



CLASSIFYING LAKES FOR BETTER MANAGEMENT

Short answers to frequently asked questions about lake classification

- Why are lakes classified into different categories?
- What is trophic status and why is it used to classify lakes?
- How are Minnesota lakes classified for shoreland management and planning?
- Doesn't the Minnesota Department of Natural Resources also categorize lakes based on what kind of fish could live in them?
- How is hydrology used to classify lakes?
- How are lakes classified for water use?
- Why are there so many different ways of classifying lakes? Which is the right one?
- Who can I contact if I have questions or a problem related to classifying lakes?
- What are some additional resources related to classifying lakes?

Why are lakes classified into different categories?

Lakes are classified in many different ways to help identify similarities and differences, to assess ecosystem health, and to help establish policies and regulations. Lakes are most often classified based on their productivity, i.e., the amount of algae and aquatic plants that the lake can support. They also may be classified based on size or hydrology (drainage), plant or animal communities, or the way humans use them (water supply, recreation, amount of development, and navigation). Classification strategies are used to formulate shoreland regulations, fish stocking plans, utility forecasts, flood control, or other management plans. Categorizing, or classifying, lakes also helps prepare realistic plans for restoration work.

What is trophic status and why is it used to classify lakes?

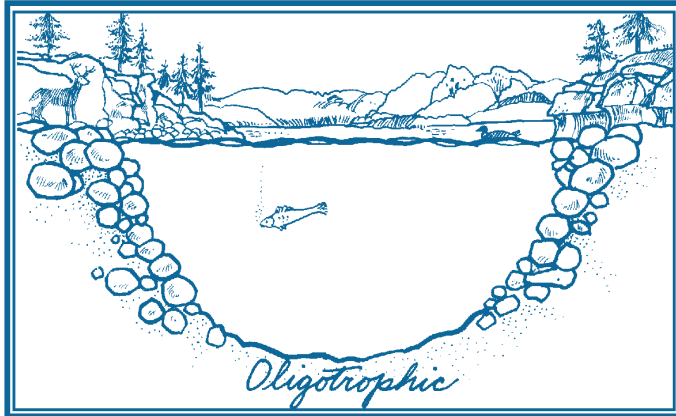
One common method for describing the health of a lake is to identify its trophic status. Trophic status is an indicator of how much growth or productivity occurs in the lake. Productivity is directly related to the availability of nutrients. Low productivity, nutrient-poor lakes usually have clear water and are called oligotrophic. Lakes of this type are common in northeastern Minnesota. Moderately productive lakes are defined as mesotrophic. Nutrient-rich lakes with high levels of productivity are called eutrophic and often can be murky and green, because of algal growth.

As concentrations of nitrogen and phosphorus increase, one can see important changes in the balance between algae in the water and

rooted plants, such as pondweeds and milfoil. In particular, increases in phosphorus can lead to dramatic increases in floating algae, which in turn intercept light needed by rooted plants. Consequently, rooted plants can decline as lakes become enriched with nutrients. Such a change in lake condition, known as eutrophication, is often viewed as undesirable, because the green and murky water that results from excess algal growth is aesthetically unappealing to many people. In addition, the loss of rooted plants can be detrimental to fish and wildlife populations, which rely on plants for habitat and food.

As eutrophication proceeds, plants and algae die and settle to the lake sediments, using up oxygen as they decompose. This means that eutrophic lakes often have low or no dissolved oxygen in the lower depths (hypolimnion), at least seasonally. Over time, large quantities of decaying plant material accumulating on the lake bottom can actually make the lake shallower. In addition, the decaying material provides a large in-lake reservoir of nutrients that becomes available for plant growth whenever lake water circulates, mixing bottom water into the upper, light-rich waters where plant growth occurs.

Conventional wisdom about lakes has been that eutrophication is a natural process, reflecting the gradual transformation of deep, oligotrophic lakes to shallow, more eutrophic ponds over many thousands of years. As the lake basin slowly fills with sediment, the lake eventually becomes shallow enough for nutrients stored in the sediments to be re-suspended into the surface waters, becoming



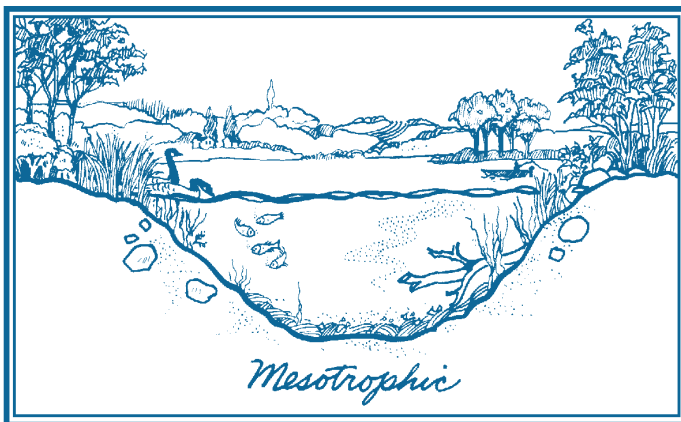
How are Minnesota lakes classified for shoreland management and planning?

The Minnesota Department of Natural Resources (MDNR) groups lakes into three main categories for making shoreland management decisions: natural environment lakes, recreational development lakes, or general development lakes. Natural environment lakes are small, often shallow lakes with uplands that are difficult to develop. Recreational development lakes are generally medium-sized, have moderate recreational use, and are surrounded by seasonal and year-round lake homes. General development lakes vary in size, are often heavily developed around the shoreline, and are typically used for recreation.

The MDNR uses the following characteristics to decide whether a lake should be classed as a natural, recreational, or general development lake:

- Size and shape
- Amount and type of existing development
- Road and service accessibility
- Natural characteristics of the water and shorelands
- State, regional, and local plans and management programs
- Existing land use restrictions
- Presence of significant historic sites.

In addition to MDNR classification of the lake, zoning requirements can specify what development will be allowed along the shoreline. Local zoning may specify the allowable land use in categories ranging from protected to high density residential to general use.

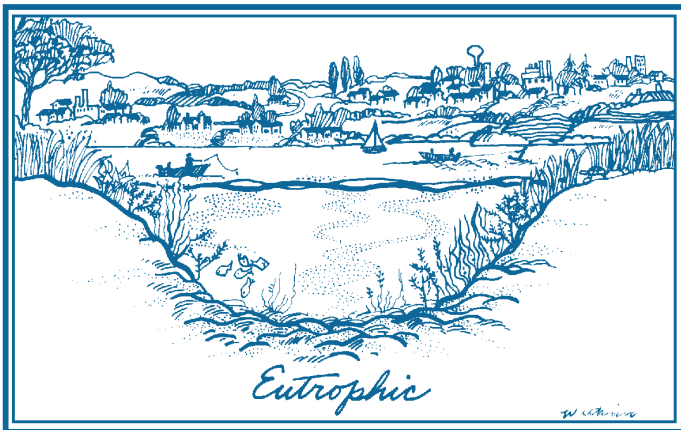


Doesn't the Minnesota Department of Natural Resources also categorize lakes based on what kind of fish could live in them?

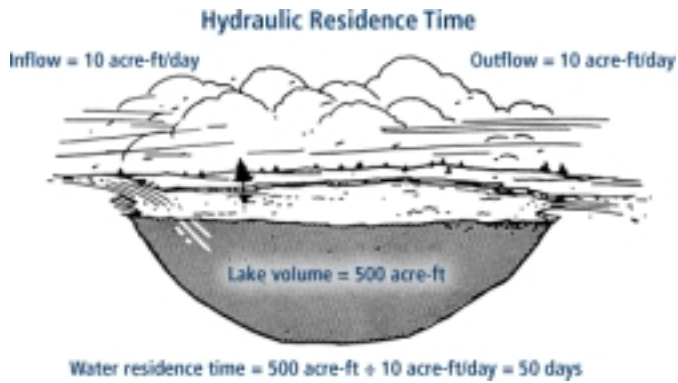
Yes, the MDNR also uses certain lake characteristics such as size, depth, hydrology, water quality, degree of development, and indigenous fish populations to identify which lakes might support certain populations of fish, to set angling limits, and to develop fish stocking plans.

How is hydrology used to classify lakes?

Lakes may also be categorized based on how water flows into or out of them, including the relative influences of groundwater and surface water, the position of the lake in its watershed, and the number of inlets and outlets. How much and how frequently water flows through a lake and the source of that water can have an effect on water chemistry and biological communities in the lake. The amount of time required to completely replace a lake's current volume of water with an equal volume of "new" water is known as hydraulic residence time or retention time. Calculating residence time helps managers understand the potential impacts of human activities on lakes, such as the effects of a pollutant spill or other "pulse" of inflow.



available to stimulate additional plant growth. As a result, the lake's trophic condition changes. Human land use practices have been blamed for accelerating eutrophication by vastly increasing the rate at which sediments and nutrients are added to lake basins. Recent research by Minnesota scientists suggests that the natural process is more complicated. The research shows that lakes recently created by glaciers are rich in nutrients and can become less productive over time as vegetation develops in the watershed. In other words, a lake's trophic status is dependent both on human activities in the watershed and natural processes within the lake basin.



How are lakes classified for water use?

In Minnesota Rules, Chapter 7050, water quality standards are listed for different lake uses. Many municipalities in Minnesota use surface water for their drinking water supply. Lake water is also used for industry, agriculture, wildlife, aesthetic enjoyment, navigation, and recreation. The Minnesota Pollution Control Agency (MPCA) categorizes uses into Classes A, B, C, and D. Class A refers to high quality water, requiring the least treatment, whereas Class D refers to poor quality water, requiring the most treatment before use.

Why are there so many different ways of classifying lakes? Which is the right one?

Because different agencies have different responsibilities, they sort lakes according to different types of characteristics. Just as you might be "grouped" based on your profession, where you live, or whether you like to fish, water ski, or canoe, so the special features of lakes are used to group them in ways that allow them to be better managed or protected.

Who can I contact if I have questions or a problem related to classifying lakes?

Check your local telephone listing, the "Who to Contact" section of the Minnesota Shoreland Management Resource Guide Web site, www.shorelandmanagement.org, or the Web sites listed below for:

Your county Water Plan Coordinator

Minnesota Department of Natural Resources (MDNR)

- www.dnr.state.mn.us

Minnesota Pollution Control Agency (MPCA)

- www.pca.state.mn.us

What are some additional resources related to classifying lakes?

A Primer on Limnology. 1992. B.A. Monson, Water Resources Center

Minnesota's Natural Heritage: An Ecological Perspective. 1995. J.

Tester

Lake Prioritization For Protecting Swimmable Use. 1997. S. Heiskary,

Minnesota Pollution Control Agency