EFFECTS OF TURBIDITY ON FOREST RECREATION POTENTIALS

by

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With increased pressures from our changing social way of life, and requirements for recreation activities as a means of escape, we as environmentalists are receiving increased demands on our waters for quality recreation experiences. New imaginative and creative approaches to recreation programs on our waterways are essential to the survival of a healthy society.

The 4 day 40-hour work week, soon to be a reality, will create a vast recreation impact. Ninety firms in the U. S. have already adopted the 4 day system. The Chrysler Corporation and the United Auto Workers have agreed to study the possibility of putting some or all of their 157,000 U. S. employees on a 4 day routine (1). This movement could create a trend thrusting tremendous demands on our already crowded recreation sites.

In Mississippi, as throughout most of the south, the warm summer temperatures direct forest visitors toward water-based recreation activities. The Mississippi Recreation Survey of 1967 lists the most important recreation activities in the state (Table I) (2).

TABLE I. MISS. SUMMERTIME OUTDOOR RECREATION PARTICIPATION

Activity	Activity Occasions
1. Swimming	17,500
2. Fishing	16,000
3. Vacation Travel	9,500
4. Sightseeing & Driving	9,200
5. Boating (Motor)	9,000

Three of the five major activities are directly water-based and the other two (vacation travel, and sightseeing and driving) are often associated with water to sit by or to walk and drive alongside. The Outdoor Recreation Resource Review Commission reports that 90 percent of all Americans seek recreation associated with water (3).

Clear water is essential for a quality recreation experience and is highly desirable from the standpoint of visual appeal, recreation enjoyment, and safety (3).

Tourist visitation is greatly influenced by water quality. Colorful brochures emphasizing a clean lake or stream creates an image of esthetic quality and attract visitors. Turbid waters indicate something less than quality and serve as a deterrent to tourism.

Let's examine the effects of water turbidity in two dimensions. First, the effect of turbidity on recreation users and secondly, the effects of users on water turbidity.

Effects of turbidity on recreation users:

The effects will be determined on each of the three major water-based activities in Mississippi.

Swimming

Turbidity has a psychological effect on swimmers. Turbid water reduces esthetic appeal. The turbidity causes light to be scattered and absorbed rather than transmitted, thus giving the water a muddy appearance which is unappealing to the recreation visitor (3).

In California the water quality criteria states "waters that are used for swimming and bathing must conform to three general conditions: (a) they must be esthetically enjoyable (free from obnoxious floating or suspended substance, objectionable color, and foul odor), (b) they must contain no substances that are toxic upon ingestion or irritating to the skin of human beings, and (c) they must be reasonably free from pathogenic organisms" (4). Many other states are strengthening water quality criteria by establishing quantitative limits for these three categories to create conditions for a quality recreation experience.

Physiological effects of turbidity are caused by bacteria and temperature. Turbidity darkens water color and creates stratification which increases temperature on surface water but decreases temperature underneath. The growth of taste and odor producing organism in a lake or stream may be stimulated by increased water temperature. Coliform organisms survive for longer periods at lower temperatures (4). Nematodes in turbidity particles can protect coliform bacteria and thus limit the effect of disinfectants such as chlorine. Experiments with military personnel found exposed to warm water continuously for several hours indicate that 85° F is a safe maximum. Limited exposure to water warmer than 85° F can be tolerated for short periods without causing undesirable physiological effects (3).

Turbidity could also create a safety hazard in that swimmers are unable to see objects underwater and divers views are obstructed below the water surface.

Fishing

Turbidity directly effects fish production. Turbid water prevents plankton bloom that is essential fish food. It also interferes with the penetration of light and militates against photosynthesis, thereby decreasing the primary productivity upon which the fish food organisms depend (3).

By excluding light, turbidity makes food difficult for fish to find and consequently fish become harder to catch. It can also disrupt the

ecosystem of a lake or pond by protecting smaller fish from predatory fish, creating an overbalance of forage fish species (4).

Turbidity is commonly associated with sediment and basically caused by erosion. The sediment fills the interstices between gravel and stones, thereby eliminating the spawning grounds of fish and the habitat of many acquatic insects and vertebrataes. It is a fortunate adaptation that fish can tolerate high turbidities for short periods (Table II).

TABLE II AVERAGE TURBIDITIES FOUND TO BE FATAL TO FISH (5)

Species	Length of Exposure (days)	Turbidity (mg/l)
Large mouth bass	7.6	101,000
Pumpkin seed sunfish	13	69,000
Channel catfish	9.3	85,000
Black bullhead	17	222,000
Golden shiner	7.1	166,000

On the Mississippi River side channels and flowing stream tributaries with good fish fauna, 4% were clear, 11% cloudy, 3% were very muddy. In these waters, with medium, poor, or no fish fauna, 1% were clear, 18% cloudy, 11% turbid, 14% very turbid, 38% muddy, and 18% very muddy (6). Turbidity clearly demonstrated a reduction in fish productivity in this experiment. Sedimentary deposits should not blanket stream bottoms to a depth of more than one-quarter of an inch in order to prevent destruction of fauna and shellfish (6).

Boating

Effects of turbidity on boaters are similar to swimming in that esthetic appeal is important. Turbid waters can discolor the boat and cause additional maintenance.

Effects of Users on Water Turbidity and Possible Solutions:

Often the users themselves increase water turbidity while participating in their favorite water-based activity.

Swimming

Swimmers create turbidity by agitating the pool bottom. Bottom characteristics and number of participants are important considerations at the swimming sites.

Some methods for reducing turbidity include regulating bottom types, use of concrete swimming pools with filters, or possibly restrict the number of users in an area. Bank stabilization along the beach will reduce the sloughing action and aid in reducing turbidity.

Fishing

Fishermen do not create an appreciable amount of turbidity. Wading in streams can create a slight turbid effect which is associated with the bottom characteristics.

Boating

Boating enthusiasts create turbidity by several methods. The wake action of motor boats cause a turbid effect along the shoreline when waves crash into unprotected banks. The wave action can also provide a favorable condition by creating water exchange in swimming areas on lakeshore beaches.

A propeller in shallow water causes a turbid effect by churning up loose silt. This action in shallow water can also have an effect on weed growth by reducing light which results in the destruction of submerged acquatic plants (3). Silt, clay, and organic materials from the bottom will be placed in suspension and recycle nutrients causing a sag in the dissolved oxygen content (9).

Gas and oil leakage from boat motors constitute a pollution threat to recreation waters. As much as 4 gallons of gasoline out of 10 may be discharged into water from outboard motors and leaded gasolines can result in lead accumulations in bottom muds which disrupt decomposition cycles. The primary effect of the lead in the bottom sediments is the inhibition of the bacterial decomposition of the organic matter produced within the lake and entering the lake from other sources. The bacteria responsible for the decomposition and mineralization of organic matter are affected by lead concentrations (8).

The number of boating enthusiasts can be detrimental to water quality. At Boundary Waters Canoe Area of Minn. in 1968, 75 percent of the visitors entered through 8 of 66 access points. Recreationists at these 8 points added 9 tons of sodium chloride, 1 ton of phosphate, and 13 tons of nitrogen. This excludes inputs from solid wastes and outboard engines (8). The combination of overenrichment of nitrates and phosphates can develop heavy undesirable algae growths (9).

Several preventative measures regulate the effects of boaters. Zoning restricts boats from certain critical areas. Jetties will break up wave action and bank stabilization reduces impact on the shoreline.

Restrictions on engine size and type influences the effects of boaters by decreasing wake action and pollution potentials. Marinas stocking unleaded fuels could reduce interruption of decomposition cycles.

Erosion

Turbidity is the secondary effect of siltation caused by erosion. Erosion is the source of the problem and must be controlled to insure

water quality.

Proper land management practices in the headwaters of streams and lakes is essential. Recreation sites must also be protected from the erosive forces of nature and the influences of man. This requires proper planning and design before development of the site.

Soil surveys provide essential information on site durability. The survey can determine if surfacing is necessary to protect the developed area. Landscape Architects and Recreation Planners can examine traffic flows and impact areas before site development and determine controls necessary to regulate visitors.

Topography is also important in site selection. Heavy impact areas require less slope than areas receiving light use. Be certain to select the proper terrain for each recreation activity. Campsites located near shorelines will attract many visitors and cause site deterioration. An even distribution of campers can be achieved by developing sites a short distance from the lakeshore. Units too close together will also increase site deterioration. The concentration of visitors causes soil compaction which destroys vegetation and creates erosion problems.

Vegetation is essential for esthetic value as well as erosion control. A grass cover affords protection to the site and is esthetically pleasing.

An overstory of mixed pine and hardwood trees provides shade for recreationists and reduces the impact of rain droplets. A maintenance program for the vegetation should be an essential part of the site plan to insure a healthy vegetative cover and reduce erosion.

Summary

Recreation is associated with mass-use and can result in miss-use or abuse if areas are not properly designed. Plans must consider environmental influences and be flexible to compensate for unforseen contingencies. Turbidity has a detrimental physiological and psychological effect on recreation users and users affect water quality. Proper planning is essential to insure the type of environment for a quality recreation experience--especially a water-oriented experience.

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