

nutrients is minimized, (2) much of the bottom is too deep and dark for plants, and (3) the shallow, well-lit side slopes are steeper than plants "like."

One way to minimize nutrient inflow is to locate the pond where little land slopes toward it so little runoff enters. Runoff can also be diverted away from the pond by means of earthen berms, diversions or grassed water-ways. A filter strip of unmowed grass and other low plants along the banks reduces nutrient inflow. Other aspects of erosion control are discussed in the section on landscaping below. If the pond is formed by a dam, an outlet structure that allows discharge from the bottom enables draw-off of nutrient-rich water that accumulates there in summer and winter.

As discussed, making pond depth 15 feet or more keeps much of the bed dark enough to reduce growth of rooted plants.

Submerged side slopes that extend 3 feet into the pond per foot of drop (a 3:1 slope) are sufficiently steep to reduce plant growth while not being so abrupt as to cause unreasonable danger to wading children. If the incline is of fine sand, it is likely to be unstable and slump if steeper than 3:1. Coarse sand, peat, or loam may be stable at a slope of 2 feet horizontal distance per foot of drop, and clay slopes of 1:1 may be stable. If your objectives are plant control and maximum amount of deep water, the steeper the side slopes the better, but a slippery clay incline of 3:1 or greater will be a great hazard to people or animals that might wade or stumble into the pond and be unable to keep their footing.

Wildlife Pond— Fishing Pond System

Ponds built in areas of heavy erosion or nutrient runoff will have a short life as a sport fishing pond. The erosion will fill in areas of the pond and, combined with the extra nutrients, result in increased aquatic plant growth. Under these conditions, it may be better to build a wildlife pond or a wildlife pond-fishing pond system.

Wildlife ponds or marsh ponds are

typically built with a maximum depth of about 6 feet. The average depth should be 1 to 2 feet. The pond bank should slope gradually at about 100:1. These conditions encourage aquatic plant growth that will be consumed or used for cover by various types of wildlife. Nutrient input from runoff is removed by the marsh plants. Nesting islands or boxes can also be placed in the middle of the pond to encourage waterfowl reproduction.

A wildlife pond can serve as a settling pond to cleanse water of excess nutrients and sediments when built in conjunction with a fish pond. Runoff water should be diverted away from the fish pond and into the wildlife pond by berms (mounds about 18 inches high and 3 or 4 feet wide). The wildlife pond should be separated from the fish pond by a dike. The dike will prevent sediments from moving into the fish pond and will prevent fish from escaping predation in the shallow weedy areas of the wildlife pond (see chapter 5, page 25). An overflow tube should be installed in the dike to prevent over-topping and dike washout during heavy rains.

A prototype wildlife pond-fishing pond system has been built near the Bird Sanctuary at the Kellogg Biological Station in Hickory Corners, Michigan. For more information on building and managing a Wildlife Pond-Fishing Pond System, contact your fisheries or wildlife Extension specialist at Michigan State University.

Surface Area

As a rule, the larger the pond, the more dependable its fish population will be. While trout ponds of only a quarter acre may support passable fishing if they have strong spring flow, most ponds don't provide satisfactory fishing unless they are a half acre or more—preferably much more.

Small ponds may need much more intensive care than large ones. The disadvantages of small ponds may be somewhat alleviated by making them very deep. Pond depth seems even more important to fish populations than pond surface area.

Landscaping and Erosion Control in the Pond's Surroundings

With a little planning, a fish pond and the area around it can be made very attractive. Decide whether you want a natural setting or a more lawn-like one. In a natural landscape, logs, stumps, rocks and uneven ground may be fitting. If much of the area is to be mowed, you may need to smooth the ground and eliminate obstacles during pond construction.

Plant cover should be established quickly on raw areas after construction to prevent erosion. Sod or a heavy stand of grasses and legumes is needed on areas of greatest slope and washing, such as berms, runoff diversion waterways, tops and slopes of dam embankments, emergency spillways, and bank slopes of the pond perimeter. The latter should be quickly vegetated back at least 20 feet from the water.

Deep-rooted plants such as alfalfa, sweet clover, shrubs and trees shouldn't be planted on earthen dams or fill embankments. Deep roots tend to weaken such structures and cause leaks. Some ponds need reinforcement, called "rip-rap," with stone of 8-10 inches (20-25 cm) diameter piled along the shoreline to protect against wave erosion, especially in the case of dam and fill embankments.

Mixed clumps of evergreens and deciduous trees, bordered by shrubs, provide food and cover for wildlife and give the pond surroundings a pleasing appearance. But trees and shrubs shouldn't be planted so near the pond that many leaves fall or blow into the water when shed. Leaves that get into the pond use up oxygen when they rot, and they create layers of litter on the pond bed, as well as furnishing nutrients for overgrowth of water plants. Keep such vegetation at least as far back from the water's edge as the greatest height the tree or shrub will reach—preferably much farther back than that. It isn't necessary to set evergreens so far back. Trees and shrubs on the shore area may also interfere with fishing.

Fence livestock away from the