Man-Made Lakes and Wildlife Values

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There is a mounting ground swell of public interest in wildlife riding beneath the breakers of current environmental concern in the United States. The old-line wildlife conservation movement was made up primarily of organized sportsmen and nature enthusiasts who could count on a rather narrow base of public support. Today, in this age of environmental militancy, when you hoist the banner of wildlife conservation, recruits come running from all directions.

Some of the newcomers are poorly informed and highly emotional, and a few march off on their own quixotic side campaigns whose success would damage rather than enhance the wildlife conservation movement. These people, however, represent the conspicuous part of an iceberg of more objective public concern that can be crystallized as the foundation for constructive natural resource programs. But the broad public concern and interest in wildlife resources do exist and have become forces to reckon with by anyone concerned with natural resource management.

Not many years ago it was possible to plan and construct a single-purpose dam and reservoir (whether for flood control, irrigation, or water supply) and to justify it solely on economic grounds. Little concern had to be given to natural esthetics or the effects of the projects on fish, wildlife, and other renewable resources. Unless a proposed project would have impinged on a national park or an important historical site or threatened to destroy some well-publicized endangered species, local economic considerations usually outweighed any natural values threatened with displacement.

With our present broad-based public concern for natural values it has become hazardous for engineers to ignore or minimize the impacts of their works on the natural scene, including wildlife and wildlife habitat. In the United States the National Environmental Policy Act of 1969 [*U.S. Congress*, 1969] makes mandatory a review of the projected impact on the existing ecosystems of any proposed federally financed or licensed water project. The existence of this law is one evidence of the public concern that I have mentioned. The U.S. Army Corps of Engineers, in keeping with the spirit of the law, last year appointed an Environmental Advisory Board made up of conservationists highly qualified to advise on wildlife problems.

This step is to be applauded and could be profitably emulated by all other agencies and authorities concerned with water management. The engineer who plans a project without full environmental consideration today can stir up a hornet's nest. Although it involved a navigation canal rather than a reservoir, the fate of the Cross-Florida Barge Canal is a recent case in point. So are the fates of the Everglades Jetport and the supersonic transport plane. For good or for bad, public concern over the potential effects on the environment was the counterweight that threw the scales in favor of the opponents of the supersonic transport plane.

I point to examples of this kind not to downgrade or criticize engineers and engineering projects but merely to focus attention on the changing temper of the times. The public today is thoroughly aroused over environmental problems. It behooves all of us concerned with natural resources to take these new attitudes into consideration. Major engineering projects based solely on local values cannot stand alone. Future projects that involve environmental change, including the disturbance of wildlife habitat, are going to be subjected increasingly to critical public review.

Few, if any, engineering achievements have a greater impact on the environment of an area than the construction of a man-made lake. Even a comparatively small one drowns out miles of stream and inundates hundreds of acres of

farmland, fields, brushland, and forest. On larger man-made lakes the destruction of preimpoundment natural values (whether wildlife, timber, or trout stream) extends over hundreds of square miles. Fortunately, however, by working in concert with wildlife authorities, the hydrologic engineer has an opportunity not given to those in other branches of his profession to create public wildlife values as great or greater than those that his works displace. Depending on the productivity of the reservoir site before impoundment, the nature of the local wildlife population, and the size, design, and management of the reservoir, a man-made lake can be destructive or beneficial to wildlife.

In desert regions, where intermittent streams are dry for long periods of time and springs or seeps are few and widely spaced, a man-made lake can open up hundreds of square miles of previously uninhabitable range to deer, antelope, and other wildlife. It can also become an important oasis for waterfowl and shorebirds.

In more humid areas, where water is not the limiting factor, the effects of reservoir construction, at least temporarily, are almost totally negative. When a man-made lake is filling, the displacement or elimination of the existing wildlife population on the immediate site is inevitable.

Practically every reservoir obliterates part of a natural stream. In some instances it may eliminate all free-flowing streams in an entire watershed. Natural floodplains are among the most productive wildlife lands.

NATURAL HABITAT

Except where overgrazing or other abuses occur, the banks and floodplains of streams almost invariably support a lusher and more diversified vegetative cover than that of the bordering uplands. On the prairies and in desert areas, banks and floodplains nurture the only true trees. In extensively wooded regions the larger streams provide breaks in the forest canopy, which permit the development of low shrubs and fruit-bearing trees that are intolerant of shade. Thickets of alder, willow, poplar, and other hydrophytic trees provide browse for deer and other large browsing mammals close to a reliable water supply. There is an abundance of insect life to satisfy the needs of songbirds and the insectivorous mammals, reptiles, and amphibians. Riffles and shoals provide fishing spots for wading birds, raccoons, and otters. The backwaters of coves support reeds and rushes, which are vital nesting sites for waterfowl and many species of songbirds.

Because they are less vulnerable to logging, river bottomlands and stream border swamps usually contain more mature and overmature trees than the adjoining uplands do. Oaks and other mast-producing trees provide essential food for a variety of wildlife. Southern hardwood bottomlands that are naturally flooded in winter support some of the largest concentrations of mallards, pintails, and wood ducks found anywhere in the United States.

Natural cavities in dead and dying trees or those opened by pileated woodpeckers and enlarged by decay provide homes for wood ducks, squirrels, raccoons, and chickadees. Eagles and ospreys prefer tall snag trees as roosts and nesting sites wherever they are available.

Each stream valley forms an ecosystem that is unique in some ways from every other stream valley because of variations in the local microclimate, geology, topography, and land and water use. Not every stream valley is as productive as that just generalized. But whatever wildlife habitat is present in the lake site before impoundment is eliminated by construction and flooding. Often, it can be replaced only by deliberate and conscious habitat restoration programs.

In some large municipal water supply reservoirs that I have seen, sanitation has required the removal of most of the vegetation and top soil and the riprapping of the banks. In such situations the near-total disruption of the ecology occurs even before the floodgates are closed. Where construction activity is confined to the immediate vicinity of the damsite, the process is more gradual but equally inevitable as the flowing streams are replaced by the rising waters of the lake.

In addition to the effects behind the dam, construction activity may change the ecology of a stream for many miles downstream through the generation of silt and the elevation of water temperatures. The relentless rise of the man-made flood as a reservoir fills threatens many forms of wildlife with death. During the spring, when the filling of a newly constructed reservoir is most rapid, at least in temperate zones, nearly all species of wildlife produce all the young that they will be able to produce throughout the year. As nests and burrows are flooded, any eggs or

young caught behind the rising water are almost certain to die. Even aquatic species like the muskrat and the beaver are subject to such losses.

The adults of most terrestrial species are able to keep pace with the rising water level and escape to adjoining cover. But biologists have long known that animals moving into a range that is fully stocked rarely survive for long in competition with resident animals of the same species. And usually the cover into which the displaced creatures are forced is inferior to that that they have vacated.

Birds, mammals, and reptiles incapable of flight or swimming for sustained distances often become trapped as hills become dwindling islands that eventually disappear. Rescue operations can never be more than partially successful.

Even though it may not affect them directly, a man-made lake of substantial size can influence populations many miles from its shores. Many species of the larger mammals (caribou, elk, and mule deer in North America and a variety of African and Asiatic ungulates) are essentially migratory. Some winter a hundred and more miles from their summer ranges. Although some, like the caribou, are excellent swimmers, any large man-made lake may create a physical barrier that few, if any, can cross. The route around the lake may be so long that the traditional and essential migration pattern is broken. In the western United States and Canada the floors of canyons, which often are among the choicest reservoir sites, are frequently the winter terminals of the big-game migration routes.

Thus, insofar as the wildlife is concerned, as the water levels begin to stabilize, the new ecosystem created by the reservoir starts with a clean slate.

NEW HABITAT

Once a man-made lake is filled and is relatively stabilized, it may create a new habitat that can be more valuable to a wider range of species than that that existed on its site before, especially when some consideration for wildlife values is worked into its design. Artificial impoundments, after all, are major tools of the wildlife manager. In the absence of natural lakes or marshes, impoundments usually form the core around which the typical national wildlife refuge in the United States is formed.

The impoundment designed for wildlife usually has values superior to those of the natural lake because its water level can be manipulated to meet specific seasonal needs. It is a common practice on many refuges to lower the water levels in spring or early summer. This change permits the natural or artificial cultivation of smartweeds, sedges, millet, or other wildlife foods on the exposed flats and shores. When the area is reflooded in late summer, it contains an abundance of seeds and leafy vegetation for the autumn and winter needs of waterfowl, muskrats, and moose.

Water level manipulation also offers one of the most effective and least expensive methods of controlling cattails, canes, and other littoral plants whose overly rank growth can crowd out more valuable food species.

Water level manipulation for the specific benefit of wildlife is practical only on wildlife refuges and management areas. But on many reservoirs designed for other purposes, such as irrigation and water supply, a similar pattern of drawdown and reflooding takes place. The peak demand for irrigation water and water used domestically usually comes during the height of the plant-growing season in late spring and early summer. Autumn rains replenish the waters and reflood the beds of any shoreline plants that may have developed during the summer.

Whether this pattern will benefit wildlife depends on the design of the reservoir and its topography and bottom soils. On many exposed shorelands, plant development is hindered when soils dry out quickly and excessively.

I am no engineer, but I assume that the ideal water storage reservoir (whether for power, irrigation, or potable water) would be designed for maximum volume and minimum surface area to reduce loss through evaporation. Some reservoirs in the canyon gorges of Utah may approach this ideal with their sheer rock walls, great depths, and narrow widths. Reservoirs of this kind have little wildlife value.

The ideal wildlife lake is almost the opposite of the irrigation engineer's ideal: shallow with gently sloping shores, small low islands, and an abundance of vegetation both in the water and on the shores. Islands are choice nesting sites for Canada geese, terns, and many species of ducks. Dead timber, whether standing or floating, is usually an asset rather than a liability in a wildlife impoundment.

Fortunately, at least from the wildlife view-

point, the engineer rarely attains anything approaching water tank efficiency in the design of a reservoir. Most man-made lakes contain secluded coves, islands, shoals, and other features that characterize a good wildlife area. It is in such areas that engineers and officials charged with the administration of reservoirs have an opportunity to replenish lost wildlife for public benefit. State and federal wildlife agencies stand ready with funds and expert advice to assist in such programs.

ZONING AND REGULATION

If an area on a man-made lake has inherent wildlife values, much can be done to enhance it through zoning and the regulation of human use. Most forms of wildlife can tolerate a considerable amount of human intrusion into their habitat. But, if an aquatic area is to realize its full wildlife potential, most uses must be regulated, and a few must be excluded. High-speed motorboating and water skiing, popular and legitimate forms of recreation on many man-made lakes, can create so much disturbance as to render an otherwise valuable wildlife area almost useless. Many mammals and birds, especially those with nests or young, have a low tolerance for extraneous noise and motion. Constant disturbance, particularly by aquatic recreationists, is one of several factors in the decline of the southern bald eagle, which usually nests near water.

Less frenetic types of recreation may be quite compatible with wildlife values. Fishing, canoeing, sailboating, and even powerboating with low-power or throttled down motors cause minimal disturbance as long as the concentration of use does not become too high. Hunting is a legitimate use of surplus game in the autumn and early winter and is easily regulated, as local conditions warrant, through the use of access permits, waterfowl blind spacing, and similar regulations. Hunting also is useful in keeping deer herds and other ungulate herds from growing so large that they damage protective watershed vegetation.

The wildlife values of many of the natural lakes in this country have become degraded through unrestricted shoreline development to a degree that would be tolerated on few modern man-made lakes. Some New England lakes that I am familiar with are hemmed in by shoulder to shoulder cottages, and their waters are contaminated by sewage.

The protection and management of the shores and watersheds of a lake are even more important to wildlife than the protection and management of the open water. Some water birds rest in open areas far from shore, but practically all feed in the shallows, and all nest either on land or in emergent vegetation close to shore. Even the Canada goose, usually considered an aquatic species, derives much of its winter food by feeding in fields.

Most artificial lakes of any substantial size constructed in recent years are managed by agencies or authorities with sweeping regulatory powers over the use of the water and a surrounding belt of watershed lands ranging from a few hundred yards to many miles in width. Like regulated timber management, wildlife habitat development on such protected lands is fully compatible with the operation of the reservoir. Even without deliberate planning and management, the shorelines and watersheds of many man-made lakes, through natural plant succession, develop food and cover as good or better for more species than those of the stream bank complex that has been replaced (and there often is more of both).

When state and federal wildlife specialists work with the engineers and the controlling authority of a man-made lake, the benefits can be compounded. Frequently (even apart from esthetic and recreational values), the benefits are reciprocal. In the western states, there are 22 national wildlife refuges totaling 127,260 ha maintained by the Bureau of Sport Fisheries and Wildlife and 49 wildlife management areas administered by state wildlife agencies, all operating on lands acquired or withdrawn by the Bureau of Reclamation. Most of these refuges are vital links in the chains of protected waterfowl habitat that join the northern breeding grounds and the wintering areas in the South. Their upland areas are havens for pronghorn antelope, bighorn sheep, prairie chickens, and endangered species. Many of those with independent water structures in addition to being wildlife refuges also serve as silt traps on the streams that feed the main reservoirs.

Wheeler and Kentucky Woodlands national wildlife refuges, developed as part of the Tennessee Valley Authority lake system, support one of the largest wintering concentrations of Canada geese in the Southeast. Nearly a quarter of a million ducks now gather each winter in the

Tennessee Valley, an area nearly barren of waterfowl before 1930. The restoration of the deer herd of the region has been equally spectacular. Prior to 1936 and at least as far back as the turn of the century, deer have been about as common there as polar bears. Today, thanks to a cooperative program involving the state wildlife agencies and the Tennessee Valley Authority, there are no fewer than 150,000 white-tailed deer. Quail, wild turkeys, squirrels, and other wildlife are far more abundant than they were in the early 1900's.

The accomplishment in this valley is an outstanding example of what can be achieved when engineers, foresters, land planners, and wildlife agencies work together to achieve public values that extend a step beyond the purely materialistic. Not all administrators of man-made lakes can work on so grand a scale. But it is an example that more could profitably follow in this day of environmental concern.

To protect water quality, the investments of individuals, and public values on man-made or natural lakes, shoreland zoning under state or federal authority is a prime necessity. If local wildlife values are to attain their full potential, zoning is the fundamental step toward sound wildlife management.

REFERENCE

U.S. Congress, National environmental policy act of 1969, *Public Law 91-190,* 91st Congress, 1st Session, 1969.