The Mystery at Sunrise Farm Pond

Why are the fish dying at Sunrise Farm Pond?

Farmers at Sunrise Farm are planting crops for the season. They spread fertilizer on the field. The fertilizer contains ***chemical nutrients*** *that help plants grow. Much of the fertilizer is used by the plants or absorbed by the soil,* ***but not all****.* ***When it rains****, some of the fertilizer goes into the stream by the field and flows into the pond.*

Sunrise Farm Pond, like all ponds, has some ***algae growth****. The algae grow slowly and have a* ***very short lifespan****. When the fertilizer runs into the pond, the chemical nutrients that help the crops grow also help the algae* ***grow and reproduce much faster*** *than they had previously.*

The ***algae grow thick*** *at the top of the water, which makes the water cloudy and blocks the sunlight from getting to the bottom of the pond where many* ***producers*** *live. As a result, it is difficult for the producers to grow and they eventually die. Normally, in the process of making their food,* ***producers make much of the oxygen*** *the pond needs. As they die, the amount of oxygen in the pond from these producers decreases.*

Because algae have a very short lifespan, they die quickly, leaving a large amount of ***dead algae*** *in the pond. The dead algae are consumed by* ***bacteria****, which are decomposers. Like all decomposers, the bacteria use oxygen in their process of consuming/decomposing the dead algae. There are a lot of dead algae, so the bacteria use a lot of the remaining oxygen in the pond.*

The oxygen in the pond significantly decreases, so ***the things in the water that need oxygen to survive begin to die****. Mayfly larvae begin to die first because they are unable to move to other, more oxygen-rich areas of the pond. With fewer mayfly larvae, the minnows and perch compete for the food. Because perch also consume minnows, the minnow population decreases, both because they have a limited food supply (mayfly larvae) and are being eaten by perch. When one of the farmers checks on the pond a few months after planting the crops, she finds that several of the perch have died, because the minnow population decreased and perch had limited food supply so they also died.*

When pond organisms die, decomposer activity increases at all levels, which uses oxygen and continues to decrease oxygen in the pond.

Farmers often apply excess fertilizer to ensure that plants don't lack the chemical nutrients needed to produce high yields.

Chemical nutrients in fertilizer typically include nitrogen, phosphorus and potassium. "Nutrients" are different from food; they are not calorie-rich, but are important for other aspects of organism function.

Many different species of algae are typically found growing in ponds. The combinations of algae types in ponds vary based on season and geographical location.

Because chemical nutrients in fertilizer are soluble in water, they can be carried in "runoff" water following substantial rainfall.

The lifespan is typically on the order of days or weeks rather than months or years.

Many algae exist as single cells, which, as individuals, are not visible without the use of a microscope. However, when these algae cells are present in great numbers, they form clumps that are visible to the naked eye.

The algae naturally in pond water already have everything else they need to grow and reproduce at a slow, steady rate (i.e., there is algae growth in the pond even without the fertilizer runoff). However, the addition of the chemical nutrients causes the algae to grow and multiply faster.

These producers are mostly plants that are limited to their location at the bottom of ponds because their roots anchor them in the soil beneath the water.

The algae and the plants at the bottom of ponds are all producers, and all producers generate oxygen as a byproduct of photosynthesis. However, much of the oxygen produced by algae goes into the atmosphere (rather than into pond water) because the algae are mostly at the top of the water.

The algae reproduce before they die, so even though dead algae accumulate, there will still be an increasing number of live algae as long as conditions are favorable for their growth.

These bacteria are microbial decomposers. Like all consumers, these decomposers get their energy by using oxygen to break down their food.

The amount of oxygen available varies at different pond locations. Some organisms can move to locations with more oxygen and some cannot. Different organisms also need different levels of oxygen to survive. Populations of organisms that are most sensitive to oxygen shortages and cannot move to high-oxygen locations will tend to decrease first.