

Wildlife versus irrigation

**Phreatophyte removal conserves water
but destroys habitats for game**

by Richard H. Gilluly

Defoliation is a term usually associated with the use of herbicides in Vietnam. But the removal of trees and other plant life is a widespread feature of the technological activities of man in advanced nations. Forests are clear-cut for lumber (SN: 12/5/70, p. 430); other areas are denuded of vegetation to make room for highways and freeways; and the hillsides of Kentucky, Ohio and other coal states are razed and heaped with ugly mounds of spoil by strip mining.

This brand of domestic defoliation is, of course, defended by developers as economically justified. It often may be. And in some instances—where enlightened tree harvesting practices are followed, for example—provision is made for regrowth and sustained yield.

But by no means are all the effects of domestic defoliation always clear. As the environmentalist movement grows in the United States, developers increasingly must justify their activities and make provision for ecological restoration. Bitter controversies are erupting as this new demand is made.

A case in point is Arizona, where Federal agencies are studying or proposing the removal of phreatophytes—deep-rooted vegetation—from the banks of many rivers in the state. The main purpose of the removal is to conserve water in that arid state. The phreatophytes, stress the advocates of removal, absorb water from the water table and release it to the air through evapotranspiration. Removal of the plants from waterways, they say, will make more water available for downstream irrigation.

Bitterly opposing the phreatophyte removal projects, some of which are already under way, are conservationists and wildlife proponents who say that the riverbank vegetation is the only major wildlife habitat in the arid state. Remove it, they say, and the adverse effects on wildlife will be devastating

and sometimes irreversible. Some also mention indications, somewhat less supported by scientific evidence, that the effects on fisheries may be equally detrimental.

Much of the controversy centers on the words used and their particular meanings to the contenders. "Phreatophyte," says Bud Bristow, a biologist with the Arizona Game and Fish Department, "is a word coined by water users." It means "plant well," or a plant that mainly uses water from the water table, in the fashion of a well, rather than from rainfall and other surface sources. But, says Bristow, the word has also acquired the connotation of plants that have no economic value, and this is the connotation stressed by the Federal agencies oriented to irrigation. Bristow insists this usage is blatantly unfair. As a scientist mandated to protect wildlife, Bristow says he could, if he wished, call cotton or other cash-crop plants phreatophytes. "They have no wildlife value," he points out. But he would rather redress the current semantic imbalance and simply call all the plants involved "riparian vegetation" (Latin: at the river).

There are hundreds of species of plants that grow along riverbanks and draw from the water table. In Arizona several predominate. At lower altitudes, mesquite and saltcedar make up most of the cover. At higher altitudes—and, higher latitudes, such as in the arid or semi-arid portions of Colorado, Wyoming and Montana—the cottonwood tree supplants the saltcedar as the dominant species along riverbanks.

A study by Steven M. Carothers of the Museum of Northern Arizona in Flagstaff and Dr. R. Roy Johnson of Prescott College shows the stark contrasts in breeding bird populations between undisturbed areas and areas where this vegetation has been removed, or partly removed, from riverbanks. There is a direct, linear relation-

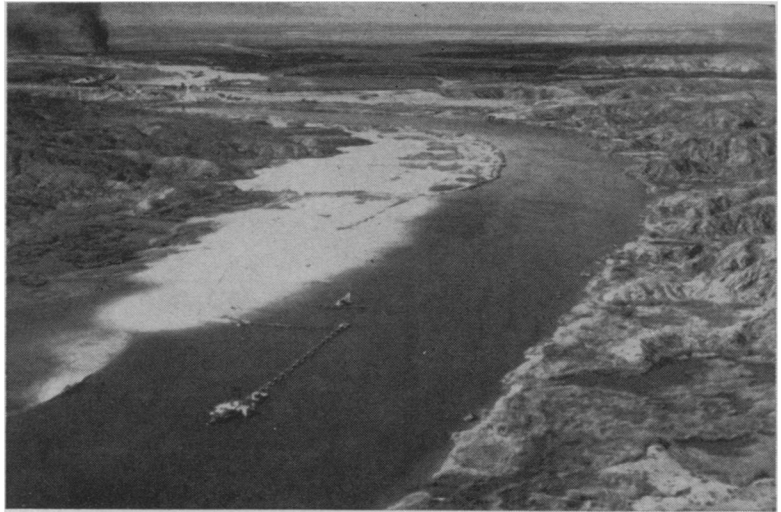
ship between the number of trees and the bird population, the researchers found. They conducted their census on two cleared areas and one control area along the Verde River in the spring and summer of 1969. A partially cleared area (10 trees per acre) had 580 pairs of birds per 100 acres. A less-cleared area (26 trees per acre) had 939 pairs of birds per 100 acres. An uncleared control area (46 trees per acre) had 1,322 pairs per 100 acres.

Dr. Johnson emphasizes that the study area vegetation is native, and that far less work has been done on the dense saltcedar stands, which are invasive. But he believes that to clear either the native or invasive stands is "sheer folly" until far more study is done. It is possible, he says, that some thinning of the saltcedar would result in wildlife benefits.

The dove, quail, grey hawk and black-bellied tree duck are some of the birds affected, according to Arizona Game and Fish Department. Other types of wildlife are also affected, of course, including deer and javelina. Although waterfowl do not use the plant cover directly, it forms sanctuaries for ducks and geese using the Pacific Flyway. These are destroyed by the removal.

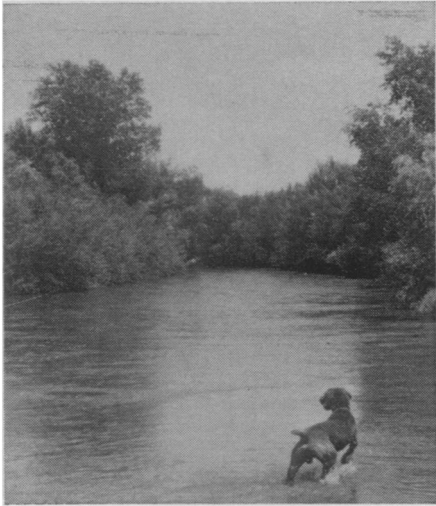
The department has done only a single, small study on fisheries effects, which Bristow admits is not conclusive. The study was a comparison of fish populations in thinned and cleared areas in a water conservancy district and in nearby uncleared areas. The fish population in the portion of the stream with cleared or thinned banks was around 80 percent less than in the control areas upstream and downstream. The fish affected included catfish, small and largemouth bass, bluegill and other panfish, carp and mountain suckers.

"The reason," says Bristow, "is that



Arizona Game and Fish Dept.

Dredge spoil covers phreatophytes and marsh habitat.



Arizona Game & Fish Dept.
Gila River: Scheduled for clearing.

the streambanks become rounded after trees are removed. No longer are the undercut banks which are created and supported partly by tree roots available. Fish use these for cover and spawning." Bristow adds that although the Arizona fishery study is not extensive enough for foolproof conclusions to be drawn, other agencies have done studies in more depth and detail relating to removal of riparian plants. Studies by the Idaho Fish and Game Department indicate damage to fisheries from the plant removal. Bristow says that besides the bank rounding, increased silt loads from the banks of rivers unprotected by vegetation may contribute to the decline of fisheries.

The water savings from the phreatophyte removal may be prodigious, and this provides the major ammunition for the water engineering agencies. The U.S. Geological Survey, which says it is entirely neutral as far as the controversy is concerned, has done studies on portions of the Gila River on the San Carlos Indian Reservation where Indians and the Bureau of Indian Affairs decided to remove phreatophytes and substitute grass for cattle grazing. The grass has not yet been substituted. This enabled the USGS researchers to compare water flow in the river before and after phreatophytes were removed.

Used was a "water budget" technique, which involved measuring all water entering a reach of the river—from the river itself, from precipitation, from tributaries and from underground sources. Such measurements were made for four consecutive years before phreatophytes were removed in the winter of 1966-67, and in the years since. Although the study is still in progress (another area was recently cleared) USGS hydrologist Richard C. Culler says an average of about two acre-feet of water per acre seems to be saved annually by removing the phreatophytes. He cautions, however,

that total annual flow in the river can range from 2 million acre-feet in a wet year down to 7,000 in a dry year, and that phreatophyte consumption will vary immensely according to the quantity of water available.

Culler also believes that once a good stand of grass is growing on the riverbanks, it may consume nearly as much water as the phreatophytes (alfalfa and Bermuda grass, in fact, are classified as phreatophytes by some writers). Thus, in the case of the Indian Reservation, the economic benefit will come mainly in grazing, not in water savings. (However, Bristow says there is a real question whether the grass will ever take hold on the cleared banks. Russian thistle grows on the banks, but so far grass seeds have failed to germinate, even when the land was physically cultivated.)

But the two acre-feet per acre figure is enticing to the irrigation agencies. Its significance is particularly evident when the 7,000 acre-foot flow of the Gila in dry years is considered (even if the savings are much less in those years).

The involved agencies, however, are by no means as zealous for removal of the phreatophytes as they once might have been. Oliver Lillard, area engineer with the U.S. Bureau of Reclamation in Phoenix, says USBR has never actually proposed wholesale phreatophyte removal, rather only considered it in "reconnaissance" studies. But he admits the reason the actual proposals have not been made may be because of the growing power of the conservationists. "The bureau is learning along with everyone else that you don't move on a project nowadays without taking the environment into consideration," he says. "Any phreatophyte removal we do in the future will be very, very selective and it will be in conjunction with the fish and wildlife people."

Also tempering the bureau's enthusiasm for phreatophyte removal is doubt about the USGS figures. Over a long period, the savings may not be as great as USGS thinks, Lillard says.

But he insists that when phreatophytes become so dense that they "choke up" a flood plain and a river channel, they have to be cleared to prevent damming and flooding. Also, phreatophytes sometimes become so dense that he says it is in the interests of wildlife to thin them to make room for grass for feed.

Lillard admits that USBR in past years has been involved in stream channelization projects that cut across oxbows to straighten channels and employ vacuum dredging to remove silt from the river channels and pile it up along the banks. According to Bristow, the silt is almost pure silica and sterile. Thus covering the topsoil and living

plants with it is as effective as outright phreatophyte removal.

And Bristow says much damage has already been done by earlier USBR phreatophyte removal projects on the lower Colorado River.

The U.S. Army Corps of Engineers has three authorizations to carry out phreatophyte removal along most of the length of the Gila River. The Corps has two goals: flood control, through slicker, neater channels and flood plains, and water salvage. The Corps had planned to begin work on one of the projects on the upper Gila and San Carlos Rivers, but last year the Sierra Club and other conservation organizations secured an injunction to stop the work because the Corps had not submitted an environmental impact statement to the Council on Environmental Quality. The court, however, did not rule on the merits of the project. But the environmentalists have now virtually assured the project, and probably the other two, will be restudied in detail.

There are numerous other arguments raging around the phreatophyte removal proposals. The Arizona Game and Fish Department maintains the proposals do not even make economic sense. It claims, for example, that the Corps projected clearing costs of \$50 per acre on part of a small project on the upper Gila, but that actual costs were from \$150 to \$350, depending on thickness of vegetation. Much of the water saved will be lost through evaporation from a reservoir and water delivery systems before it can be used for irrigation about 100 miles downstream. And the remainder, says the department, will bring only \$2 to \$10 per acre-foot at the delivery point. This does not justify the cost of the removal, the department claims.

The Game and Fish Department estimates that it takes about 20 years for streambank vegetation to recover its former quality for wildlife habitat after clearing. In the usual ecological succession, Russian thistle, an annual, is the first plant to be reestablished. Then in four to five years, the trees begin to take hold once again. In about 10 years' time, trees are large enough to provide enough habitat for some breeding of birds. But only after 20 years has saltcedar grown enough to provide really good dove habitat.

Along with many other conservationists, Bristow is questioning the need for more irrigation in Arizona. He points out that there is so much uncultivated land in the state that if water were available—from diversion from the Northwest, for instance—the irrigation projects could be built almost ad infinitum. He suggests that to achieve an optimum balance of man with nature, the time to stop may be now. □