* occurs in the Wingra shrub-carr and has been successfully transplanted to the nursery. (Map 19)

Salix discolor Muhl. Pussy-Willow. The pussy-willow is even more variable than *S. bebbiana* in both form, leaf shape, and size, and flowering behavior. It is found on all of the low grounds of the Arboretum and is notable for the large size and silky appearance of the flowering catkins as they begin to expand in the springtime. (Map 20)

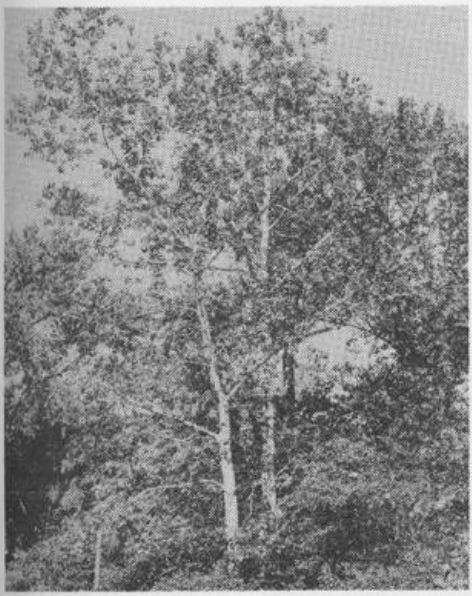


Fig. 7 Balsam Poplar

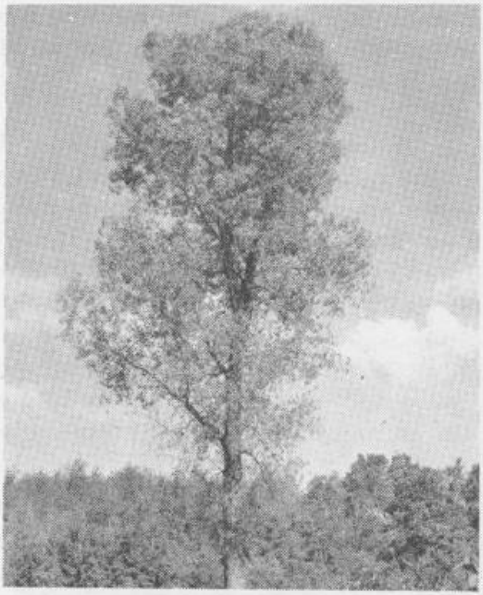


Fig. 8 Cottonwood

Fig. 9 Long-beaked Willow

Fig. 10 Black Willow

Salix humilis Marsh. Prairie Willow. This species closely resembles the Pussy-Willow in everything but size and ecological behavior. It is much smaller in all of its parts and it grows in dry instead of wet places. The favored habitat in Wisconsin is the dry prairie, but it is found on all types of prairie and on sand barrens. It possesses great power of recuperation following fire. In the Arboretum, the Prairie Willow is found on the prairies and also in the Grady Tract Oak Openings. (Map 18)

Salix interior Rowlee. Sand-bar Willow. A pioneer plant of sandbars and beaches, this wide-ranging species is very common in low spots on the prairies of the Arboretum, but it appears to avoid the wet, calcareous peat and muck soils near Lake Wingra. It forms extensive colonies of medium-sized shrubs. Their long, very narrow leaves with distinct teeth are characteristic and make this species easy to recognize. (Map 21)

Salix lucida Muhl. Shining Willow. This large shrub is notable for its very glossy leaves, each with a very long tail-like extension at the tip. It is rare in the Arboretum and is known at present only from the Teal Pond area. (Map 19)

Salix nigra Marsh. Black Willow. Fig. 10. The Black Willow is the only native tree willow on the Arboretum. It is much less common than the introduced *S. alba* var. *vetellina,* with which it has produced a puzzling series of hybrids. The largest trees in the Arboretum are in the area just south of Stevens Pond, with the largest specimens 13 feet 2 inches in circumference at the base. However, the tree is most numerous in the lowland forests on the southeast shore of Lake Wingra. (Map 22)

Salix petiolaris Sm. Slender Willow. There are few unusual characters expressed by this shrubby species. It resembles both *S. humilis* and *S. sericea* to some extent. In the Arboretum, it is largely restricted to the area around the Lake Wingra shore, and the Teal Pond marsh, but it is very common and widely distributed in the shrub-carrs of southern Wisconsin. (Map 23)

Salix serissima (Baily) Fern. Autumn Willow. Fig. 11. This very distinctive willow is notable for its very late blooming and fruiting seasons. The fruits commonly do not ripen until September. It is a very attractive species, with smooth and highly glossy leaves, dark green on top and whitened beneath. In the Arboretum it is a fairly rare member of the Wingra shrub-carr and is also found in the Wingra fen, which is an area of peaty soils with an internal flow of lime-rich water. (Map 24)

MYRICACEAE (Wax-myrtle family)

Myrica asplenifolia L. Sweet Fern. The pine woods and pine barrens of northern Wisconsin are redolent with the resinous odor of Sweet-fern on any warm day. The plant is a low shrub with a bur-like fruit. It has been planted in the Arboretum along the edges of the Jack Pine Forest, where it has done remarkably well, forming clones over 20 feet in diamerer. Other plantings have been made in the Leopold Pines and the Grady Pines. Sweet Gale *(Myrica gale)* was formerly found along the shore of Lake Wingra but has not been seen in recent years. (Map 24)

Fig. 11 Autumn Willow–Note fluffy seeds

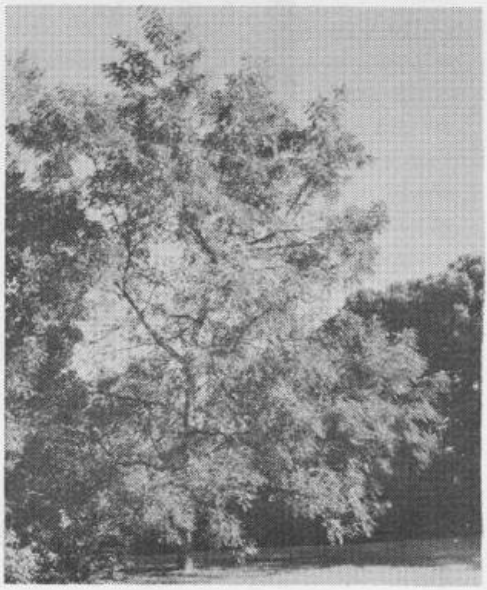


Fig. 12 Black Walnut

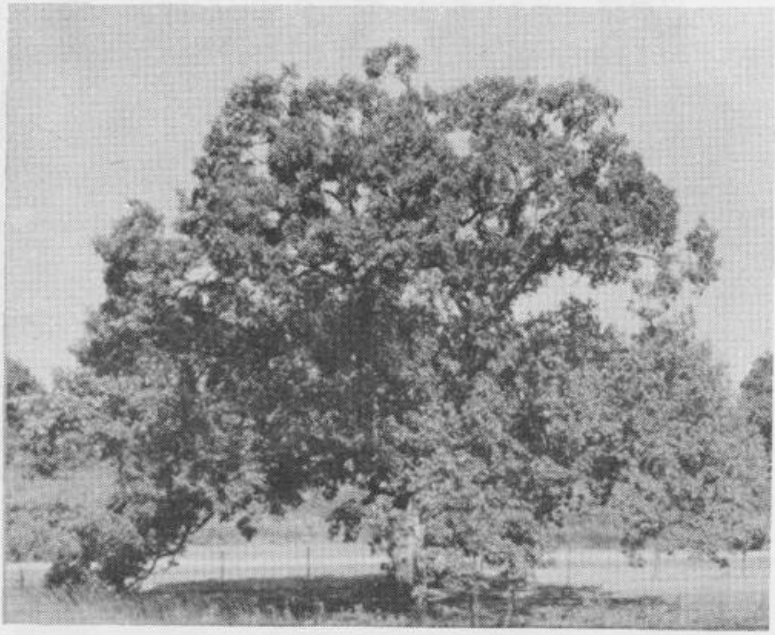


Fig. 13 White Oak in Prairie

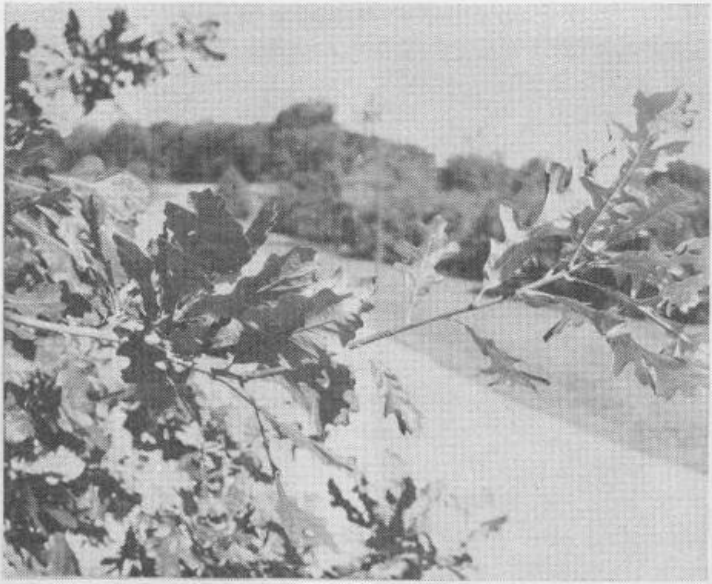


Fig. 14

Lammas shoot on Bur Oak

Fig. 15 Red Oaks in Wingra Woods

JUGLANDACEAE (Walnut family)

Juglans cinerea L. Butternut. This species is typically found in the upland forests of southern Wisconsin but it also occurs sparingly all the way to the northern border of the State. In native forest stands, it is almost always a rare or infrequent member of the community, with little reproduction evident. In the Arboretum a number of mature trees are to be found in the Noe Woods. These are exceptional because of the great number of seedlings, saplings, and small trees they have produced. If all survive, the Butternut will become a dominant member of the forest in the near future. The reproduction is found within the forest and also in open places around the margin. The largest mature tree in Noe Woods is 5 feet, 1 inch in circumference at breast height. (Map 25)

Dr. J.R. Habeck has reported (Arb. Jour. Paper No. 41, 1960) finding an abundant supply of Butternut fruits cached in the branch whorls of both Red Pine and White Pine in the adjacent Leopold Pines. They had been firmly placed in the angle between the branch and the main stem by grey squirrels, who had carried them from the parent trees in the Noe Woods.

Juglans nigra L. Black Walnut. Fig. 12. The only mature examples are found in Noe Woods. A number of specially selected varieties have been planted along McCaffery Drive and Administration Drive, near the lilac plantings, where they have borne fruit for a number of years. Many saplings of native origin have also been planted in Gallistel Woods, where they are making excellent growth. This tree produces the most valuable lumber of any species in the state. As a result, it is now very rare in native forest stands. We hope to restore normal densities to our woods on the Arboretum. (Map 26)

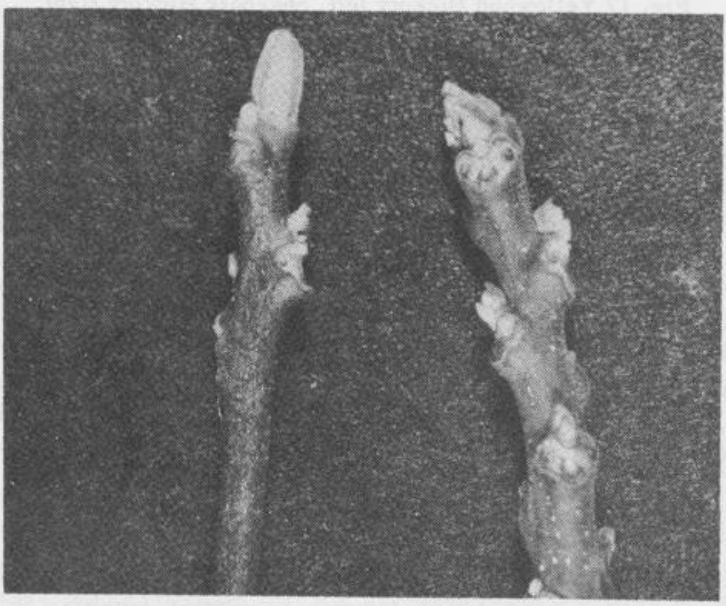


Fig. 16 Butternut left, Black Walnut, right

Carya cordiformis. Yellowbud Hickory. This species is also known as Pignut Hickory, but the brilliantly colored sulfur-yellow buds are such an outstanding characteristic of the tree as to fully justify the local name Yellowbud. There are a few mature trees in Noe Woods and one large tree (5' 10'' in circumference) near the old Grady homesite. These few trees apparently have been the source of nuts for the very many seedlings and saplings now wide-spread in the western half of the Arboretum. Some of these seedlings are more than 1/4 mile from the nearest mature specimen and seem to argue in favor of bluejays or other birds as the major agent of seed dispersal. Although the Yellowbud Hickory is very shade tolerant and is a typical member of the Maple-Basswood community in Southern Wisconsin, it can also grow well in fully open sites and frequently acts as a pioneer species, as in the oak opening on the Grady Tract. (Map 26)

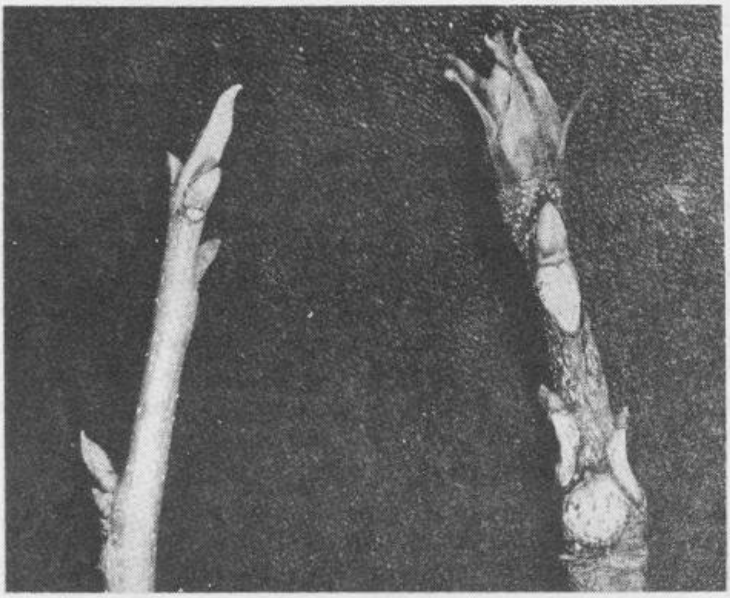


Fig. 17 Yellowbud Hickory left, Shagbark Hickory right.

Carya ovata. (Mill.) K. Koch. Shagbark Hickory. This is the common hickory of southern Wisconsin, bearing edible nuts. It is widespread in all of the oak woods of the Arboretum, reaching greatest numerical importance in the Wingra Woods, particularly near the stream at the eastern edge of that forest. The largest known specimen of this species in Wisconsin stands as an isolated individual at the eastern end of the spruce-fir portion of the Aldo Leopold Pines. It is 7' 10'' in circumference at 4-½ feet above the ground. Another tree, only slightly smaller, formerly was to be found just southeast of the wild-flower nursery in Gallistel Woods, but it blew down in the winter of 1958-59.

This species is very subject to attack by an insect which bores into the terminal bud, where it causes a great reduction in length-growth of the twigs in the following year. As a result, the young trees grow in height very slowly. (Map 27)

CORYLACEAE (Hazel family, not including the Betuleae or Birch subfamily)

Corylus americana. Walt. American Hazelnut. This shrub is common in all of the oak forests of the Arboretum. It reaches greatest densities in the open places of the Lost City Woods. Although found throughout Wisconsin, it is most common in the south. The fruits are almost universally attacked by a weevil. Only

in exceptional years do any appreciable numbers of nuts escape destruction. The Hazel is among the earliest of the woody plants to come into bloom. It has its sexes in two separate types of inflorescence, the male flowers borne in long, pendulous, yellow staminate catkins, while the female flowers are concealed in small scaly buds, with only the scarlet stigmas appearing in the open. A dwarf ecotype, only 2 to 3 feet tall was found in Columbia County and has been introduced to the Arboretum Nursery. (Map 28)

Corylus cornuta Marsh. Beaked Hazelnut. This Hazel is easily recognized by the beak-like extension at the tip of the involucre surrounding the nuts. It is confined to the conifer forest regions in northern Wisconsin, but it grows well in the Arboretum. Our plantings in the Leopold Pines are recent, but there are some older specimens in the horticultural area. (Map 28)

Ostrya virginiana (Mill.) K. Koch. Ironwood. Another name frequently used in textbooks for this species is Hop Hornbeam. It is a member of mesic forests throughout Wisconsin, where it is usually an infrequent tree. Highest densities are to be found in forest stands which have been lightly grazed in the past and have subsequently been protected. On the Arboretum, the Ironwood is to be found in Gallistel Woods, Wingra Woods, and Noe Woods, with occasional trees elsewhere. The tree is always of small size and never reachs the top of the canopy. The wood is very hard, perhaps because of the very slow growth of the stems. (Map 29)

FAGACEAE (Beech family)

Fagus grandifolia. Ehrh. Beech. In Wisconsin, this species is now confined to the vicinity of Lake Michigan. However, pollen records from the Wingra Marsh indicate that it was formerly present in the Madison region, probably about 5000 B.C. It has been planted in numbers on the lower ground at the eastern end of the Wingra Woods in the future Beech-Maple-Hemlock community and is doing very well at present, although none of the trees are more than twenty feet tall. Additional trees are present in the Ohio Valley Hardwoods section of the Gallistel Woods. (Map 29)

Quercus alba. L. White Oak. Fig. 13. This species is found in all of the wooded areas of the Arboretum and is probably the most common native tree. The largest specimen is the open-grown tree at the western-most end of the main prairie. It is 10 feet in circumference, 42 feet tall, and has a branch spread of 75 feet. Other large trees are found near the Wheeler Council Ring on Monroe Street. The tree is so common in Wisconsin that little need be said about it. (Map 30)

Quercus macrocarpa. Michx. Bur Oak. Fig. 14. Like the White Oak, this species is found in all of the Arboretum wooded areas, but it is by no means so common. The species is extremely variable and a number of forms are present on the area. All have small acorns like the form *olivaeformis,* but they differ in corkiness of the twigs, in lobing of the leaves, and in amount and whiteness of the pubescence on the lower side of the leaves. A number of large trees occur around the margins of the main prairie and their offspring have provided the matrix for several small oak openings.

The Bur Oak is notable because of the frequency with which it produces two periods of branch elongation during the growing season. The second of these are called "Lammas shoots" because they are supposed to begin to grow about Lammas day, or the first of August. Actually, the second growth is often initiated in early July. Frequently these second growths are larger and more vigorous than the first ones and are especially likely to produce corky ridges on the twigs.

Fire resistance is another outstanding characteristic of the Bur Oak. The species can tolerate ground fires better than any other species in Wisconsin. This resistance develops early and is well established by the time the saplings are eight feet tall, even when they are growing in tall grass prairie.

Hybrids between Bur Oak and White Oak are known as *Quercus bebbiana* Schneid. There are many examples of this hybrid in Gallistel Woods and a few in the other wooded areas. (Map 31)

Quercus bicolor Willd. Swamp White Oak. No native trees of this species remain on the Arboretum, but a number of seedlings have been planted just beyond the western end of the Grady Prairie and in the Gallistel Woods. In Wisconsin it is found primarily on the second terraces of major rivers in the southern part of the State. It is almost as fire resistant as the Bur Oak. (Map 32)

Quercus borealis Red Oak. Fig. 15. The greatest concentration of this majestic tree is in the Wingra Woods, where more than one half of the total dominance in the forest is contributed by this species. The largest tree is 9 feet, 2 inches in circumference. Red Oak is very susceptible to oak wilt and a number of areas of kill-out exist in the Wingra Woods. The openings in the canopy have stimulated the growth of many young Black Cherry and Shagbark Hickory saplings but many oak saplings are now beginning to appear. The Wingra Woods was grazed prior to 1932 and was subject to early spring ground fires. All of the trees killed by oak wilt have serious fire scars at their bases. (Map 32)

Quercus ellipsoidalis E.J. Hill. Hill's Oak. This species is also known as Jack Oak and Scrub Oak. It differs from the Black Oak in the shape of the acorns and in its habit of retaining the stubs of dead branches along the main trunk for 50 years or more. In the Arboretum, it is fairly common on the Wyocena sands of the Grady Tract, where it forms an important member of the forest. The largest tree of the species is located there, with a circumference of 8 feet 1 inch. A number of typical trees are to be found in Gallistel Woods and Lost City Woods, but these have been badly hit by oak wilt in the last few years. (Map 33)

Quercus velutina Lam. Black Oak. This species is also found in all of the wooded areas, where it is intermediate in commonness between white and bur oak. An excellent specimen, 79 inches in circumference, is to be seen along the path at the west edge of Wingra Woods. The greatest concentrations are to be found in Gallistel Woods, where a number of kill-out areas of various ages due to oak wilt are present. Many trees intermediate between Black Oak and Hill's Oak occur in the Arboretum, especially in the Grady Tract and the Noe Woods. Hybrids between these species have been given the name *Quercus palaeolithicola* Trel., but we have a complete series of intergrades which produce puzzling combinations of characters. One frequent combination has acorns and leaves which are intermediate between the two suspected parents but which has bark closely resembling that of the Red Oak. Map 33 shows the areas of abundance of *Q ellipsoidalis, Q. velutina,* and *Q. palaeolithicola.*

V. Native Woody Plants of the Arboretum. The Elm Family

ULMACEAE (Elm Family)

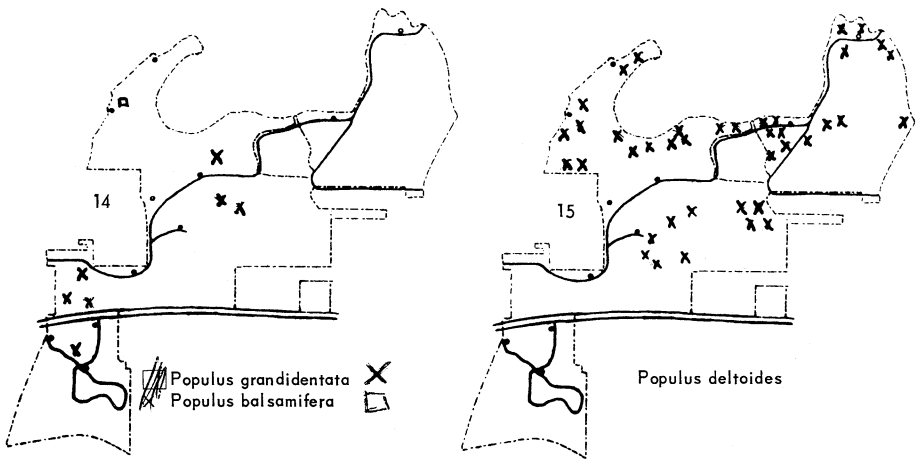
Ulmus rubra Muhl. Slippery Elm. The inner bark of this species is very macilaginous, whence the common name. The tree grows best in rich calcareous woods of maple and basswood, although it generally requires soil disturbance, as

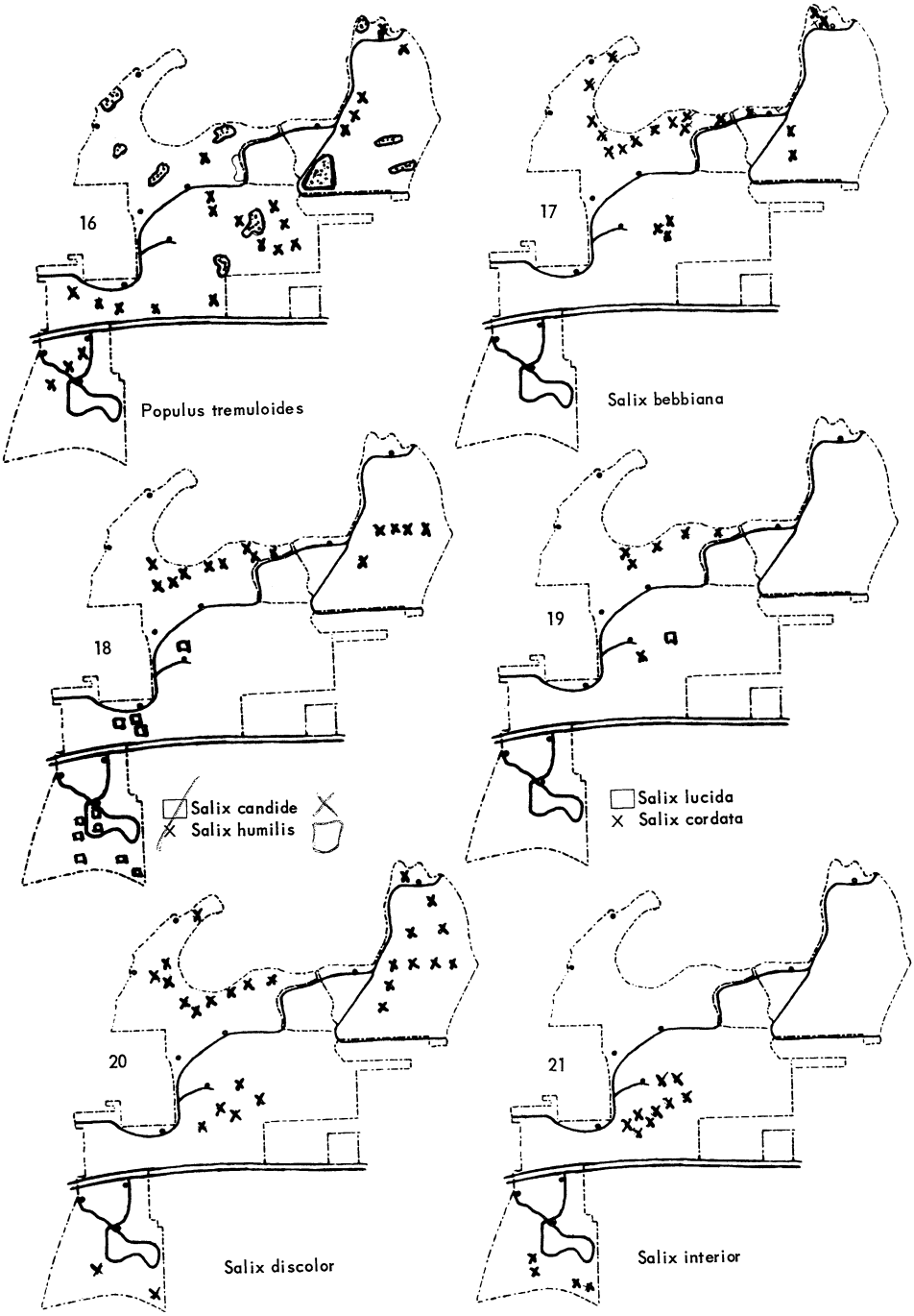
by grazing, to achieve high populations. Only rarely is it found in close proximity to the Red Oak *(Quercus borealis)*. One of the striking peculiarities of the Slippery Elm is the ability of its seedlings to send out numerous rhizomes with whip-like shoots at their tips. This process results in large clones or clumps of seedling-sized plants which may cover an area up to 30 feet in diameter.

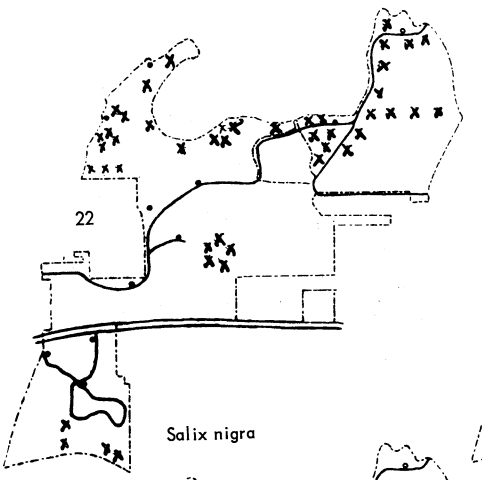
In the Arboretum the species is rare, being found only in the Noe Woods and the Gallistel Woods. (Map 34)

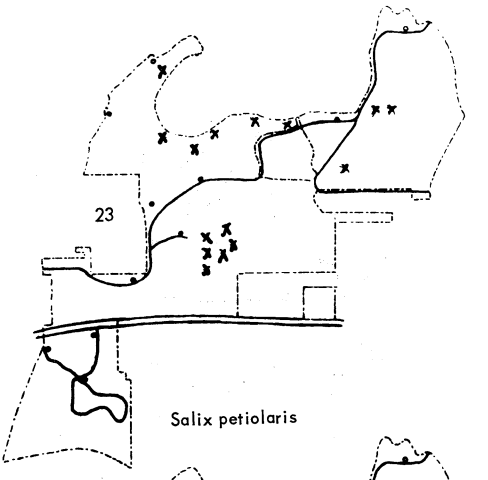
Ulmus americana L. American Elm. This stately tree has been widely planted on the city streets of most towns in northeastern United States, in spite of the fact that its natural home is the moist riverbottom rather than the dry and partially paved soils of the city streets. Largely because of this ecological mismatching, the tree is subject to various serious diseases, notably phloem necrosis and Dutch elm disease, both of which can cause disastrous results. Sooner or later the landscape architects, park planners and others officially concerned with street plantings will wake up to the realization that the best trees to plant are the ones which were originally native to the site. In the meantime, taxpayers will be asked to produce huge sums for the largely ineffective and definitely bird-killing sprays that are currently recommended. (Map 35)

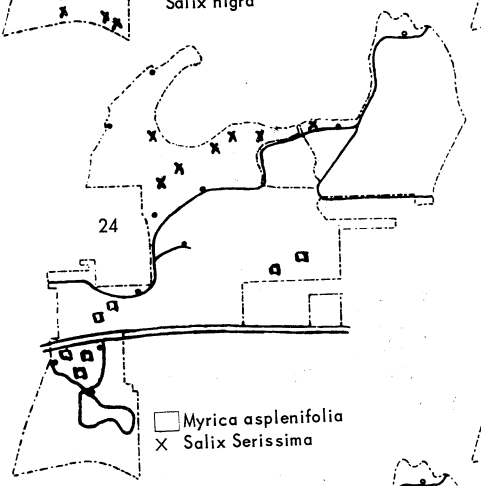
Celtis occidentalis L. Hackberry. The hackberry is found in rich floodplain forests, mesic upland forests of maple and basswood, and more rarely in rich oak forests. Its stucco-like bark sets it off as a very distinctive and unmistakable species. In the Arboretum it is found sparingly in all of the oak forests. The largest tree is to be seen in the horticultural area just west of the Ho-Nee-Um pond. (Map 34)

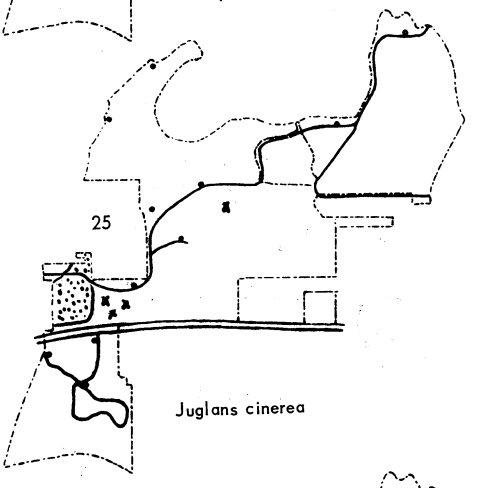


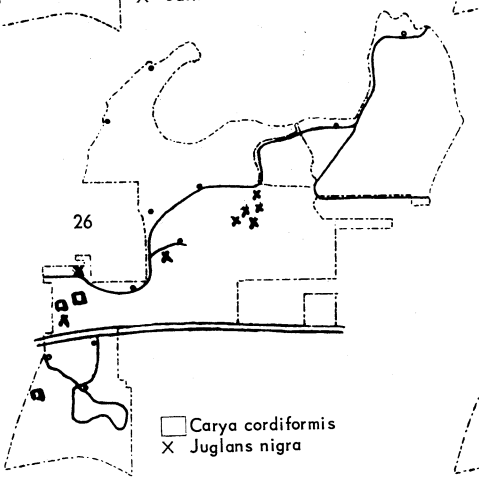

16
Populus tremuloides
17
Salix bebbiana
18
Salix candide
Salix humilis
19
Salix lucida
Salix cordata
20
Salix discolor
21
Salix interior

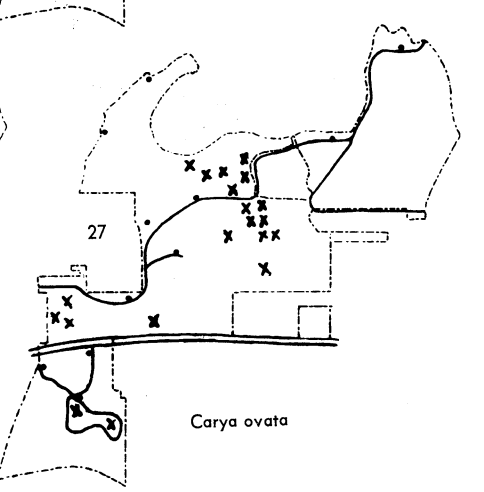

22
Salix nigra


23
Salix petiolaris


24
Myrica asplenifolia
Salix Serissima


25
Juglans cinerea


26
Carya cordiformis
Juglans nigra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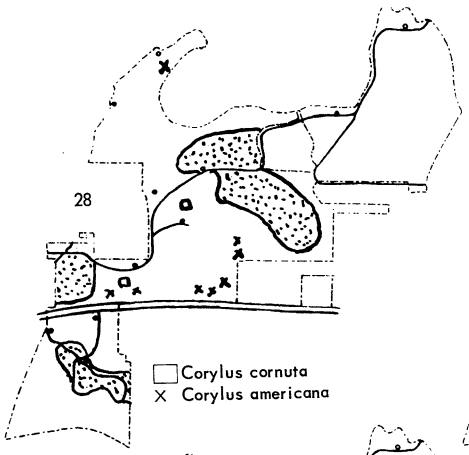
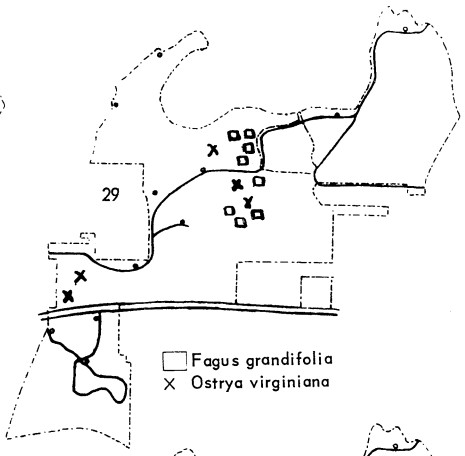
Carya ovata


28
Corylus cornuta
Corylus americana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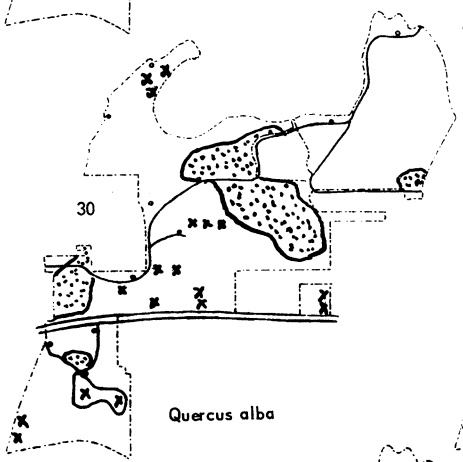
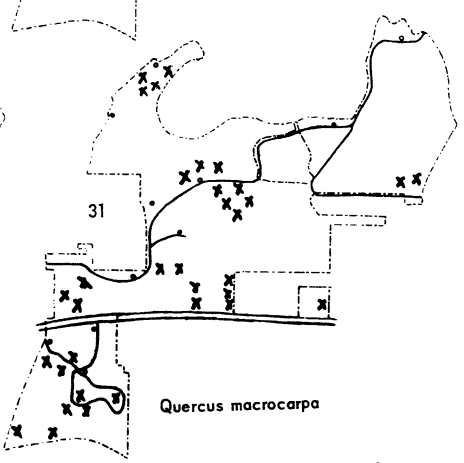
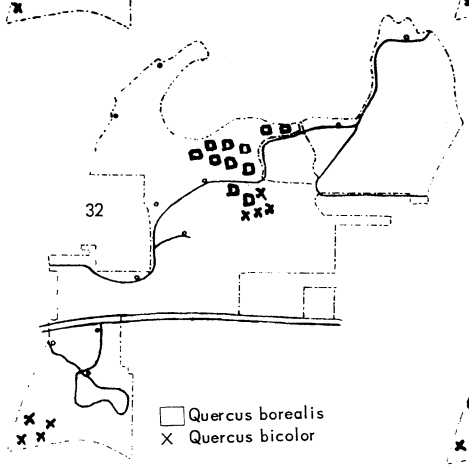
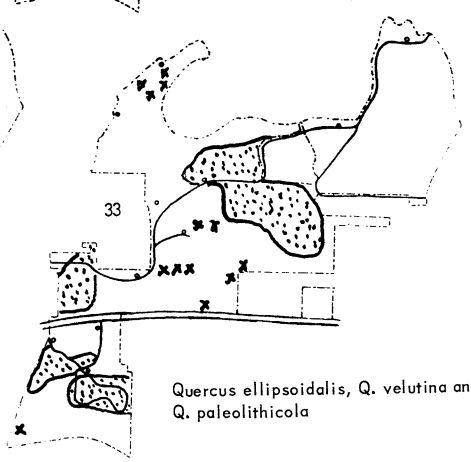
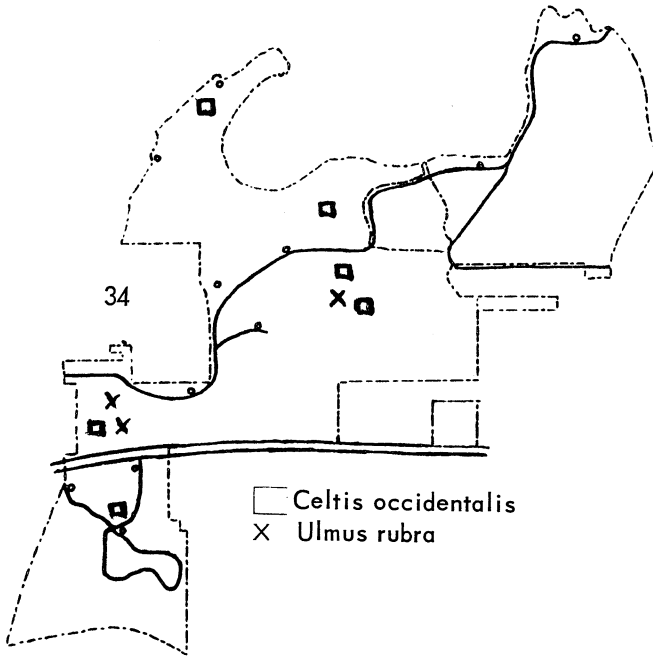
Fagus grandifolia
Ostrya virginiana

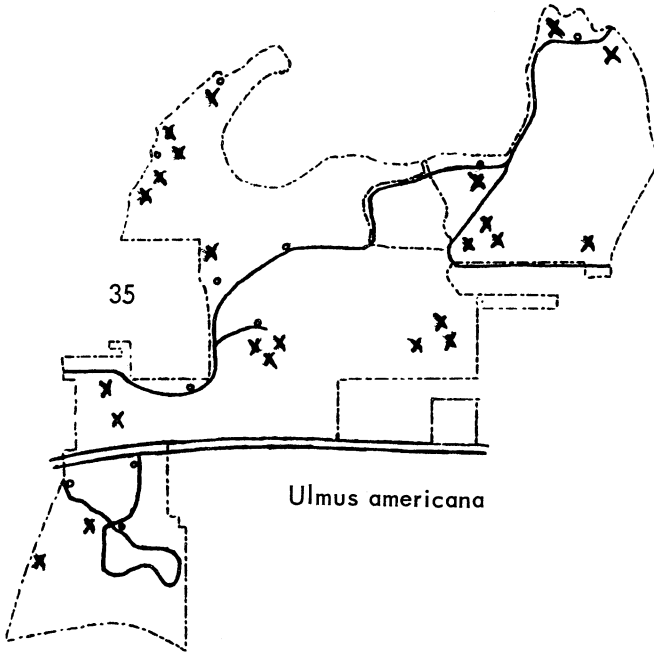

30
Quercus alba


31
Quercus macrocarpa


32
Quercus borealis
Quercus bicolor


33
Quercus ellipsoidalis, Q. velutina and
Q. paleolithicola


34
Celtis occidentalis
Ulmus rubra


35
Ulmus americana

Future Research on Open-Sea Navigation

From field and laboratory evidence, compiled from four different species of fresh-water fish, it is clear that many fish possess a sun-compass mechanism, and of importance here are the results of our unpublished laboratory tests on young silver salmon, which show that they too have this mechanism for orientation.

If salmon could maintain a compass course in the open sea, even a slight drift with currents would displace them to such great distances that they would be driven to shore hundreds of kilometers from their home-river system (see Fig. 2).

Possible Influence of Sun Altitude

Perhaps there are other cues which are perceived in navigation. Celestial cues may not be the only significant ones.

In seeking an understanding of the mechanism of the sun compass in animals, the application of laboratory methods has been extremely illuminating. Nevertheless, it must be kept in mind that these methods have not provided us with an explanation of navigational ability.

The results from field tests have established navigational ability in birds, but such ability requires, in addition to the sun-compass type of orientation, some other factors, such as those that enable homing pigeons, for example, to find home loft after being released at distant, unfamiliar places. For salmon, comparable field tests have not been made, even though oceanic migration appears to demand some type of navigational ability.

The take-off directions of the white bass when released out of sight of shore in the middle of a large lake support the view that at least one species of migrating fish uses its ability to maintain a compass direction when the sun is visible.

In our Laboratory Braemer simulated drastic longitudinal displacements with trained fish by shifting their "time sense."

When testing these fish during the noon hour, he observed that the zenith position of the sun could be correlated with a partial reorientation which resulted in choices that were in the compass direction of take-off of their training period.

This result suggests that the altitude of the sun plays a role in orientation.

In order to shed further light on this point Schwassmann* and I flew some sunfish (*Lepomus cyanellus)* that had been trained in orientation to the sun for several weeks at Madison, Wisconsin (43°N), to the equator at Belem, Brazil (1°S), where we tested them out of doors in our circular sun-orientation maze (Fig. 3). These fish did not adapt to this new and radically different daily sun movement but continued to make the compensation for the azimuth curve of the sun that would have been "correct" for Madison.

*Research assistants on this project are Horst Schwassman and Francis Henderson. The project is supported by funds from The National Science Foundation and The Office of Naval Research.

Under the equinoctial sun at the equator a rapid deterioration of the oriented behavior of the displaced fish occurred, and all the fish showed an increasing tendency to maintain the same angle to the azimuth position of the sun throughout the day. Because of the somewhat preliminary nature of this experiment, no definite conclusion can be drawn as to the probable cause of this behavior. (The fish for these equator experiments in South America were trained in the testing tank located on the platform at the Arboretum. We will begin another series of experiments next summer. Trained fish will be shipped by air express to an assistant in Belem, Brazil for further analysis of the fishes' sun-compass behavior at a drastically different latitude.)

This account has been taken in part from two of my recent articles:

Hasler, Arthur D., 1960. Guideposts of Migrating Fishes. Science 132(3430): 785-792

_____, 1960. Homing Orientation in Migrating Fishes, Ergebnisse der Biologie 23:94-115

Fig. 1 Platform and tank erected immediately east of the headquarters. It is used in fish orientation studies.

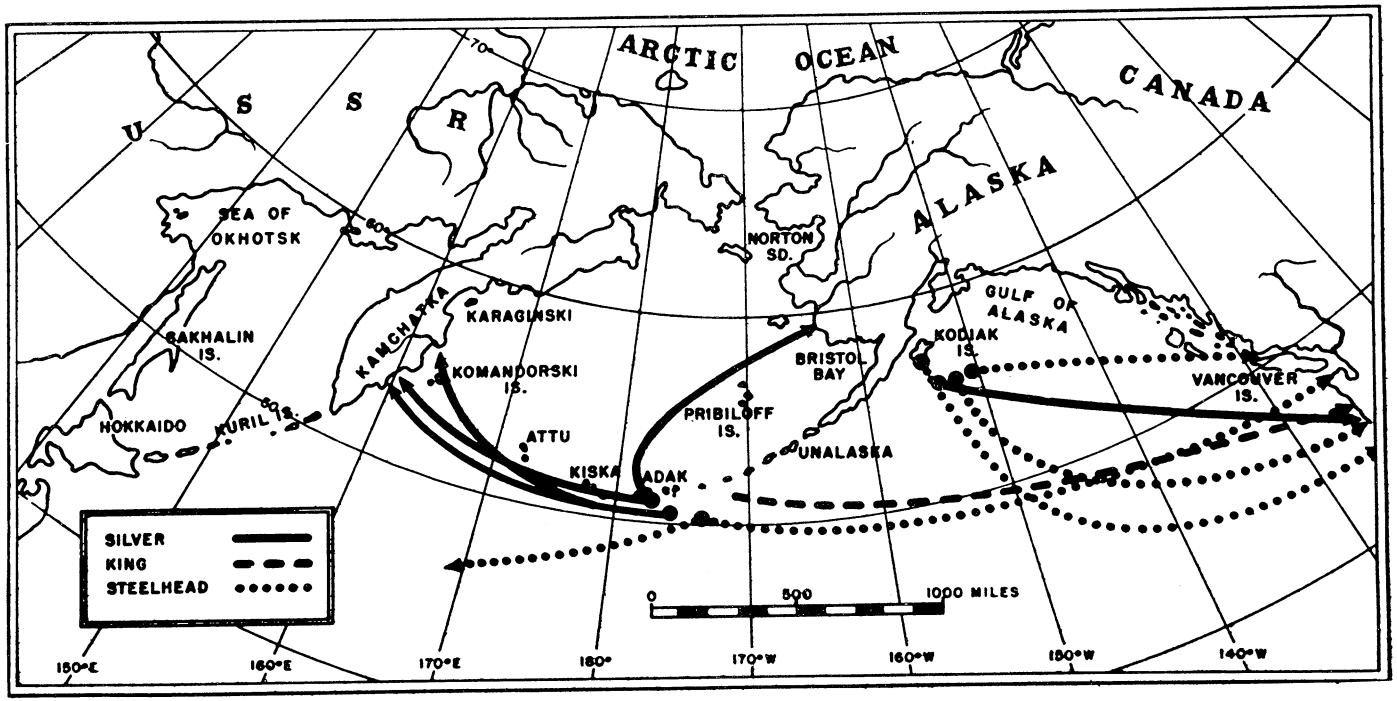


Fig. 2. Generalized distribution of recaptures of king and silver salmon and steelhead trout tagged at sea from 1956 to 1960. The routes shown are the shortest distances between the marking and the recapture points. [International North Pacific Fisheries Commission]

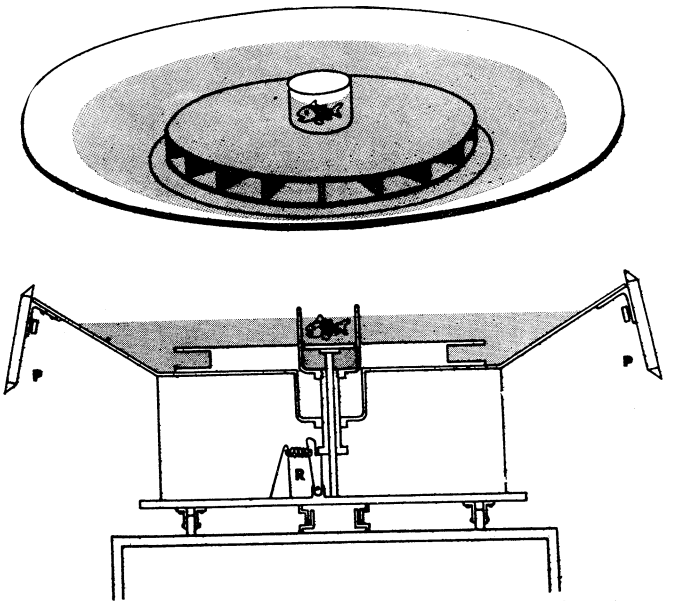


Fig. 3 Tank for training fish to a compass direction (Top) View from above, showing the hidden boxes. (Bottom) Side view showing periscopes (P) for indirect observation and the release lever (R) used to permit the cage to be recessed by remote control when the fish is released.

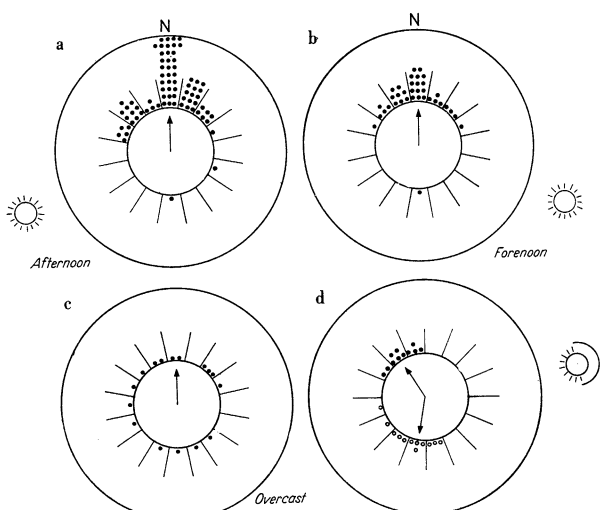


Fig. 4 Scores of fish trained to north. a) Tested in the afternoon with 16 possible choices. b) Tested in the forenoon with 16 possible choices. c) Scores of Fish B tested under completely overcast sky on two different days. d) Scores of Fish B using an artificial light, where the altitude was the same as the sun. ● solid dots: scores of fish trained to north and tested in the forenoon; o circles: scores of same fish tested in the afternoon.

Arboretum Personnel

Chairman, Arboretum Committee—J.T. Curtis, 326 Birge Hall, Univ. Wisconsin, Madison 6, Wis.
Executive Director ..... G.W. Longenecker
Superintendent ..... J.R. Jacobson
Botanist ..... F.R. Swan
Editor, Arboretum News ..... H.C. Greene

THE UNIVERSITY OF WISCONSIN

ARBORETUM NEWS

Vol. 10, No. 2 Madison, Wisconsin June, 1961

JOHN T. CURTIS

John T. Curtis, Professor of Botany and Chairman of The University of Wisconsin Arboretum Committee, died in Madison on June 7, after a long illness, at the age of 47.

Professor Curtis was born in Waukesha, Wis., graduated from Carroll College in that city, and completed his graduate work in botany at The University of Wisconsin. He was appointed as instructor in Botany in 1937 and rose rapidly – allowing for time spent in Haiti during World War II – attaining the rank of full professor in 1951. His speciality was ecology, a field in which he became widely known. In 1959 he published his book "The Vegetation of Wisconsin", the summation of much of his work and that of his colleagues and students over a twenty-year period. Professor Curtis' many professional achievements and honors will be presented in detail elsewhere. It is our purpose in this brief article to confine our attention mainly to his outstanding and continuing services to the Arboretum for the past twenty-five years.

From his arrival on the Madison campus in 1934, shortly after the establishment of the Arboretum, Professor Curtis maintained an intense and unflagging interest in its affairs. He was appointed to the Arboretum Committee in 1939 and had served continuously since. He filled the post of Arboretum Research Coordinator with distinction and dedication for a number of years, and in 1959, when A. F. Gallistel retired as Chairman of the Arboretum Committee, Professor Curtis was the natural choice as his successor.

Somewhat aloof and austere in manner with those whom he did not know well, Professor Curtis nonetheless possessed great organizing ability, persuasiveness in presenting his views, and a great deal of farsighted shrewdness. His knack of getting at the essentials of any problem was outstanding, a talent which will be sorely missed in future operations of the Arboretum which, it seems certain, can only grow more complex as the years pass.

Professor Curtis was a person of marked versatility and he employed his abilities unstintingly in giving direction to the development of the various plant communities in the Arboretum, and in furthering the prosecution of research on the area. Despite the fact that he was an exceedingly busy individual he was a person upon whom this writer, as Editor of the Arboretum News, could always depend for numerous suggestions and articles which have appeared in almost every number of the News in recent years. His latest project in this connection was a series of articles on the native woody plants of the Arboretum, two of which have been printed as supplements to the Arboretum News.

In this photograph Professor Curtis is shown recording data in the laboratory at the Arboretum. The "laborer" is Dave Archbald, former Arboretum Botanist.

The establishment of a seed exchange with other arboreta and botanical gardens was a project in which Professor Curtis was much interested and which he conducted with great success. His idea was that we should get away from routine offerings and specialize in the seeds of desirable native plants. The great demand over the years for many of these seeds is testimony to the soundness of his concept. He was himself a gifted grower of plants and personally purchased many rare and beautiful exotic species for trial in the gardens around his home. He also employed many native species in these gardens. If a plant was growable in the Madison area, he was the man who could grow it. If plants did not succeed he replaced them with others, so that there was always something attractive on display. He built a small, but very choice rock garden in his yard, and converted a screened porch with a south exposure to a home greenhouse. Thus, no matter what the season, anyone visiting his home was sure to see something beautiful and unusual. At one time he devoted much attention to orchid culture and attained professional competence in the field. He had recently become interested in succulents and had assembled a valuable collection of them.

Professor Curtis displayed great courage and determination in remaining active almost until the end. His final contribution to the Arboretum was a carefully thought-out resume of his views as to the direction he thought research on the Arboretum should take, and possible means for implementing it. We who have been associated with him in conducting the affairs of the Arboretum feel his loss keenly. There is no doubt that, had he lived, he would, with skill and success, have guided the Arboretum to ever-increasing prestige among institutions of its kind.

—H. C. Greene

History of the Arboretum

"Madison's Public Wilderness: The University of Wisconsin Arboretum" is the title of an interesting article by Mrs. Nancy D. Sachse in the Wisconsin Magazine of History (Winter number, 1960-1961). The account is liberally illus- with photos and maps, and gives a connected story of the Arboretum from its founding to the present, with special emphasis on the personalities and land acquisitions involved.

Madison Newspapers Cover Prairie Burn in 1961

Both Madison newspapers, the Wisconsin State Journal on April 25th and the Capital Times in its Green Sheet for May 9th, gave extensive coverage, with spectacular photographs, of the controlled burning of the Arboretum prairie by the Arboretum work crew under supervision of J. R. Jacobson. The State Journal's article is entitled "As in Old Days, Fire Aids Nature", that of the Capital Times "Science Reaps Harvest of Facts in Arboretum Prairie Burning". We are grateful for this useful and factual publicity. The Grady Tract prairie, in that section of the Arboretum south of the Beltline Highway, was also burned this year.

Faville Prairie Burned

The sixty acre Faville Prairie Reserve, near Lake Mills in Jefferson Co., which has been under Arboretum control for a number of years, was successfully burned off by Supt. Jacobson and the work crew on May 2nd and 3rd. High winds combined with other unfavorable conditions, which necessitated extensive back firing and strip burning, stretched the job out over two days. Up until World War II this area was mowed annually in the fall for prairie hay, which effectively maintained its non-brushy prairie character, but with cessation of mowing, burning, which unfortunately cannot be done as often as we would like, has been the only practical large-scale means of brush control, although some cutting and poisoning of larger shrubs has been done.

Dry Winter Detrimental to Fall Plantings

The excessively dry winter of 1960-1961, in combination with further drouth conditions in early spring, produced conditions which seem to blame for poor success of some of our plantings, notably white cedar in the area about the Teal Pond. Some of these are dead and dying and will have to be replaced, despite the fact that they were vigorous and sizeable plants which had been grown in our own nursery and which, given even average favorable conditions, would probably have done very well.

Interesting Plants of the Arboretum. 16. Twayblade Orchid

The Lily-leavea Twayblade *(Liparis liliifolia)* is a rare member of the oak forest community in southern Wisconsin. It is a bulbous orchid, with a single pair of broad basal leaves and a few-flowered raceme (spike). The individual flowers are about 1 cm. in diameter with a broad mauve-purple flaring lip. The other flower parts are green, so that the whole effect is not very attractive to most observers. It is found from New England to Minnesota and south to Georgia and Missouri.

As mentioned by Curtis and Greene in Arboretum Journal Paper No. 25 (1953), on the subject of population changes in Arboretum orchids, this species spread from the Noe Woods to the Leopold Pines in 1946. The population literally exploded, with a peak estimated number of 23,000 plants in 2½ acres by 1949. Thereafter the population began to decline, reaching a more or less stable level of about 1000 plants in the same area in 1952 and thereafter.

Since 1956 the Twayblade has been noted spreading to other areas. It is now found in large colonies in the Jack Pine forest, in an adjacent aspen stand, at several places in both the main prairie and the Grady prairie, under the spruce and fir trees east of the Nakoma golf course, and in other places as well. The major mystery of the spread is why it took so long to begin. If the plant can grow in all of the above diverse localities, why was it not there to begin with? The only reasonable answer would seem to be that the degree of protection we have given the area, with no fire, grazing, or other disturbance, has been sufficient to enable the plants to become established.

The Twayblade Orchid is easily grown in the home garden. All it requires is shade and a reasonable amount of moisture. A location under shrubs on the north side of a house, in a silt loam or sandy loam soil, will suit the plant very well. We have had it in cultivation for over 15 years in the same spot, and it has maintained or slightly increased its population during that time. —*J. T. Curtis*

Lake Wingra Vista

One of the most pleasing views in the Arboretum is that of the west end of Lake Wingra, as seen from the public road just to the west of, and downhill from, the Wingra Woods parking lot. Up to now there has been no place where a motorist might legally stop, in order to obtain a little more than the fleeting glimpse available from a moving car. It is planned to construct a small off-road overlook at this point, where a car or two may pull off the road for a limited period to allow the occupants to enjoy the vista. Parking, in the sense of locking up and leaving the car, will not be permitted, however.

Educational Film on the "Prairie Biome"

Movie shots of the burning of the Arboretum prairie in 1961 will be included in an educational film on the prairie, to be produced and sold by the Encyclopedia Britannica organization which sent a team of professional photographers to Madison for the purpose of obtaining this footage.

An Explanation

Various factors, beyond our easy control, have led to delay and irregularity in the issuance of the Arboretum News for the past year or so. We hope and plan to resume a regular schedule in 1962.

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THE UNIVERSITY OF WISCONSIN

ARBORETUM NEWS

Vol. 10, No. 3-4 Madison, Wisconsin July-October, 1961

The 1961 Growing Season

The summer of 1961 was on the cool and dry side in June and July, but later provided us with some very hot weather, while still building up a sizeable moisture deficit. Fortunately for our fall planting season this situation was rectified on September 12th and 13th when there was a steady soaking rain which amounted to between 5 and 6 inches and put things in fine shape for transplanting from the nursery. Both Arboretum prairies, following spring burning, were in excellent condition throughout the summer, and were the subjects of several illustrated newspaper accounts. In general, despite rainfall shortage, we did not suffer measurably and the season may be accounted a good one from the developmental standpoint.

Arboretum Committee Chairman

Professor Grant Cottam, of the Botany Department, has been named Chairman of The University of Wisconsin Arboretum Committee to succeed the late J. T. Curtis. The active committee, as now constituted, consists of Cottam, R. J. Dicke, Entomology, A. D. Hasler, Zoology, G. W. Longenecker, Horticulture, R. A. McCabe, Wildlife Management, and H. C. Greene, Botany, Committee Secretary. We count ourselves fortunate in having the continued interest and cooperation of Mr. A. F. Gallistel, former longtime Committee Chairman, whose "know-how" and experience are invaluable to us in this transitional period. Members of the Arboretum Advisory Committee for 1961-62 are: D. M. Benjamin, Entomology, J. H. Beuscher, Law, C. C. Center, Commerce, R. F. Evert, Botany, T. T. Kozlowski, Forestry and Wildlife Management, J. E. Kuntz, Plant Pathology, H. H. Lettau, Meteorology, W. G. Reeder, Zoology, W. L. Sachse, History, A. W. Schorger, Forestry and Wildlife Management, N. J. Smith, ~~Director of Residence Halls~~ Medicine, and J. H. Wilde, Art Education.

The "Great" Treasure Hunt

As a result of the thoughtless irresponsibility of the operators of WISM, an aggressively non-educational, "rock-and-roll" type Madison radio station, the Arboretum and private citizens in adjacent areas were subjected in July and August to an extended period of harassment and annoyance. The cause of all this was a so-called treasure hunt conducted by WISM, aided and abetted by local

merchants. The "treasure" was a monetarily valuable certificate contained in a small capsule, with clues to whereabouts of same being broadcast daily. As is usual in such contests, to prolong the agony and allow for maximum advertising, the clues are at first impossibly vague, only gradually being made more specific. With no prior consultation whatsoever with Arboretum authorities, the initial clues were such as to direct the treasure seekers to the Arboretum, with results which were most unfortunate from our viewpoint. Literally thousands of people roamed the area, trampling, poking, and probing, and overall doing considerable damage, particularly about the headquarters buildings where there were, among many other incidents, several "break-ins" and an attempted entrance of the residence of the foreman, who happened to be on vacation at the time. Shingles were pulled from the roof, and the door forced, to the stout instrument shelter in Gallistel Woods. The work of the labor crew and Supt. Jacobson was greatly disrupted as a result of the necessity of taking at least minimal measures to protect our property from the mob. The word "mob" is used advisedly for, although at our insistence, WISM tried to direct people away from the west part of the Arboretum to the "Lost City" area where the "treasure" was eventually found, their efforts were completely in vain and until the last day of the hunt the whole place continued to be overrun by the unreasoning crowd. Our hope, perhaps unjustified, is that among the multitude there may have been a few persons who, now that they have been introduced to the place, will appreciate the Arboretum for its own sake, and make proper use of it in the future, a sort of use which we welcome. Consultations are being held with representatives of the Wisconsin Attorney General's office with a view to ascertaining legal steps which may be taken to prevent any future invasions of this sort.

Maple Woods Development

The Arboretum now has a fairly mature stand of sugar maple-basswood in a rather narrow strip adjacent to the Beltline Highway in the southeast corner of that portion of the Arboretum which lies north of the Beltline. The leafy canopy has now almost closed over, providing the dense shade in summer, so characteristic of such woods. The herbaceous plants in this area, at the time tree planting was begun, were not the early spring bloomers which provide the unique beauty of a maple woods, but later-developing species which could not withstand the dense shade of midsummer and have hence largely died out, leaving a bare forest floor, ideal for the introduction of the flowering species characteristic of maple-basswood. These plants mostly complete their period of active growth in spring and early summer, thus being adapted to the shade conditions prevalent in maple woods and providing the great contrast between the spring and summer aspect of such places where, from being covered with almost a solid mass of spring wildflowers, by August the forest floor is almost bare, giving the uninitiated observer no clue as to its spring beauty.

It is planned to develop here, as rapidly as possible, a typical herbaceous understory. We are fortunate in that here at Wisconsin we have very complete studies of the species composition of such woods as they occur in this area, a most useful guide to the development of a reasonably authentic, if synthetic, understory. We now have a good nucleus stock of maple woods plants in our wildflower nursery in Gallistel Woods, but insofar as possible we will place our principal reliance on seeding techniques. Some of the more conspicuous and better-known wildflowers of the maple woods are the red trillium, divaricate phlox, spring beauty, waterleaf, Dutchman's breeches, and dogtooth violets.

Since this area is in a rather shallow strip along the highway, and thus exposed to drying summer winds from the roadway, we plan to make a close planting of leafy shrubs along the fence line to retard wind passage and thus improve

moisture conditions here, and incidentally provide for screening off this very busy road to at least a limited degree.

"Exclosures" in the Leopold Pines

Visitors walking through the Leopold Pines may have noticed and wondered as to the purpose of the small, tightly-fenced areas scattered about the woods. These are plots surrounded by chicken-wire mesh which is buried in the soil at the base to exclude rabbits and protect woody and semi-woody plantings within from their depredations. In the past attempts to set up a typical pine woods plant community have been stymied by our all too numerous and voracious rabbit community. No sooner would we set out plantings than they would be nipped off or, if not immediately destroyed, they would be consumed during the first winter. It was thought that if permanent protection could be provided to strategically situated "reservoirs" of pine woods plants they, or at least some of them, might in time spread out by seeding and other means, and perhaps become established in large numbers during "lows" in the rabbit population. It is a matter of common experience that plants that have been handled and are freshly transplanted are much more likely to be browsed than are plants which have developed in situ. There are currently five exclosures, the one farthest east having been established for four years, another for three years, two for one year, and another just recently set up. Supt. Jacobson has put much effort into obtaining plant stock for this project. Among the plants, which are mostly thriving, are fly honeysuckle, wintergreen, Diervilla (bush honeysuckle), club moss, several kinds of ferns, huckleberries, blueberries, partridge berry, thimbleberry, Aronias, maple-leaf viburnum, Rafinesque viburnum, hazelnuts, gray and round-leafed dogwood, Clintonia, violets, hepaticas, white trilliums, pink ladyslippers, paper birch, and red maple. It is planned to do some careful thinning of the pine stand at certain points to make light conditions more favorable for initial establishment of plants of the forest floor. In time nature itself would do this thinning but, being impatient, and anxious to obtain results within the lifetimes of some of us now around, we are trying to accelerate matters.

Our New Greenhouse

A 20 foot single bench, lean-to type greenhouse has been erected at the south end of the laboratory building, in the Arboretum headquarters area. We have long needed a facility of this type for propagation work during off-season periods, as well as during the active growing season. This house has an air-conditioning unit and has been connected to the laboratory electrical, heating and plumbing outlets. The foundation is of poured concrete 3½ feet deep and the wall resting on it is of concrete block construction, about 3 feet high and sealed over the outer surface. There is a small sink in the house and drainage to the outside has been provided for. The whole is a very neat job of which we can be proud, and results from Supt. Jacobson's supervision and careful attention to detail in the course of the construction. We expect to put the house to immediate use.

The Arboretum Seed Exchange in 1961

Our seed exchange mailing list at present includes 23 institutions in the U.S. and 132 in foreign countries. Foreign countries include Algeria, Argentina, Austria, Belgium, Bulgaria, Canada, Czechoslovakia, Denmark, England, France, Germany, Ghana, Holland, Hungary, Ireland, Italy, Japan, New Zealand, Norway, Poland, Portugal, Rumania, Scotland, Spain, Sweden, Switzerland, Tasmania, Turkey, Union of South Africa, U.S.S.R., and Yugoslavia. The 1961 list contained 59 items, only three of which were not requested by any of the responding institutions which numbered 75 in 1961. A total of 552 packets of seeds were sent to those requesting them.

Present Status of Lime Prairie

The lime prairie, because of its conspicuousness and proximity to the parking lot for the Leopold Pines area, has been subjected to a lot of wear and tear, particularly during the treasure hunt when a good many of the larger stones at the periphery were pulled loose by eager treasure seekers. However, despite all this it is coming along, its principal deficiency being an inadequate stand of grasses resulting in a bare unfinished look which attracts attention. Much grass seed, including prairie dropseed, grama grass and little bluestem was sowed on the area this fall and it is hoped that in a year or two it will have a more natural aspect. Keeping down the weeds, principally wild parsnip and pilose aster, is a main concern at present, but a good grass cover should help greatly in their control. Many seedlings of desired plants are present and it is simply a matter of a year or two until they attain a respectable size and in fact some of them may prove to be present in larger than desirable numbers in the long run. Stabilization will ultimately be attained, but it will take a while.

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