Ponds in Drought[1]

Water volume and depth

Watershed or runoff ponds must be constructed with the proper amount of watershed to fill them under normal weather conditions. Average annual rainfall, soil types, land slope, vegetative cover and climate are some of the factors that will determine how much watershed will be required to provide an acre foot of water. The watershed must be able to provide enough water volume to fill the capacity of the pond basin.

Watershed ponds are affected by drought in a number of ways. The loss of water volume and diminished pond depth during extended drought is most obvious. Deep watershed ponds (12 feet maximum depth, or greater) may be built to contain extra water capacity to compensate for anticipated water loss during hot, dry weather. Relative to surface area, many runoff ponds contain inherently large water volumes and are deep due to hilly topography.

Most warm water fish production occurs in the 4 to 6 feet of water located near the surface. Under normal conditions, ponds with a maximum depth of more than 8 feet offer little benefit to fish production. However, extra water volume may be desirable where ponds are exposed to prolonged dry weather. Ponds located in arid lands may be constructed to maximum depths of 12 or 14 feet (Mattinson and Glassock 1997). During drought, shallow ponds may dry up or fish may die due to compromised water quality. Shallow ponds that can be readily topped off with ground or surface water may not need the extra capacity. The capacity of irrigation, livestock, hydrants and some reservoirs may be maximized relative to the pond's surface area in order to supply large amounts of water during dry conditions.

Seepage and evaporative water loss

Many ponds leak small volumes of water either constantly or periodically. Excessive pond seepage may result when ponds are constructed in inadequate or poor locations, or they are improperly built. Poor sub soils containing too much sand, gravel, silt, rock formations or too little clay may allow for excessive seepage under normal weather conditions. Water may seep through the basin of ponds where the clay barrier is not adequate to provide water retention. Some pond dams are constructed without adequate topsoil removal which prevents proper sealing and compaction at the base. Water may leak from under the dam and in severe cases may cause a collapse. Some soil types require the construction of a core trench to anchor the dam into the sub soils. Quality clay soil is compacted into the trench and core of the dam to prevent seepage and possible dam failure. Ponds may lose water around plumbing structures such as drain and overflow pipes installed in the dam. Anti-seep collars should be placed on all drain pipes and other plumbing built into dams. These barriers prevent water movement along the outside of pipes which may compromise the dams' integrity. Large trees and shrubs growing on dams may cause seepage by the piping of water along root structures and may eventually weaken the embankment. Woody vegetation growth should be prevented on dams.

During some years, evaporative water loss may be compensated by direct rainfall into the pond in humid environments (Boyd 1990). However, dry season water loss may not be replenished with direct rainfall until months later. Ultimately, watershed runoff must supply the most timely water replacement during the warm season and the majority of the volume throughout the year.

Physical and biological effects of low water levels

Pond shorelines exposed by receding water levels during drought may create a number of pond management problems along with a few opportunities for pond managers. With large portions of the pond basin exposed, the clay basin liner may develop deep cracks. Marginal clay barriers may become damaged and seep upon re-flooding, or seepage problems in ponds that already leak may become more severe. Low pool levels offer some opportunities to renovate dams and remove some silt and debris once the basin can support heavy equipment. Care should be taken to avoid damaging the clay liner during such renovations. Properly repair any damaged areas of the basin with compacted blankets of quality clay soil.

Water quality should be carefully monitored during low water conditions in order to maintain fish populations. Dissolved oxygen depletions may become more frequent and more severe due to the elevated temperature of shallow water and as organic material such as plants and algae decompose. Aeration devices may be required to maintain adequate dissolved oxygen concentrations (>5 mg/L) particularly in ponds where fish are heavily stocked and fed (> 1,000 lbs per acre). Increased water temperature, pH and reduced water volume may lead to elevated concentrations of toxic un-ionized ammonia gas (NH_3). Feeding should be restricted and supplemental water added to the pond, if available, in an effort to reduce un-ionized ammonia concentrations.

Low water levels may reduce or eliminate shallow water nursery habitat used by young game and forage fish species. Concentrated predation by larger fish may positively or negatively affect future sport fish population balance in a pond or lake. Beneficial predation may occur when carnivorous fish reduce over abundant forage. However, excessive predation of young game and forage fish could limit food availability to larger fish and delay their recruitment into the fishery. Predators such as water snakes, fish eating birds and river otter may prey more readily on concentrated fish populations confined in shallow water.

Aquatic plants and filamentous algae may have more shallow water habitat, less than 3 feet in depth, to extend their growth and increase density during low water levels. Increased vegetation growth in shallow water may interfere with fish feeding, seining and sport fishing activities. Ponds filled with aquatic plant and algae growth may increase the habitat in which small game and forage fish species hide and avoid predation by larger fish. Such conditions could contribute to an overabundance of small fish and cause a future imbalance in pond fish populations. Lake managers may

struggle to control aquatic vegetation growth in shallow waters. Contact herbicides and algaecides should be used with care to prevent chemical toxicity to fish and to avoid oxygen depletions.

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