Water Fluctuations as a Factor in the Life of Six of the Higher Plants of Central Oklahoma

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Beginning in 1950 and extending to the present time, observations have been made on the effect of water coverage on the wetland and upland plants of Central Oklahoma. The major portion of this study was carried out at Lake Carl Blackwell. Six plants have been singled out for comment in this paper.

Fraxinus pennsylvanica Marsh., Var. *subintegerrima* (Vahl) Fern., Green Ash, is probably the most outstanding of these plants as far as its ability to withstand water inundation is concerned. This plant withstood water depths of about 30 inches for a 17 months' period beginning in May, 1951, and extending through August, 1952, and an earlier shallow water-inundation period of about three months during the summer of 1950. A mass of adventitious roots developed from the cambium layer just below the water line, some of which later established themselves in the soil near the base of the plant. About half of those inundated did not develop adventitious roots. Why some developed adventitious roots, while others in the same area and at the same level did not, could not be explained; however, the cambium layer at the bases of both remained viable. Trees covered to depths greater than 36 inches did not live through the 17-month period, but did remain alive longer than other trees native to the area. This species, especially well-adapted to wetland areas, is recommended for plantings as a shade tree in lakeside park areas subject to inundation.

Ulmus americana L. American Elms varying in inundation depths from 6 to 30 inches were selected for study. The bases of these trees were covered with water up to a depth of 24 inches during the late summer of 1950 for a period of about three months, and were again inundated about May 5, 1952. The fact that the depth of water varied only slightly during the period which followed (June 5, 1951, to Sept. 5, 1952,) made conditions ideal for determining the effect of the depth of water coverage on the inundation-killing period. The yellowing and shedding of the leaves occurred at about the same time as the decrease of the cambium in the trunk of the tree. The yellowing and shedding of the leaves were arbitrarily chosen as indicators of the time when the tree could no longer return to normal. All the trees in this group developed leaves during the spring of 1951. Leaves of the trees with bases covered to a depth of 30 inches were stunted. They dropped before August 5, 1951. The leaves of the trees with bases covered to a depth of 24 inches started turning yellow on August 5, 1951, and dropped before Sept. 14, 1951. Leaves of trees with bases covered to a depth of 14 inches started turning yellow by Sept. 14, 1951, and by October 1, 1951, had been shed to a large extent. Trees covered to a depth of only 6 inches retained their leaves until frost. The cambium layer of the trees with 6 inches of water coverage remained viable throughout the winter. These trees developed leaves the following spring, but the trees died soon after foliation. These observations tend to show that water depth, or a factor associated with water depth, has an effect on the inundation-killing period of the plant. They also tend to show that the American Elm can withstand a shallow water-inundation period of about three months for the rapid growing season, a period of four or more months for the late summer season, and possibly longer for the dormant season. This assumption was substantiated by the discovery at Canton Reservoir of living American Elms which withstood water coverage of 8 feet for a period of three months during the spring and summer growing season of 1951. The American Elm, a native of the wetland and upland areas of Central Oklahoma, is recommended for planting as a shade tree in lake side park areas likely to be inundated.

Cephalanthus occidentalis L. Button Bush showed remarkable ability to withstand inundation. Plants inundated to a depth of 36 inches for a period of three months during the summer of 1950, and again to a depth of 44 inches for a period of 15 months (June 5, 1951, to Sept. 5, 1952, are living at the present time. These bushes developed large masses of adventitious roots which apparently aided in the plants' survival. Out of the large number of water roots developed, only a few roots from plants with shallow water coverage of about 12 inches became permanently rooted. The Button Bush, a natural wetland plant, provides excellent cover for upland game birds; while it is inundated, it can provide excellent protection for young and growing fish.

Amorpha fruticosa L., False Indigo, lived through three months' inundation during the summer of 1950 with water coverages up to 48 inches. The plants' growth under varying depths of water coverage seemed normal, but on August 16, a decided difference was noted between the growth made by the plants in shallow water and the growth made by the plants in deep water. Examination disclosed a deceased cambium layer in the lower portion of the submerged stem of the plants. A large mass of water roots had developed from the upper living portion of the deeply submerged stems, while plants only shallowly covered produced few water roots. These adventitious water roots developed chlorophyll, and it was assumed that they took over part of the photosynthetic function of the plant. Plants producing large masses of these roots developed full-bodied seeds. The seeds of plants in shallow water were shriveled, and their ability to reproduce was doubted. Some of the plants in deep water lived through the winter of 1951 and developed vegetative structures the following spring. These plants died as the water receded. A search failed to find water roots that had become permanently established in the soil. Evidence indicates that this plant can withstand an inundation period of about three months but will be completely killed if inundated for longer periods.

Tamarix gallica L., French Tamerisk, Salt Cedar, one of the first plants to appear in a dewatered area, has a fate similar to that of False Indigo. Plants withstood water coverage to a depth of 36 inches for a period of three months during the late months of 1950 and lived to produce normal vegetative structures in the spring of 1951. These plants were again inundated about May 5, 1951, to a depth of 48 inches. After a period of about three months the cambium layer of the lower portion of the submerged stem developed water roots. These plants continued to exist, though submerged, through the fall and winter of 1951 and put forth a small amount of foliage the following spring. They died before the waters receded in September of 1952. Apparently this species can withstand an inundation period of about three months, but will be completely killed if inundated for longer periods.

Cynodon Dactylon L., Bermuda Grass, also showed resistance to water coverage. Plants covered to a depth of 6 inches lived about 15 months (June 5, 1951, to Sept. 5, 1952), with only slight damage. Most of the plants covered to a depth of 12 inches died during the spring and summer months of 1952, but some remained alive, establishing themselves after the water receded in September of 1952. A few apparently dormant rhizomes, covered to a depth of 18 inches for a period of about 15 months, (June 5, 1951, to Sept. 5, 1952), resumed their normal vegetative processes during September and October, 1952, after the waters had receded. This species could be used successfully for lawns in lakeside park areas which are subject to short inundation periods.