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Old Beyond Years

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Valuable is the lake front property--until the lake begines to stink.
Lucky the fisherman--until he can only catch rough fish.
Happy is the boat owner--until green scum coats his dock, his boat, his water skis.
Forunate is the nearby city--until water from the reservoir testes and smells rotten.

Because geologic creation did not grace the Texas landscape with natural bodies of water, all standing water over 5,000 acre feet in the state is in manmade reservoirs built since 1930.

Many of these reservoirs are already showing signs of old age.

All lakes age naturally by filling up with sediment and decomposed organic matter; however, many natural lakes formed thousands of years ago are younger in lake age than modern Texas reservoirs.

When a reservoir is no longer able to serve its intended functions-- water conservation, power plant cooling, flood control, recreation, or municipal supply --it is considered functionally extinct. It is also extinct when the cost of maintenance is more than the benefits derived from it.

An extinct lake may fill up with silt and organic material so that it is no longer able to hold water for flood control or conservation just as a reservoir designed for power plant cooling will not be functional when filter-clogging algae or plants become too big a problem. Environments unsuitable for good fish to survive or water unpleasant to look at or drink are other signs of extinction.

Many lakes within the state will become extinct long before they should unless management practices are developed to slow down the rate of plant production.

Reservoir planners estimate the useful lifespan of a reservoir before construction ever begins. Nutrients, light, temperature, and watershed sediment load are all considered in determining the number of years of expected usefulness. Lifespan for Texas reservoirs is considered to be only 100-125 years.

The major sign of advanced age in Texas reservoirs is excessive algae and weed growth encouraged by an oversupply of nutrients, shallow lake basins, long hours of sunlight, and mild winter temperatures. Agencies such as the Soil Conservation Service have educated farmers, highway builders, and developers to minimize sediment load in runoff. The siltation problem (reservoir filling up with sediment from fields upstream) is no longer as major as it once was.

Reservoirs Studied

A current study at Baylor University funded by the Texas Water Resources Institute could mean longer, more useful lives for Texas reservoirs.

Dr. Owen T. Lind, a biologist at Baylor, is studying the lake-aging phenomenon called eutrophication. He feels that the rates of eutrophication can be reduced--even reversed--with proper lake management. Lind and his team of limnologists (scientists who study the physical, chemical, and biological conditions in fresh water) are studying factors which cause accelerated aging in reservoirs.

The sizable surface water storage in reservoirs--more in Texas than in any other state except Alaska--is a valuable state resource. With proper management, Texas reservoirs can provide many more years of benefit than if allowed to "age" at the present accelerated rate.

What is proper reservoir management to prevent accelerated eutrophication? No one knows for sure, according to Lind. There is simply not enough documentation on reservoirs, especially those in temperate climates. Lind does feel that overproduction of plants is the number one problem in Texas reservoirs. He is also confident that retarding the growth rate of water weeds and algae should retard the rate of eutrophication and that this should be easier to accomplish in reservoirs than in natural lakes.

Lind explains that there have been misinterpretations in reservoir management because it is patterned after natural lake management in northern climates. "We don't know what factors are governing the productivity of the reservoirs and what management practices should be undertaken to lengthen the useful time of the reservoir. There is simply no adequate body of knowledge on man-impounded reservoirs in the South."

Two Reservoir Types

There are two basic types of reservoirs in Texas: soft water, protected lakes of East Texas and hard water, wind-whipped lakes found in Central and West Texas. East Texas lakes, protected by hills and trees, are quite clear and stable and are typical of reservoirs fauna throughout the Southern Pine Forest states.

Central and West Texas lakes, and those throughout the Central and Southwestern United States, are generally shallower than those in East Texas and have almost constant suspended turbidity. Water in these reservoirs may be as much as ten times as hard with twice as much phosphorus and other nutrients as those lakes in forested areas. The chemical nature of the lakes is very different because of the types of runoff areas: forest land in East Texas, limestone and agricultural land in Central and West Texas.

Rooted water weeds such as water hyacinth and hydrilla choke entire areas of East Texas lakes. Rooted plants are not a problem in Central and West Texas lakes because of the wind and turbidity. Overproduction in these lakes is in the form of a floating microscopic algae.

Lind and his research team chose Lake Sam Rayburn as a typical East Texas lake and Lake Waco as a representative Central or West Texas lake. Rayburn and Waco are the same age lakes, each completed in the mid 1960's. Rayburn is much larger--a characteristic of Eastern lakes. Retention time in West Texas lakes is much shorter than in the large lakes of East Texas. The average stay in Lake Waco for a given water molecule is only thirty-three days.

Factors Analyzed

The Baylor researchers are analyzing chemical, biological, and physical makeup of each lake, hoping that the differences in the reservoirs will help find common factors affecting overproduction in all lakes.

Some of the questions they hope to answer with the research are, "What factors regulate or govern production?" "How important is it that the reservoir is wind-whipped or protected by forest?" "What difference does it make that the water is ten times as hard or that the phosphorus content is twice as much or that the forms of phosphorus are different?"

Specifically Lind is looking at the rate of growth at the base of the food pyramid rather than trying to assess the total productivity of a lake. He explains that total productivity--plants, animals that eat the plants, animals that eat the plant-eating animals--are all dependent upon the base. Even though Lind is not specifically studying the production of fish, his understanding of what is controlling the production of plants "will help in developing policy best for bass and crappie, and all those other good things from a lake."

The rate of growth (photosynthesis) is measured by determining the rate which carbon dioxide is actually being made into plant tissue and the quantity of producing plants is measured by the actual amount of chlorophylls that are present in the water.

At the same time these tests are made, a broad spectrum of environmental variables is measured. Potential nutrients such as phosphorus, nitrogen, and silicon as well as sunlight energy, temperature, and suspended turbidity are some of the variables studied during tests conducted at two-week intervals.

Tests are made on the project's floating laboratories: a 20-foot deck boat, a 35-foot cabin cruiser for rough weather, and a small flat- bottom boat used by the team's skin diver. More extensive analyses continue at the well-equipped water lab on the Baylor University campus.

Management Practices

Lind will not be in a position to recommend reservoir management policy until his study is completed in 1979.

Obvious management practices to slow plant production, however, are reduction of new nutrients coming into a reservoir or removal of nutrients already there.

Sewage effluent is a principal source of nutrients. Almost all of the treated sewage in Texas is heavily loaded with phosphorus and nitrogen because tertiary treatment to remove them is not required. Another major source of nutrients in reservoirs is agricultural runoff. The same nutrients a farmer adds to his fields, when washed into a reservoir, will certainly stimulate plant production.

Flushing at certain times of the year when the water in a reservoir is loaded with nutrients is desirable if the practice is compatible with reservoir management of flood control or conservation. For instance, the first heavy rain in the spring is loaded with nutrients and could be flushed immediately. Later runoff is relatively clean.

Surface water in lakes does not have as many nutrients as lower layers because the nutrients have been taken up by plants. When the plants die, they sink to the bottom and release nutrients into that layer. Plant harvesting is a way to remove existing nutrients from a reservoir. There are experiments underway using large floating harvesters to cut and bail water weeds to be used for cattle feed.

Since deep lakes thermally stratify (layer) according to temperature, properly built dams could flush out the layer of cold bottom water which is high in nutrients. Merely flushing the nutrients on downstream to another reservoir or into the bays and estuaries should not, however, be the ultimate answer. Because light is an important factor in plant growth, another possible way to limit plant production in future reservoirs would be to construct deeper basins. This would minimize surface area and light exposure to total water volume.

Lind hopes that his analysis of factors affecting plant production in reservoirs will aid policy makers in optimum reservoir management and ultimately in the management of entire river basins.

It could mean many added years of pleasure and value from Texas reservoirs.

Meanings for Uncommon Words

algae n, pl: the principal plant life of most large lakes. It is usually seen as a brown, green, or red scum or seaweed around a lake edge or on the water surface.

eutrophication n: the natural aging of a lake. All lakes--like people--are aging and will eventually die. Lifespan and usefulness of lakes--like people--can be lengthened and enhanced by proper care.

limnology n: the study of fresh water. An important word for Texans who fish, boat, live on flood plains, or drink water. Scientists who study limnology are called limnologists.

nutrient n: something that promotes growth. Nutrients such as phosphorous and nitrogen promote plant growth in lakes just as they do in fields and lawns.

plankton n: tiny plants or animals which float on or swim in water.

reservoir n: a manmade lake. (A lake is an inland body of standing water.)

stratification n: the layering of lake water according to temperature. During summer months, warm water on the top of lakes does not mix with the cold, nutrient-laden water underneath.