



lecture resources  
*...bringing ecology to life*

# THE ECOLOGY OF FRESHWATERS

***A complete freshwater ecology course on CD-ROM.***

***PowerPoint presentations showing the variety of freshwater types, the species you are likely to find and the techniques you need to understand their ecology***

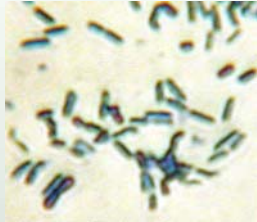
## LECTURE 3

### BACTERIAL, PLANT AND FUNGAL LIFE IN FRESHWATERS

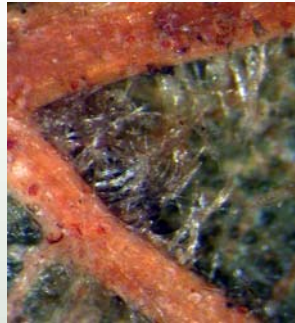


Photography, text & design by Pisces Conservation

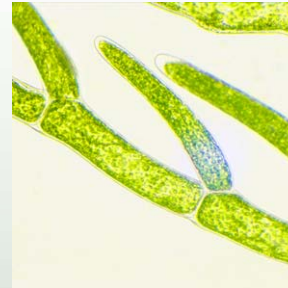
*At the base of all aquatic food chains are found:*



Bacteria



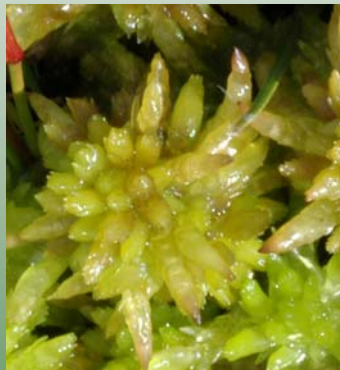
Fungi



Algae



Lichens



Bryophytes (mosses)



Pteridophytes (ferns)



Angiosperms (higher plants)

*All aquatic ecosystems are powered by the activities of these organisms*



Primary producers and decomposers in freshwaters

Bacteria are present in all freshwaters and in non-acid waters they are the dominant decomposers.



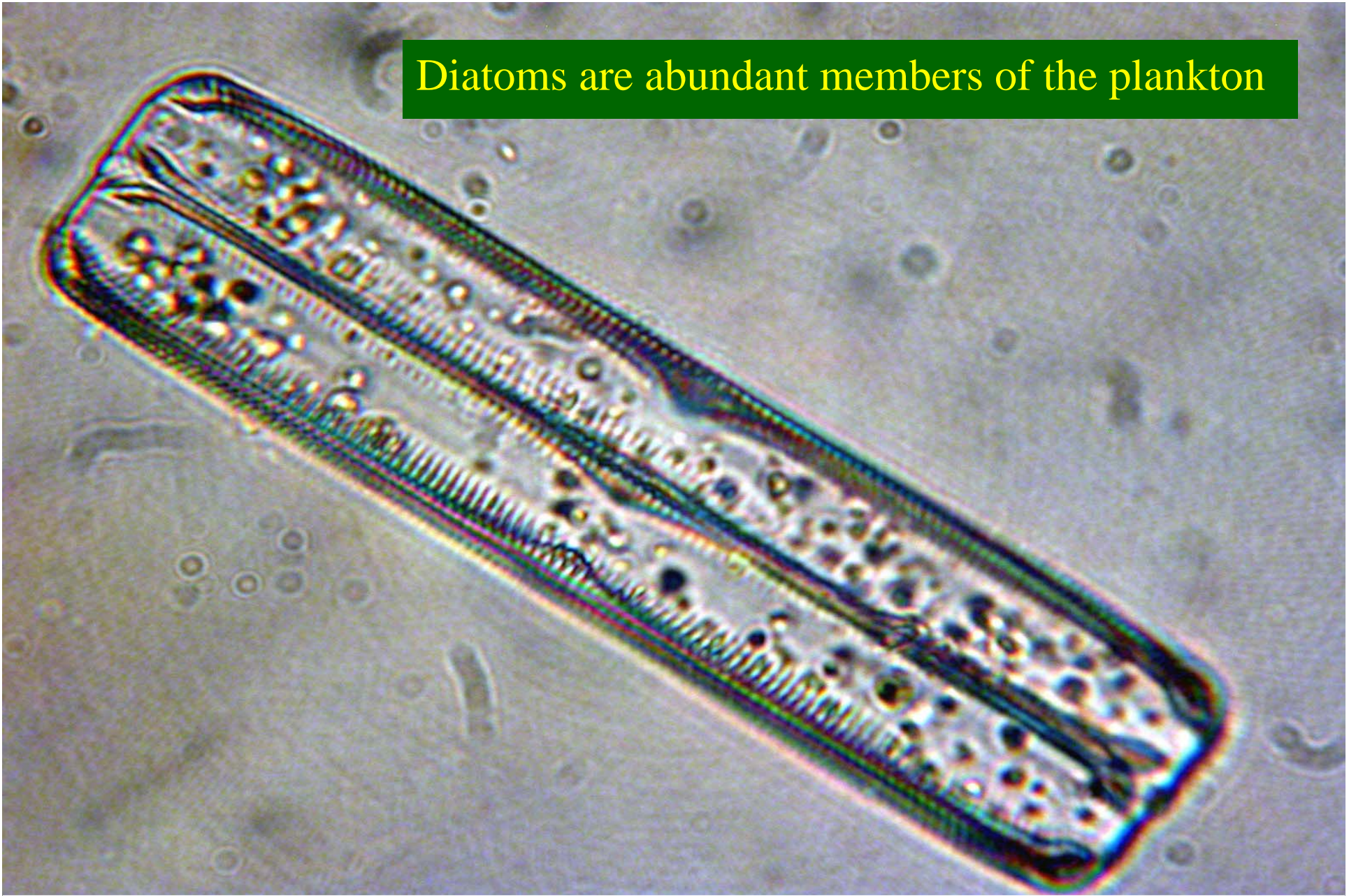
Bacteria

The morphologically simplest members of the plankton are the single-celled organisms such as blue-green algae (cyanobacteria), Chococcales etc.



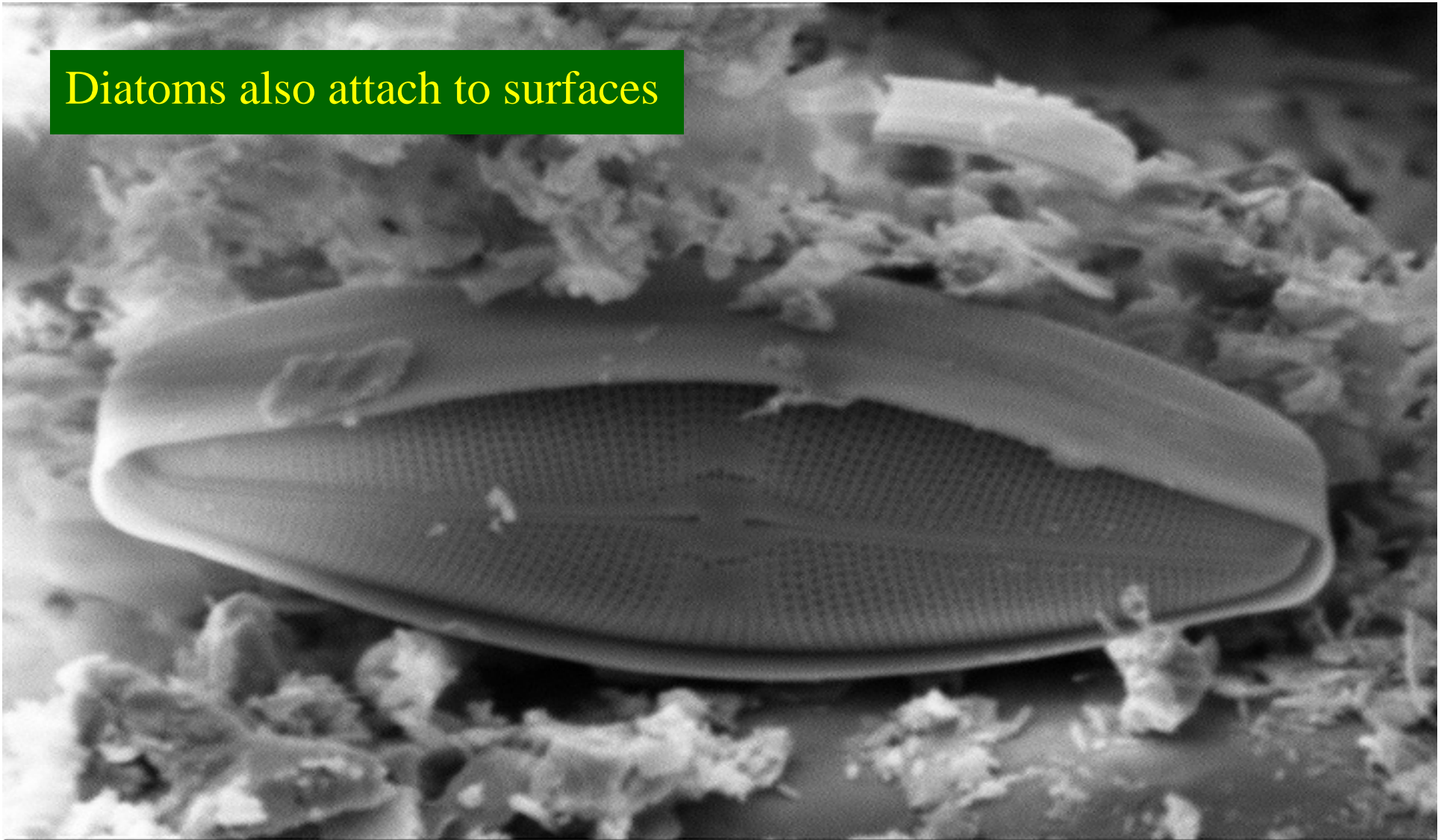
Planktonic algae

Diatoms are abundant members of the plankton



Planktonic diatoms

Diatoms also attach to surfaces



3 $\mu$ m  
|-----|

EHT = 10.00 kV

WD = 27 mm

Signal A = SE1

Date :26 Jul 2001

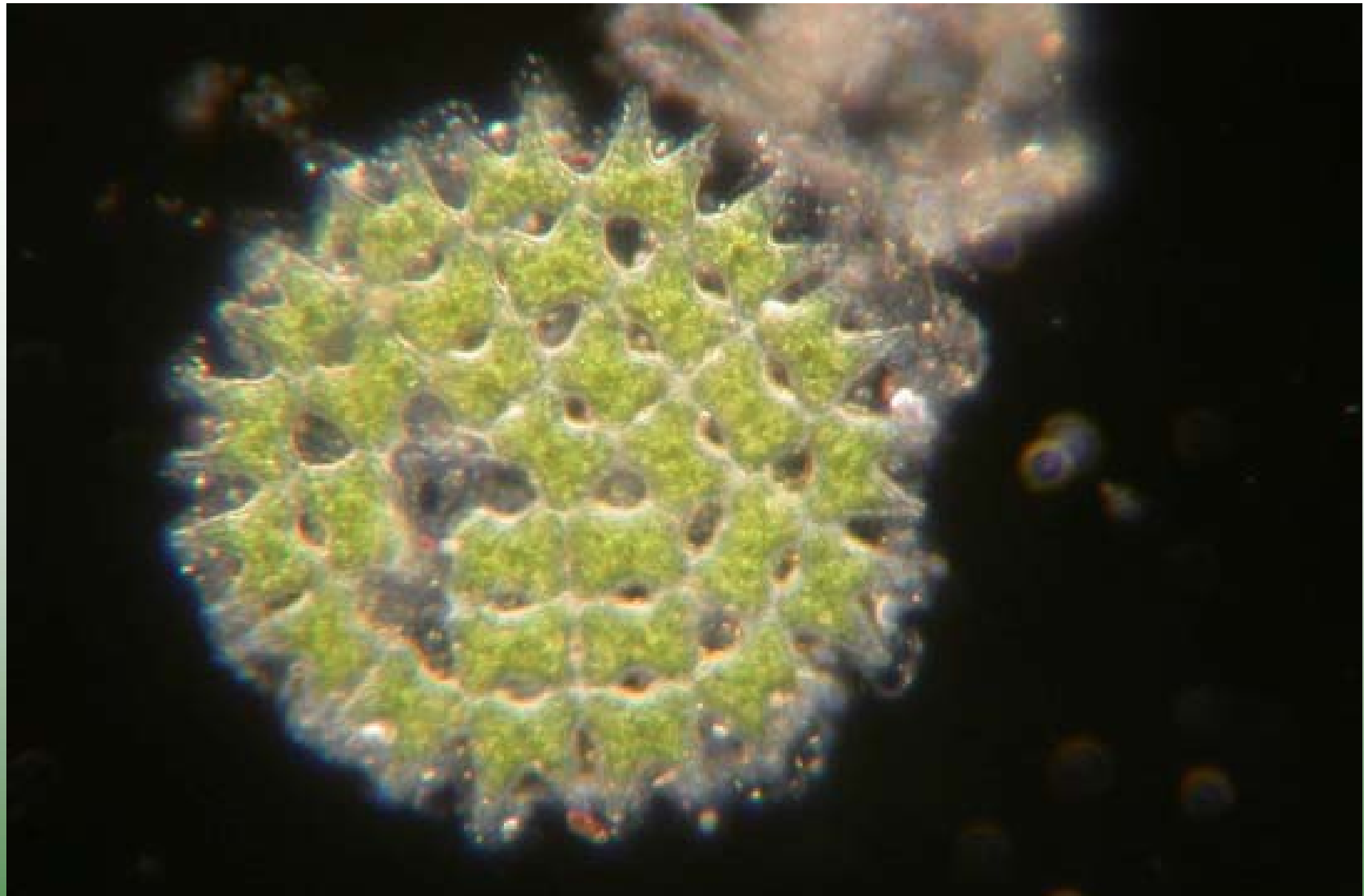
Time :12:35:14

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Benthic diatoms

*Note the size, this is about 45  $\mu$ m long*



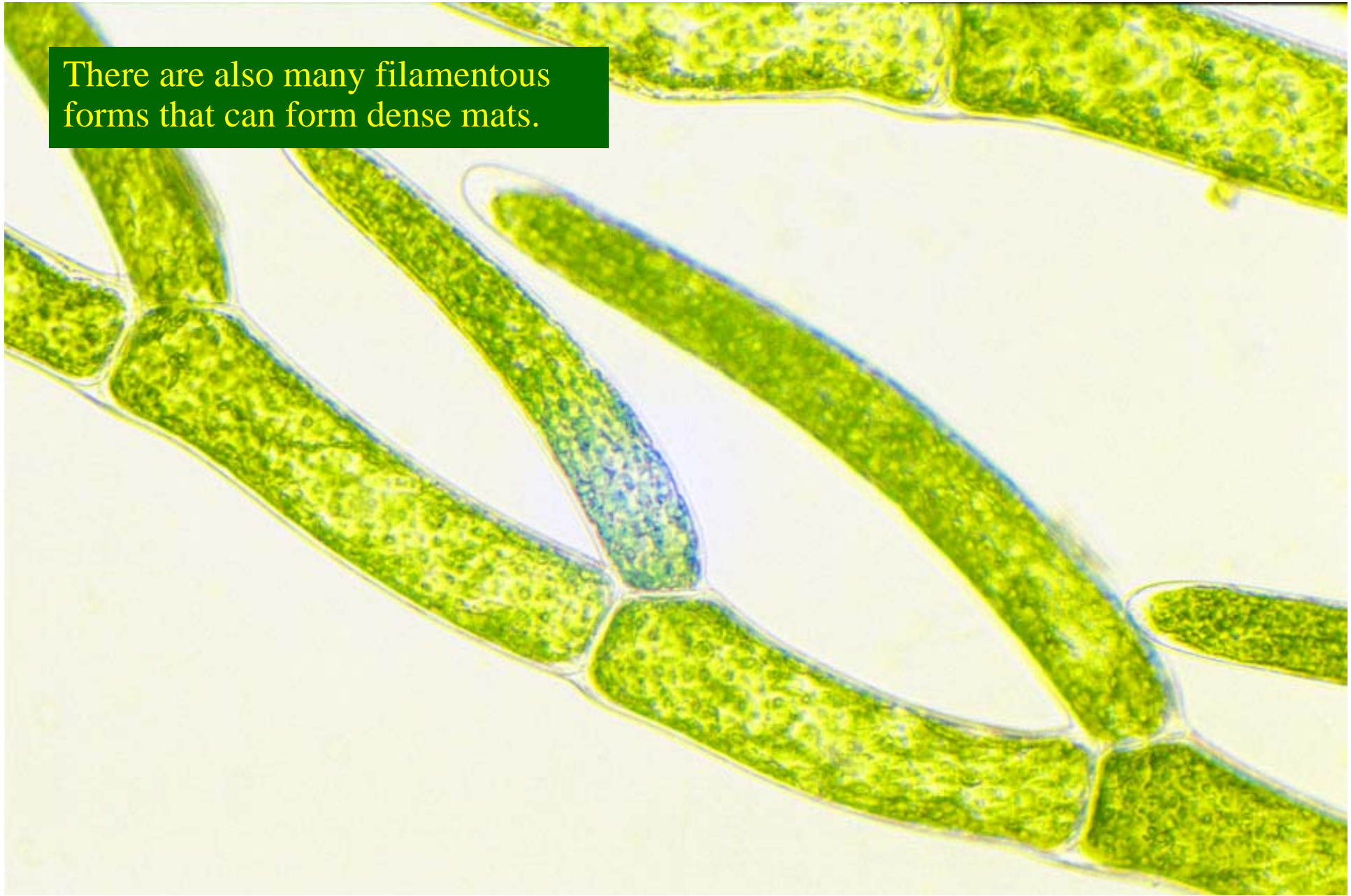
There are also actively swimming colonial forms.



Colonial swimming algae

*Pediastrum boryanum* var *cornutum*

There are also many filamentous forms that can form dense mats.

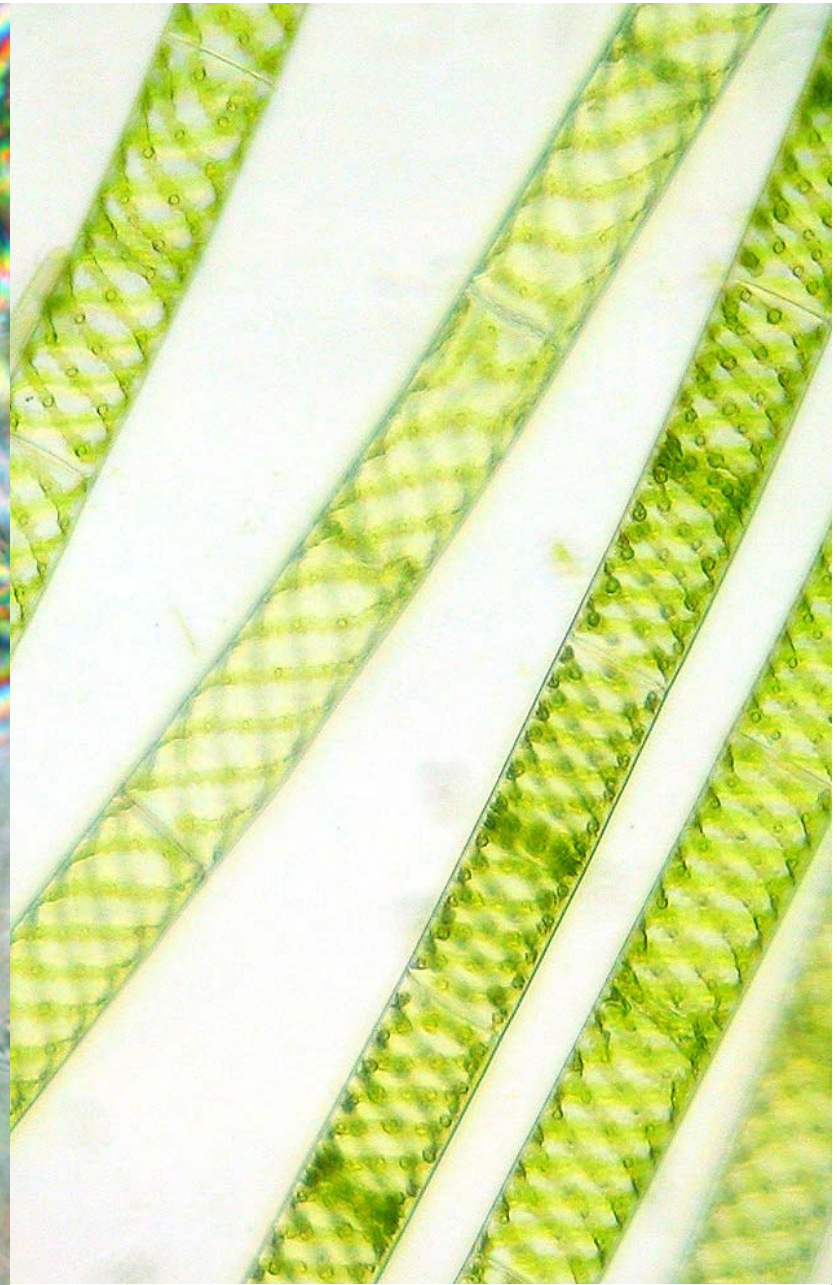
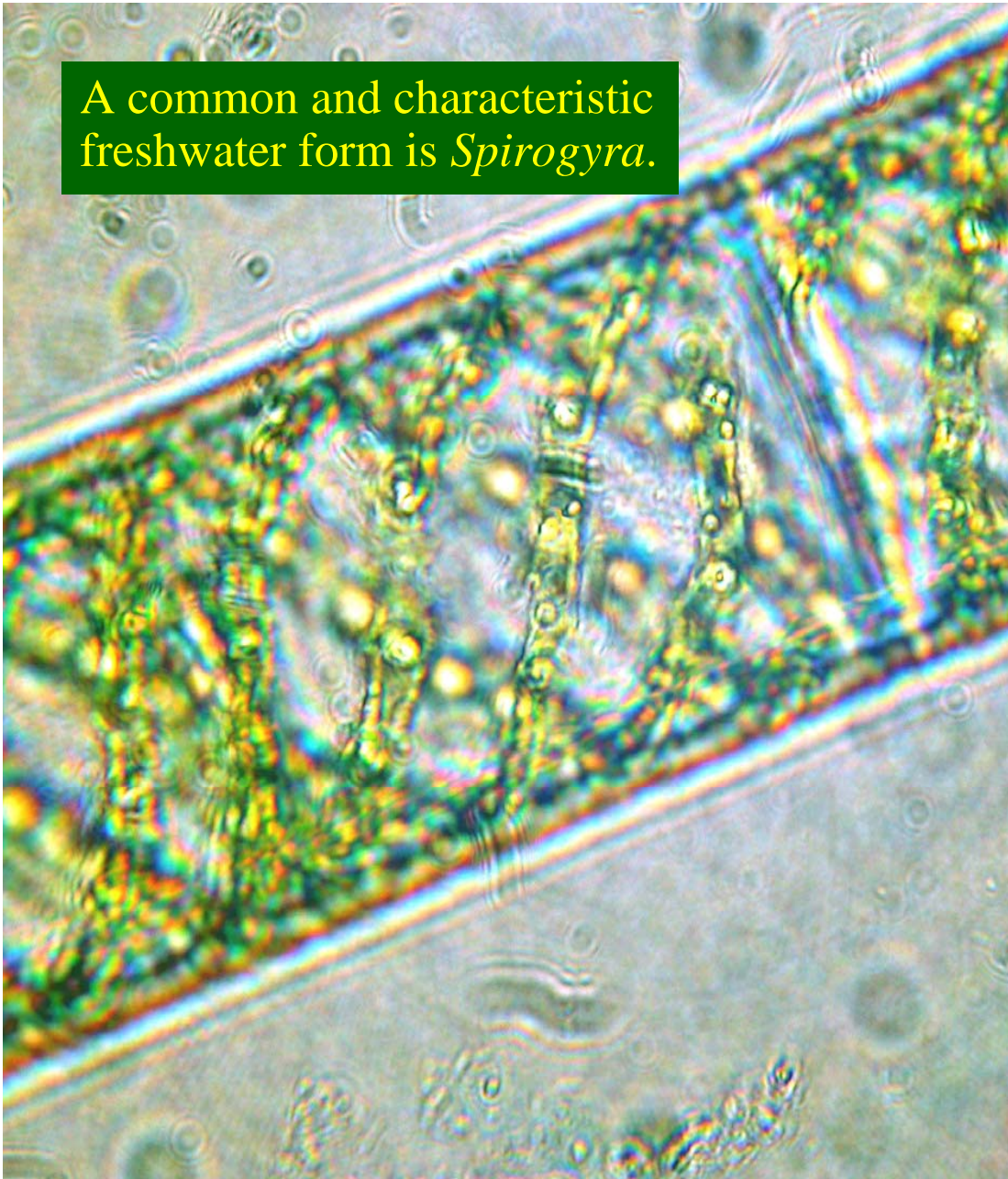


Filamentous algae

*Cladophora* sp.



A common and characteristic freshwater form is *Spirogyra*.



Filamentous algae

*Spirogyra* sp.

Enteromorpha is also very common.

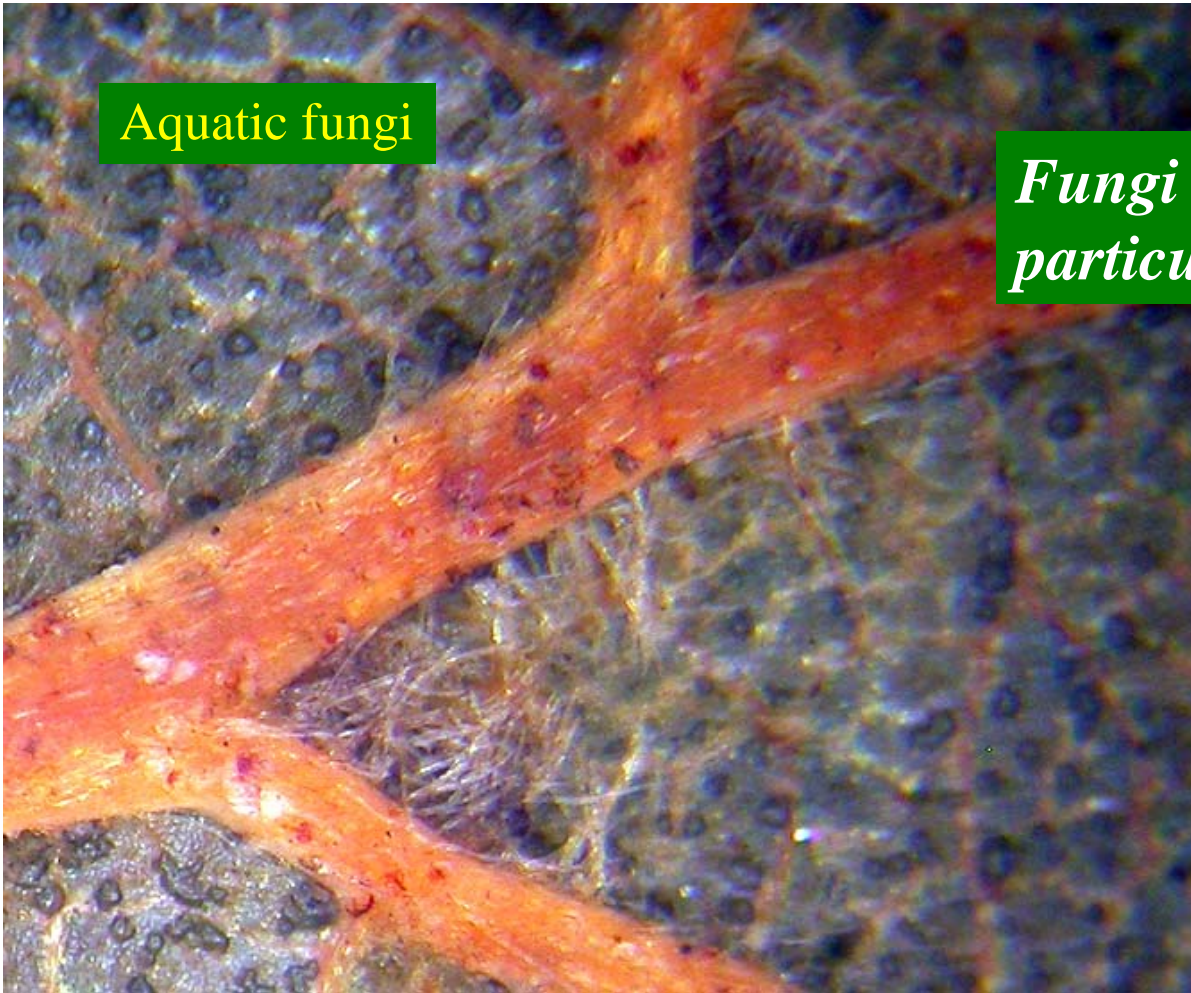


Filamentous algae

*Enteromorpha*

Aquatic fungi

*Fungi are major decomposers,  
particularly in acidic waters*



Aquatic fungi

Aquatic macrophytes are the conspicuous plants that dominate wetlands, shallow lakes, and streams. The term includes;

Aquatic angiosperms (flowering plants)


Pteridophytes (ferns)

Bryophytes (mosses, hornworts, and liverworts)



Aquatic macrophytes

*Amazon basin*



**Macrophytes are divided into four categories based on their growth habit**

***1. Floating unattached plants***

Roots, if present, hang free in the water and are not anchored to the bottom.



## Floating attached aquatic macrophytes



### *Floating attached plants*

...have leaves which float on the surface, but their stems are beneath the surface, and their roots anchor the plant in the substrate.



## Submerged aquatic macrophytes

### *Submerged plants*

... the entire plant is below the surface.



## Emergent aquatic macrophytes

### *Emergent plants*

...have roots below and stems and leaves above the water's surface.





## The importance of aquatic macrophytes in freshwater systems

Aquatic macrophytes play a vital role in ecosystems.

They are primary producers and an important food source.

They provide a substrate for algae and shelter for invertebrates and young fish.

They offer nesting sites for birds and mammals

They aid in nutrient cycling.

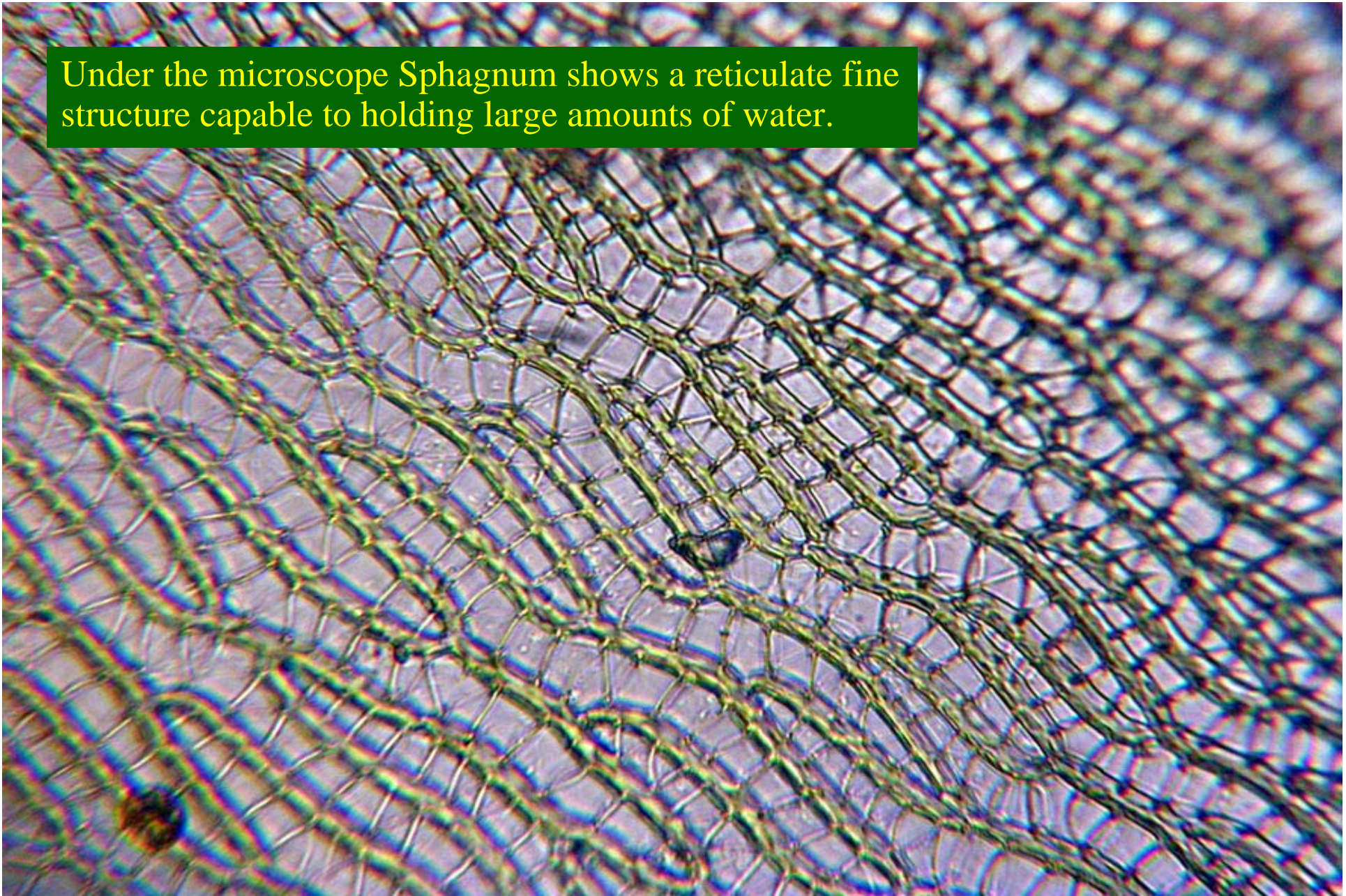
They catch sediments and help stabilize river and stream banks.



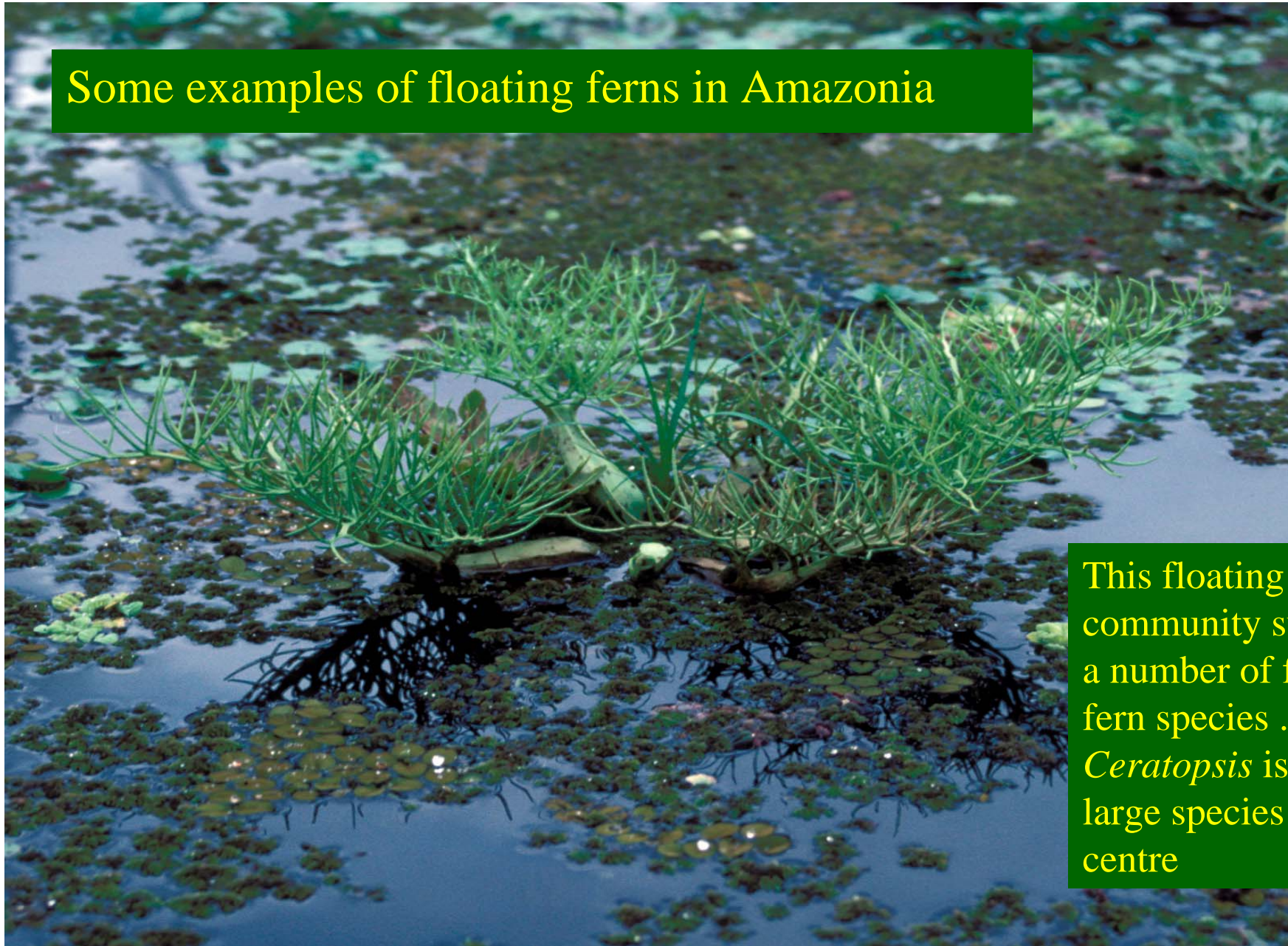
One of the most important aquatic mosses is *Sphagnum* which forms extensive bogs in temperate and sub-arctic regions



Under the microscope Sphagnum shows a reticulate fine structure capable to holding large amounts of water.



## Some examples of floating ferns in Amazonia



This floating community supports a number of floating fern species .  
*Ceratopsis* is the large species in the centre





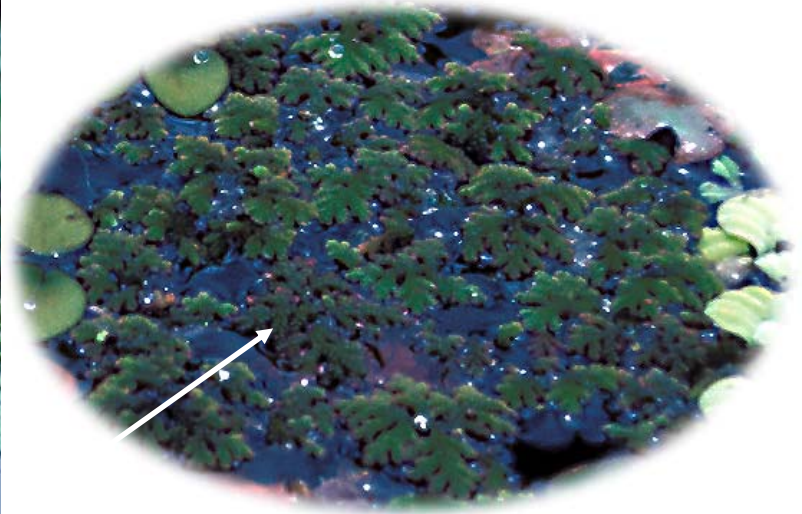
*Salvinia is a floating fern, common in both the old and new world. There are 10 species, some of which have become pests where introduced.*



Salvinia has round or oval fronds



*Ferns*



*Azolla* has minute fronds often with a reddish tinge. It holds the symbiotic blue-green alga (*Anabaena azollae*) which can fix nitrogen. This enables *Azolla* to thrive in low productivity waters.



The Angiosperms are found in all freshwater habitats and vary greatly in form and life style.



## Aquatic flowering plants 1

The smallest flowering plants known are tiny floating forms such as woflia (watermeal ) and lemna (duckweed)





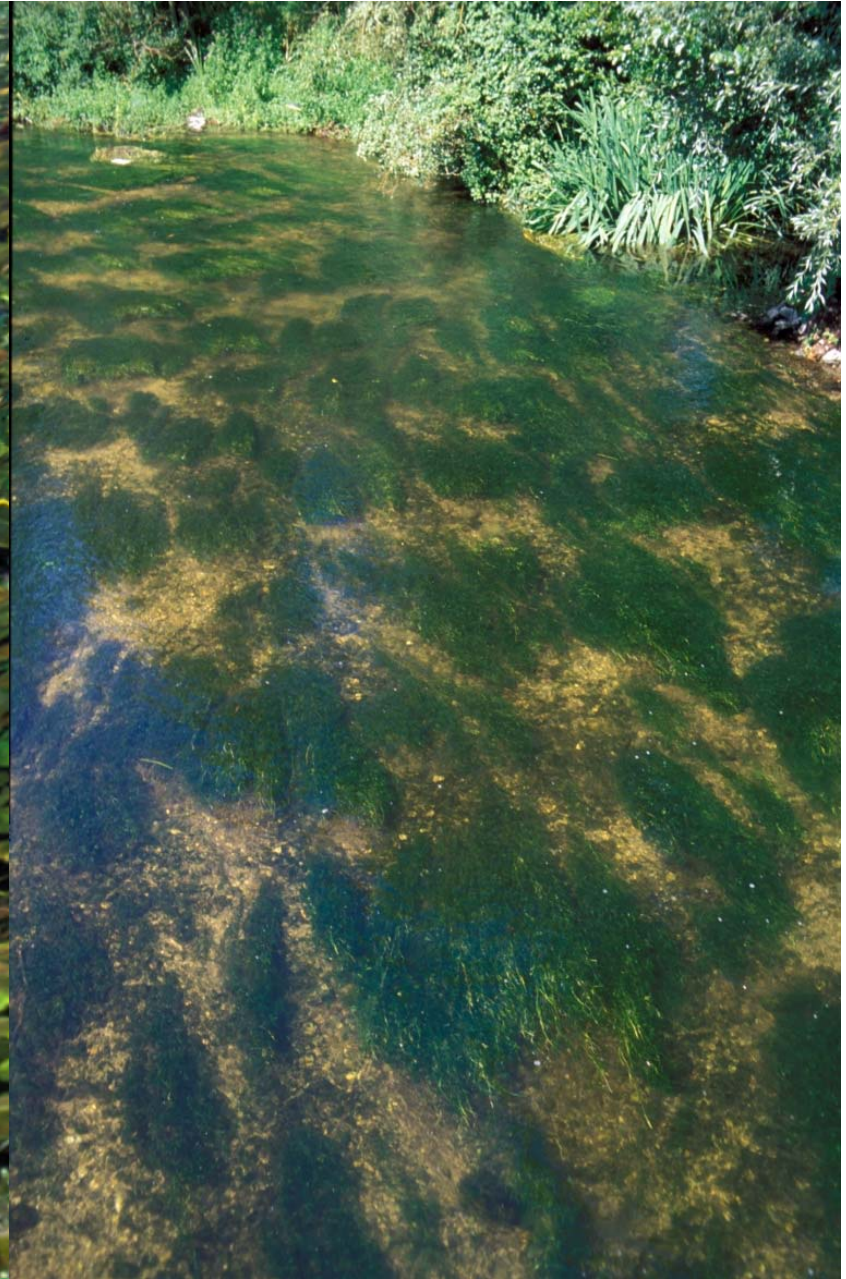
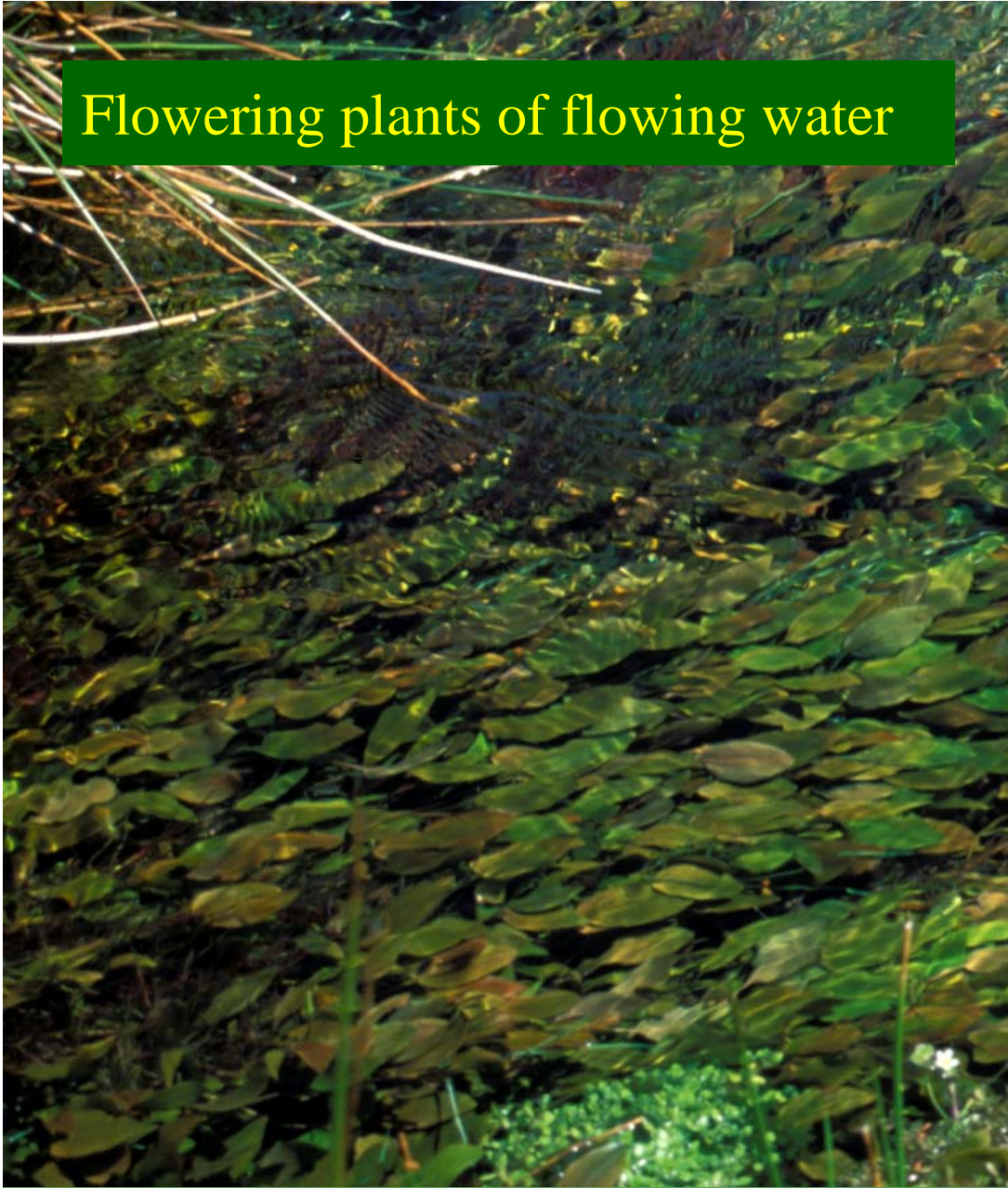
In shallow still waters with little depth variation, water lilies are often the dominant angiosperms and can reach a large size, shading out everything beneath them.



The flowers of aquatic angiosperms must be elevated above the water in order for pollination, whether insect or wind mediated, to occur.



Flowering plants of flowing water



Aquatic flowering plants 5

*Potamogeton sp* *Ranunculus sp.*

In many parts of the world aquatic grasses may form extensive floating meadows and are important habitats and human resources e.g.wild rice



*Floating meadow, Amazonia*



**Even trees can be semi-aquatic. These floodplain trees spend many each year underwater. Their wood is heavier than water – they will not float!**



**Flooded forest**

*Igapo forest, Amazonia*



Submerged trees during the Amazonian flood season



Aquatic environments are often low in nitrogen and some plants have evolved to catch small organisms to increase nitrogen intake.



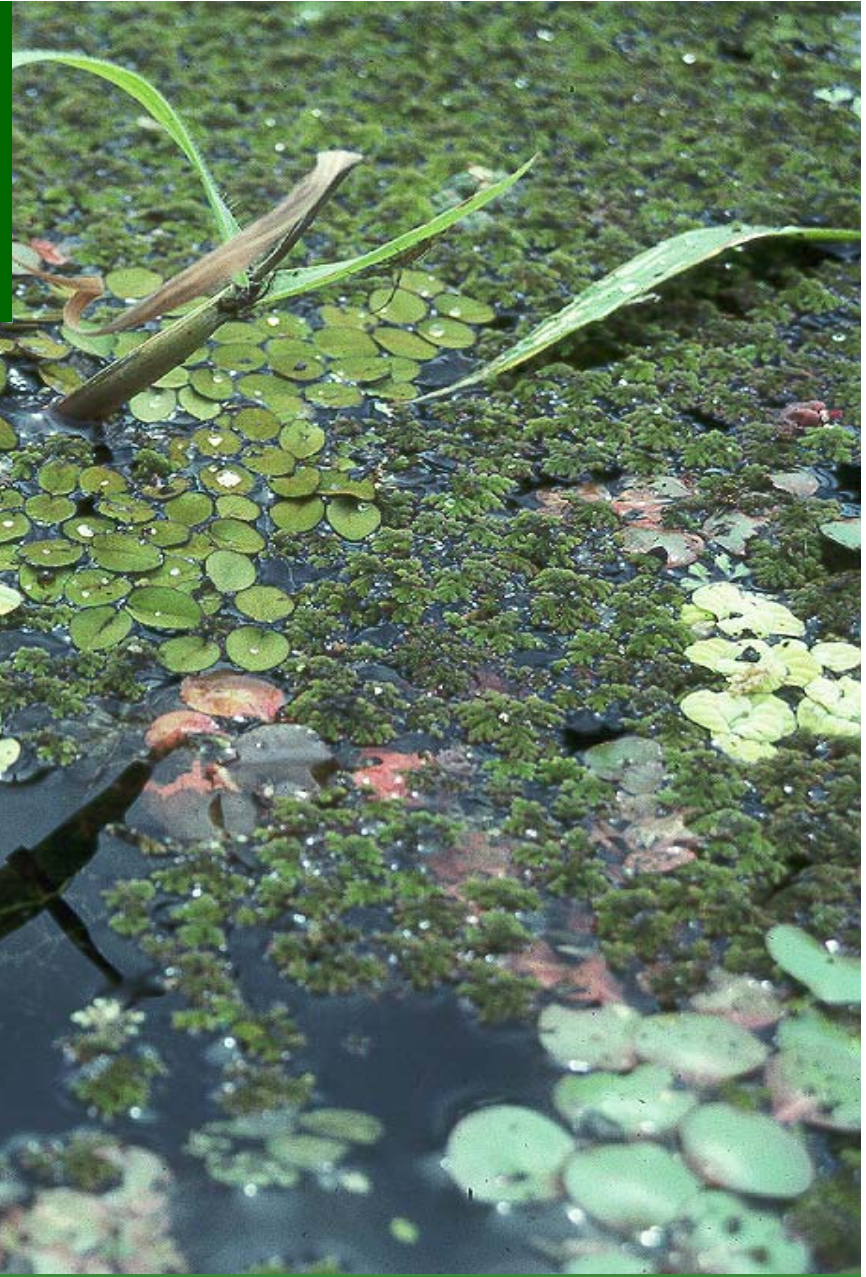
Fraser Island, Australia



Carnivorous plants

Sundew, *Drosera spatulata*

Vegetative reproduction occurs primarily via stem fragmentation, but in some species the whole plant (*Lemna*, *Eichhornia crassipes*), shoot fragments (*Ceratophyllum demersum*), or specialized organs such as tubers (*Hydrilla*, *Potamogeton*) are the means of dispersal.



## Reproduction of aquatic plants



Because of their rapid vegetative reproduction some plants can clog waterways - for example water hyacinth



Pest plants

Water hyacinth *Eichhornia Crassipes*

The speed of the water determines the type of plants found.



Fast water encourages low, encrusting forms



Slow flowing or lentic bodies can have large leafy forms present.



Light is the most important factor in determining the presence of plants

Light levels beneath the surface can be affected by many factors such as

- Depth
- Turbidity (sediment)
- Shading (trees etc.)
- Water colour (chemical staining)
- Ice formation

*Blackwater forest stream, Amazonia*



If large amounts of nitrogen and phosphorus enter freshwaters, algal blooms can develop which smother other plants.





**Flood resistant trees**

**Bankside grasses**

**Emergent vegetation**





**Flood resistant trees e.g. *Cecropia***

**Floating grass with attached roots**

**Floating unattached plants**

