

## Eutrophication: too much fertilizer

This activity is based on "Building a Bloom"

[http://www.bigelow.org/edhab/building\\_bloom.html](http://www.bigelow.org/edhab/building_bloom.html)

And "Terraqua Column" from *Bottle Biology*

[http://www.bottlebiology.org/investigations/terraqua\\_main.html](http://www.bottlebiology.org/investigations/terraqua_main.html)

Eutrophication is a process whereby water bodies, such as lakes, estuaries, or slow-moving streams receive excess nutrients that stimulate excessive plant growth. The plants can be algae and/or nuisance plant weeds. This enhanced plant growth, often called an algal bloom, reduces dissolved oxygen in the water when the dead plant material decomposes and can cause other organisms to die. Nutrients can come from many sources, such as fertilizers applied to agricultural fields, golf courses, and suburban lawns; deposition of nitrogen from the atmosphere; erosion of soil containing nutrients; and sewage treatment plant discharges. Water with a low concentration of dissolved oxygen is called hypoxic.

From <http://toxics.usgs.gov/definitions/eutrophication.html>

In other words, eutrophication occurs when a water-based ecosystem has too many nutrients. This phenomenon is also called nutrient loading. Unlike on land where excess nutrients can leave the soil and don't cause too much damage, excess nutrients in bodies of water have nowhere to go and can be disastrous.

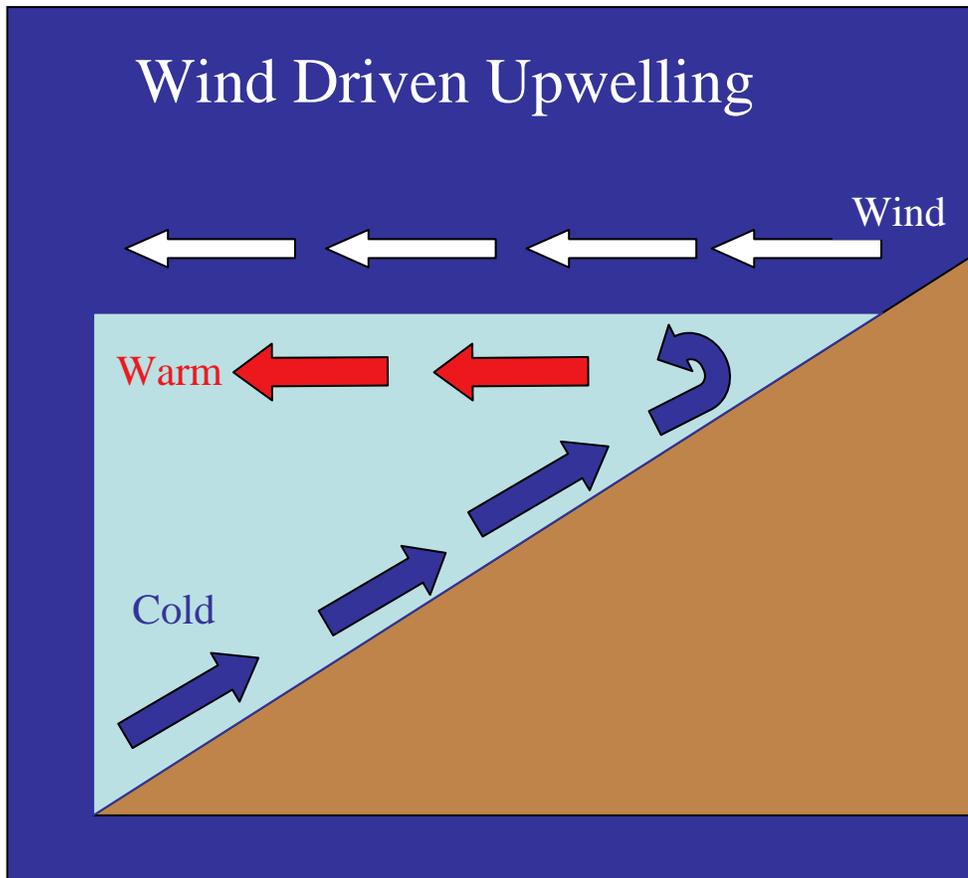
Are there examples in your community of algal blooms that have had negative effects on the ecosystem? Ask your local forest service agents, or county extension agents if anything like this has happened in your area. There have been bad algal blooms off the Oregon coast in recent years that have created 'Dead Zones' where the oxygen levels are so low that fish cannot survive.

Not all plankton blooms cause eutrophication, some are normal. Off the Oregon coast there is usually a large spring phytoplankton bloom that feeds all sorts of other organisms. These blooms are caused by upwelling of cold nutrient rich waters from the bottom of the ocean. Water upwelling is related to wind (related to another activity). When the wind blows off-shore (from the land to the sea) the water closest to the shore gets pushed away and water from below wells up (upwells) from below. (see diagram below). No bloom is just as bad as too big a bloom. There have been problems with this off the Oregon coast as well, but scientists don't know why. Since phytoplankton (algae) is at the base of the food chain in the ocean, when there aren't enough phytoplankton everything else suffers too.

Here's a link to an interview with local scientist Bill Peterson from NOAA in Newport. The interview was on NPR's "All Things Considered" and he was interviewed by Robert Siegel.

<http://www.npr.org/templates/story/story.php?storyId=4750600>

Attached is an article from *the San Francisco Chronicle* on the plankton blooms and upwelling. This topic links well with one of our other lessons.



An interesting experiment on eutrophication can be accessed here:

[www.umanitoba.ca/institutes/fisheries/eutro.html](http://www.umanitoba.ca/institutes/fisheries/eutro.html)

In this activity students will be creating their own ecosystems and experimenting with different amounts of fertilizer to experiment with how much fertilizer is too much for a body of water.

### Materials:

- One or two plastic 2-liter bottles (with caps). One for the basic system, and two if you want to make a covered ecosystem.
  - You can ask students to bring 2-liter bottles from home, save bottles yourself or ask other teachers, or go to a local recycling center and 'buy' them for 5 cents each.
- *Bottle Biology* chapter 1
- Sand and dirt
- Fertilizer
- Water (if using water from a 'live' source – stream or pond water or from an aquarium this is all you need)

The SMILE Program  
Summer Teachers' Workshop, 2005  
*Eutrophication: too much fertilizer*

- Algae culture – only if you use tap water. See *Bottle Biology* chapter 1 for a list of sources for algae cultures, or ask the biology teacher in your school.
- Equipment list in *Bottle Biology* chapter 1
- Seeds
- Cotton string

As a club, discuss how much fertilizer they think would be too much for the terrarium ecosystem and design an experiment to test their theories. The club should build at least 4 ecosystems, but you can build as many as you have materials for. One of your systems should be the control where you don't add any fertilizer at all.

Once you have an experimental design, have the club members break up into groups to make the ecosystems. Leave the ecosystems in a sunny window in your classroom and have club members observe what happens. If you make your ecosystems without tops you need to make sure that they don't dry out, especially when the seeds are germinating. You may have to water between club meetings. Have club members make observations of the conditions of the different ecosystems. What color is the water, does the ecosystem have a smell? If it does smell, is it a good smell, or a bad one? How much fertilizer is too much for your terrarium ecosystems? If you have access to microscopes you could have club members look at what's growing in your water.