POND BOTTOM LINER STRATEGY IS MORE THAN A COVERUP

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Ornamental ponds are a common landscape feature of many midwestern arboretums, horticultural display gardens, golf courses, and housing subdivisions. These ponds are usually small, with areas less than 10 acres and depths rarely greater than 18 feet. The primary purpose of an ornamental pond is to enhance and highlight the beauty of the surrounding landscape. Occasionally, the ornamental pond is by itself an outstanding landscape feature. Secondary uses include fishing, swimming, and irrigation water supply.

Ornamental ponds are not merely holes in the ground that fill with water. To be an asset to a landscape, the ponds usually require intensive management efforts. Infestations of rooted and floating aquatic plants and blooms of various forms of algae have rendered many an ornamental pond a liability rather than an asset. The causes of excessive aquatic plant growth are surprisingly few. Excessive inputs of plant nutrients, inappropriate fish stocking, and the introduction of exotic plant species are the underlying causes for the decline of most ornamental ponds. Some aquatic systems management strategies deal directly with the underlying problems in ornamental ponds, but most are symptomatic cures. Management techniques used in ornamental pond management include watershed manipulations designed to limit nutrient inputs and sediment loading, deep dredging, piscicide applications, quarantining, harvesting, chemical herbicide applications, water dyes, bottom liners, flushing, water level control, raking, shallow dredging, drawdown, introduction and management of desirable plant and animal species.

Benthic semi-barriers are a recent addition to the arsenal of techniques used to control aquatic plant infestations. These barriers resemble large sheets of fiberglass windowscreen and are laid over the top of aquatic plant beds to control the plant growth beneath them. Perkins et. al. (1980) reported that a benthic semibarrier, Aquascreen (manufactured by Menardi-Southern, Houston, Texas), was an effective control for Eurasian Watermilfoil *(Myriophyllum spicatum L.)* in Union Bay at the outlet of Lake Washington, Seattle, Washington. Mayer (1978) reported similar results for the control of various aquatic plant species in Lake Chautauqua, New York.

The pond located in the Dow Gardens, Midland, Michigan, is a 3.5-acre shallow water (mean depth less than four feet) ornamental pond. The primary function of the pond is one of aesthetics and secondary function is to supply irrigation water to the terrestrial gardens. Aquatic herbicides are rarely used in the pond because of its irrigation function. The pond system is infested with *Elodea canadensis* Michx. During the summer of 1979, Aquascreen was placed over a luxuriant bed of elodea. An attempt was made to fasten the screen to the pond bottom with stakes and brick weights, but these efforts were largely unsuccessful due to the

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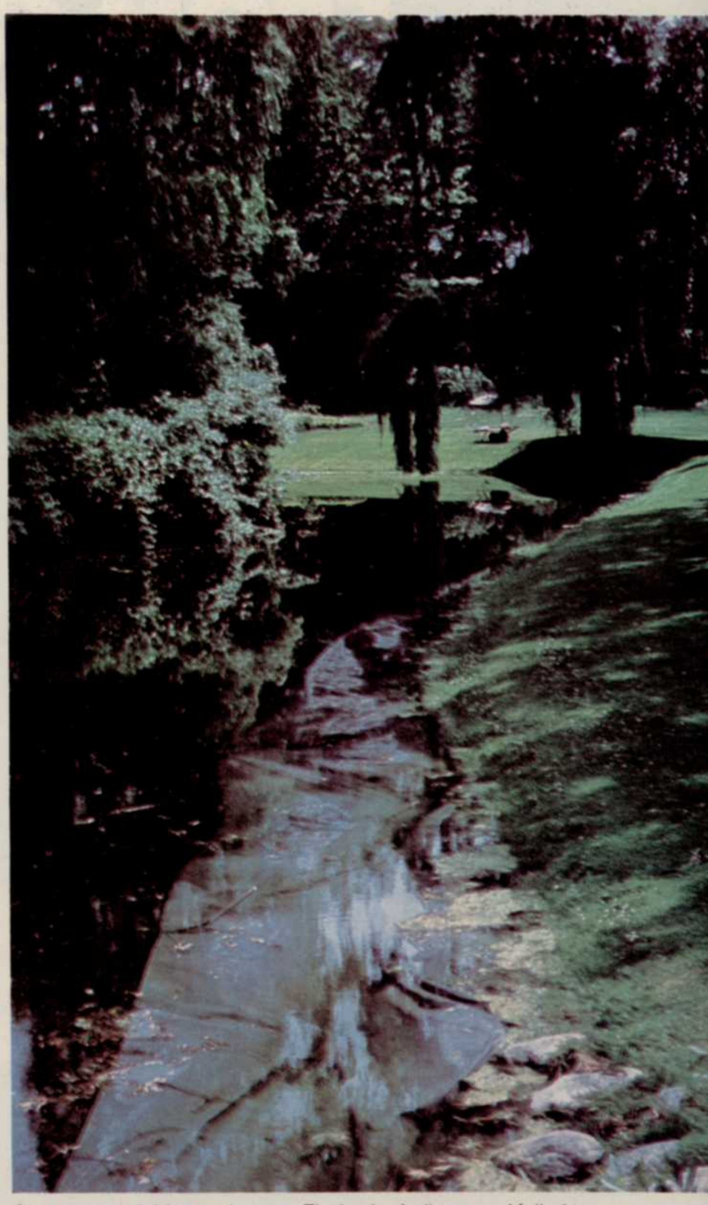

Aquascreen laid over vigorous Elodea in shallow pond failed to control by shading or compression. Elodea is moderately shade tolerant.

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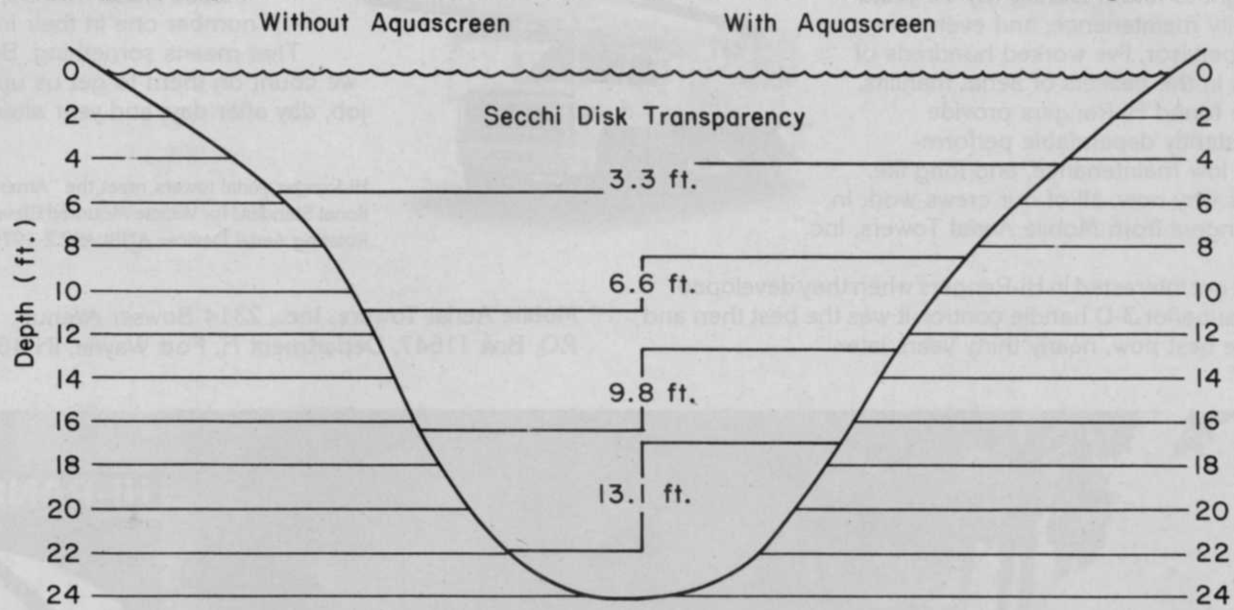
dense and rigid structure of the plant community. Despite this problem, the Aquascreen was left in place to see if plant control would come about by shading out the elodea beneath the screen. The elodea, growing beneath the Aquascreen, did not decline in vigor, however. Complaints concerning the appearance of the test site led to the removal of the Aquascreen



Comparison of the maximum depths that *Elodea canadensis* can grow without being limited by too little light under natural conditions and under Aquascreen given four different Secchi disc transparancies.

four weeks after it was applied. It appeared that the light attenuation was not great enough to control aquatic plant growth in shallow water.

Light Limitation

An investigation of the percent light attenuation caused by Aquascreen was conducted with a Li-Cor LI-188 Quantum/Radiometer/Photometer. Measurements were made in air and at various water depths. Our findings agreed with other researchers (Perkins et. al., 1979; Mayer, 1978) that Aquascreen attenuated light penetration by roughly 60%.

The depth to which light can penetrate through a column of water is a function of scattering and absorption by the water and dissolved and suspended substances in the water. A standard measure of transparency (depth of light penetration) in a pond or lake is made with a 7.9-inch (20 cm.) diameter white disc called a Secchi disc. These discs can be purchased from many scientific supply companies or can be easily constructed from a variety of common materials. A Secchi disc is lowered into the water on a line, cord, or chain to the depth where it just disappears as viewed from the water surface and then raised again to the depth where it reappears. The mean of these two depths is the Secchi disc transparency value for that pond or lake. The greater the depth where the disc finally disappears, the more transparent the water.

The maximum depth at which rooted, submersed plants can grow in typical ornamental ponds is determined by many factors but chief among these is water transparency. Secchi disc transparency roughly estimates a depth that is a certain fraction of the depth where light is so attenuated by absorption and scattering that it is not adequate to allow plant growth. This maximum depth varies from species to species, ranging from where 2% to 10% of the light that falls on the surface still remains. Like terrestrial plants, some aquatic plants are more shade tolerant than others. Elodea is a relatively shade tolerant species. Data suggest that it can grow where only 4.5% of surface light still remains (Hutchinson, 1975). Figure 1. shows graphically the maximum depth that elodea can grow, given different water transparencies with and without Aquascreen. Above the data lines light is sufficient for elodea to grow, but it would not grow at greater depths due to light limitation. It is obvious from this figure that Aquascreen does not shade

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elodea adequately in shallow waters to make it a viable control mechanism if light attenuation were its only mode of control.

Compression and Space Limitation

It appears that the principal mode of aquatic plant control affected by Aquascreen is compression and space limitation. It would also appear to be impractical to attempt this sort of control for a dense, rigid, and compact mature stand of elodea. Aquascreen does, however, show promise as a preventative or re-infestation control of elodea in an area that has been previously cleared of vegetation by raking, cutting, shallow dredging, or herbicide application. This was tested in the Dow Gardens pond system during the summer of 1980.

On May 7, 1980, four 5x5-foot sheets of Aquascreen were placed randomly in a shallow water area that had just been raked free of vegetation. Two 5x5-foot plots were chosen as controls. All the vegetation from the six plots was harvested on August 8, 1980 and ash-free dry weights were determined for subsamples.

Elodea grew beneath the Aquascreen and appeared to be vigorous but did not displace the screens upward in an unsightly fashion. Aquascreen was indeed quite effective in controlling the growth of elodea when applied in this manner. The plant biomass growing beneath and through Aquascreen was only 3% of that found in the control plots measured as ash-free dry weight per square foot.

Elodea growing adjacent to the treatment plots tended to overgrow the edges of the screens, but none of the treatment plots were completely covered by the encroaching plants. This year we will treat a much larger area with Aquascreen to evaluate the extent of adjacent plant encroachment over the treatment area and its impact on the efficacy of Aquascreen as an aquatic plant control tactic.

Aquascreen appears to have a great potential for the control of rooted, submersed aquatic plants in shallow ornamental ponds, as long as good pond bottom contact is made. Luxuriant, rigid, and dense plant communities, such as those formed by elodea, may have to be removed mechanically or with herbicides prior to the application of Aquascreen so that proper bottom contact can be made. Bottom contact is also essential so that the treatment will not be aesthetically objectionable. Although the light attenuation effect caused by Aquascreen is not adequate to be a viable control strategy in typical shallow ornamental ponds, the compression and space limitation effects caused by Aquascreen integrate well into ornamental pond management planning and technology.