New York State Federation of Lake Associations, Inc.

What's Phosphorus Got to Do with It?.

by M. Elizabeth Conners

What is Phosphorus, Where Does It Come From., and Why Is It So Important?

Phosphorus is important because it is a plant nutrient, or fertilizer. Aquatic weeds and algae, like land plants, require minerals from the soil to grow. just like land plants, aquatic plants respond to additions of fertilizer by growing thicker, taller, bushier, and more widespread. When the plant growth in a lake (the symptom) gets to be a problem, one of the most effective responses is to limit growth by reducing the amount of fertilizers (the cause).

Garden fertilizers contain nitrogen, phosphorus, potassium, and sometimes other minerals. For fertilizing land plants, nitrogen is the mineral needed in largest quantities and is generally the largest fraction of the fertilizer. Aquatic plants also need nitrogen and other trace minerals, and additions of nitrogen to lakes can also increase plant growth. The main factor controlling aquatic plant growth in most lakes, however, is phosphorus. This is because phosphorus is usually (though not always) the mineral that is in shortest supply relative to the plant's needs; even if other minerals are available in large quantities, if there is not enough phosphorus, growth will be slowed. Reduction in phosphorus input to a lake is often the target of a lake or watershed management program.

Sources of Phosphorus

There are two principal pathways that supply phosphorus to lakes. The first is from external sources, including runoff from the watershed, point sources such as sewage treatment plants, and atmospheric input. Controlling the external nutrient sources is the main reason why lake management programs include and emphasize proper management of the lake's watershed. Runoff from fertilized fields or lawns, livestock areas, urban and paved areas, and areas of soil erosion all carry phosphorus into the tributaries and eventually into the lake. Additional phosphorus is added from septic tanks, as well as municipal or industrial discharges. Some phosphorus is also carried from distant sources in rain and snow, and enters the lake directly through precipitation.

The internal supply of phosphorus to the plants in a lake is much harder to measure and control the phosphorus from external sources. Nearly all lakes have at least part of the bottom covered by soft mud or silt, which is usually very rich in phosphorus. In shallow water, these sediments encourage the growth of rooted plants such as milfoil or pond lilies. in deep water, phosphorus-rich sediments are at risk of becoming anoxic (lacking oxygen) and setting up a cycle of internal loading or internal cycling that can result in extreme algae blooms and water-quality problems.

Phosphorus compounds are part of a special chemical cycle in lake bottoms that is mediated by dissolved oxygen. Under most circumstances, phosphorus compounds are strongly associated (adsorbed) with soil or other particles. As long as dissolved oxygen is available, chemical attractions (primarily to iron oxides) bind most of the phosphorus to the sediment. If the lake begins to lose oxygen near the bottom sediments, however, a chemical shift occurs that releases the bound phosphorus back into the water and makes it available for plant growth. Once a cycle of anoxia and internal phosphorus loading from the sediments is underway, this internal supply can quickly become the controlling factor in the lake's rooted plant and algae growth.