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Measuring Periphyton Growth in a Bottomland Hardwood (BLH) Wetland

PURPOSE: This technical note introduces a method to measure periphyton growth in BLH wetland forests during the flooded winter and spring season using a device specifically designed to account for water fluctuation and high turbidity.

BACKGROUND: As primary producers, periphyton (attached algae) are an important component of many aquatic ecosystems. They create complex and diverse habitats used by many invertebrates and small fish for protection and food.

During the summer, the forest floor of a BLH wetland is dry and shaded by the dense canopy of woody vegetation. As a result, algal productivity in BLH forests appears insignificant during this time of year. However, the character of the BLH forest is transformed during the wet season. Trees and shrubs are bare, opening the canopy for direct light penetration to the forest floor. This season is dominated by periodic flooding with water depths fluctuating unpredictably and at varying rates. The water flowing through the system is often high in nutrients. Dense periphyton growths have been observed attached to floating debris in the BLH forest during winter and spring floods, suggesting that the role of periphyton during the wet season should be examined.

Even under these favorable conditions, the water of BLH systems is often turbid, limiting light penetration into the water column and restricting the depth at which periphyton can grow. Although the dormant BLH forest provides ample substrate for periphyton attachment, flood cycles usually occur at intervals greater than periphyton colonization and growth rates (i.e., the periphyton are either left exposed to desiccation by low flood cycles or flooded to depths where light becomes limiting.) Because of this, periphyton rarely attach to standing vegetation, but are instead attached to twigs, branches and trees which float with the flood cycles, thus providing well lit substrate near the surface of the water.

METHODS: The need to quantify periphyton growth potential on floating debris in BLH forests led to the development and construction of a simple plexiglass device especially suited for that purpose (Figure 1). The device consists of a sealed cylindrical float 15 cm in diameter and 75 cm long. Attached at one end, perpendicular to the main axis of the float, is a short 5-cm-diam cylinder. A pipe passes through the short cylinder and presses vertically into the sediment. This allows the float to swivel with changing currents and to rise and fall with floods, keeping the attached organisms at a uniform water depth. Artificial substrates for experimental growth of periphyton consist of strips of plexiglass (60 by 2.5 by 0.32 cm). The strips are prescored at 7.5-cm intervals throughout the length so that the 7.5-cm sections can be snapped off as uniform samples. Using this configuration, the smallest sample has a surface area of 37.5 cm^2 when both sides are used. The water column can be monitored at 7.5-cm intervals from the surface to a depth of 60 cm. Thirty strips can be suspended from each float. This configuration allows for flexibility in sampling design, e.g., replication and vertical resolution. During a study, the entire device is installed in a natural local depression after floodwaters provide enough depth to freely float the device. Installation in a depression maximizes water depth to keep the strips of artificial substrate from contacting the sediment between flood peaks. The biological sample scraped

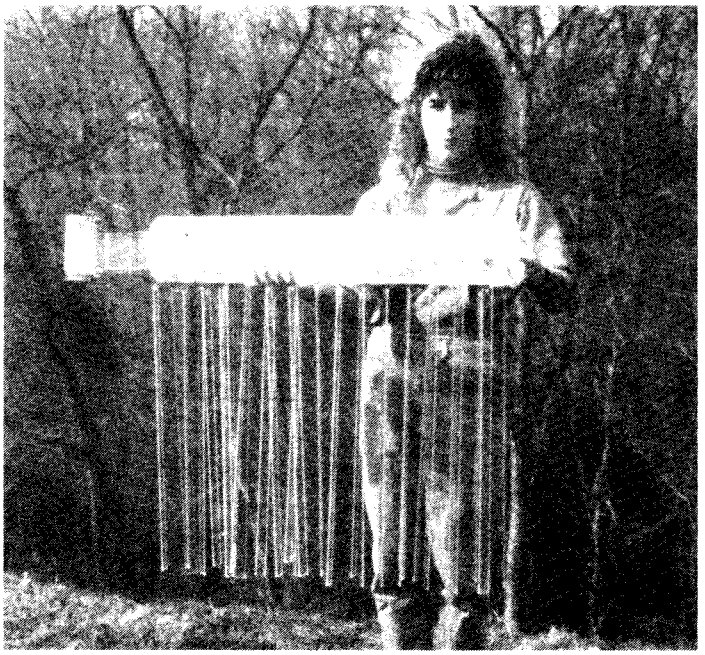

Figure 1. Photograph of the device developed to measure periphyton growth in BLH forests

from the plexiglass sections can be analyzed in many ways. Common techniques include pigment analysis and gravimetric measurement of biomass.

RESULTS: This device was used in a BLH study on the Cache River in Arkansas. Chlorophyll *a* was used as a measure of periphyton biomass. Maximum biomass was observed at the surface and decreased rapidly to very low values at a depth of only 0.5 m (Figure 2). This biomass was achieved after 9 weeks of growth. Six species of chironimid larvae inhabited the periphyton growing at the artificial substrate.

CONCLUSION: The device described herein can be used to quantify potential community production and to help elucidate the importance of this production to the function of BLH forests. The device can be constructed easily and inexpensively.

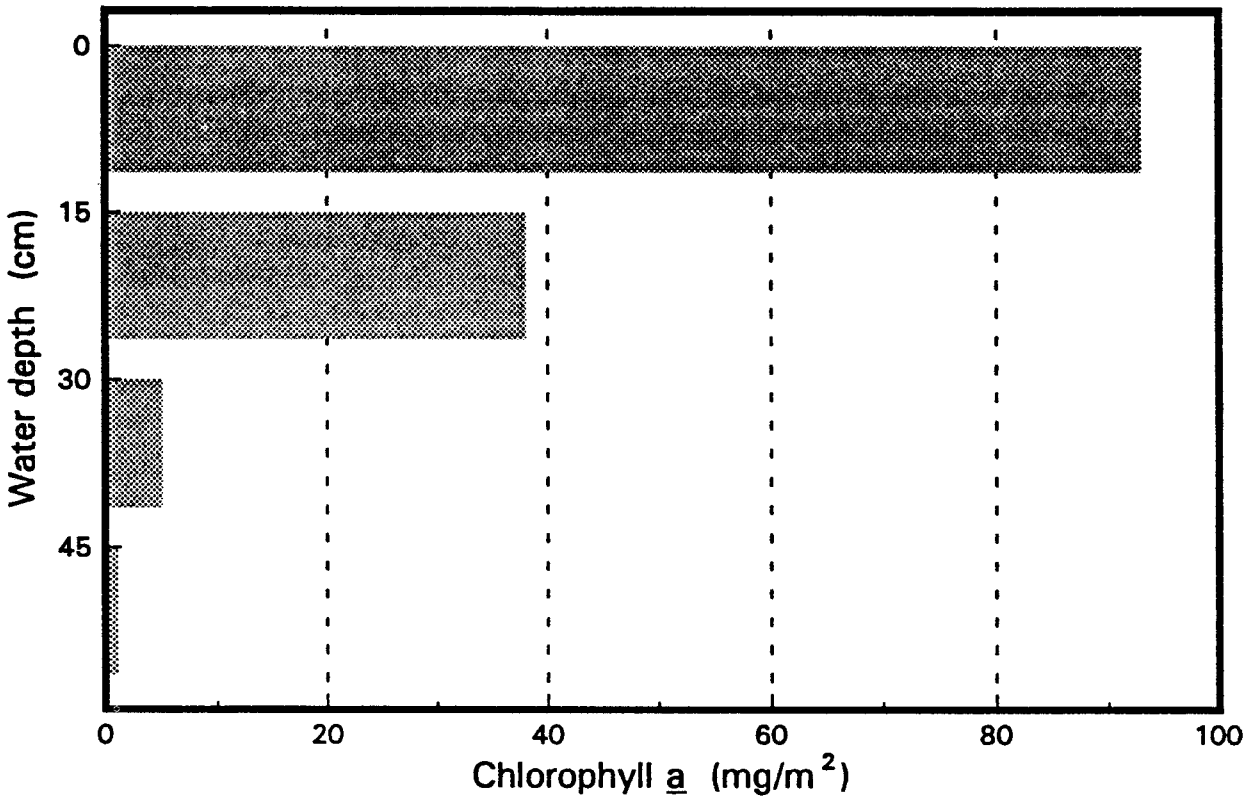

Figure 2. Graph illustrates the high biomass of periphyton present near the surface of the water and the rapid decrease with water depth

Results of field investigations using the device have shown that there is great potential for periphyton growth on floating debris in BLH forests during the flooded season of winter and early spring when most of the other primary producers in the system are dormant. Observations of invertebrates inhabiting the periphyton growths indicate that the periphyton may be an important food source and may provide habitat in the BLH during the flooded season.

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