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EC75-1427 Ponds for Nebraskans

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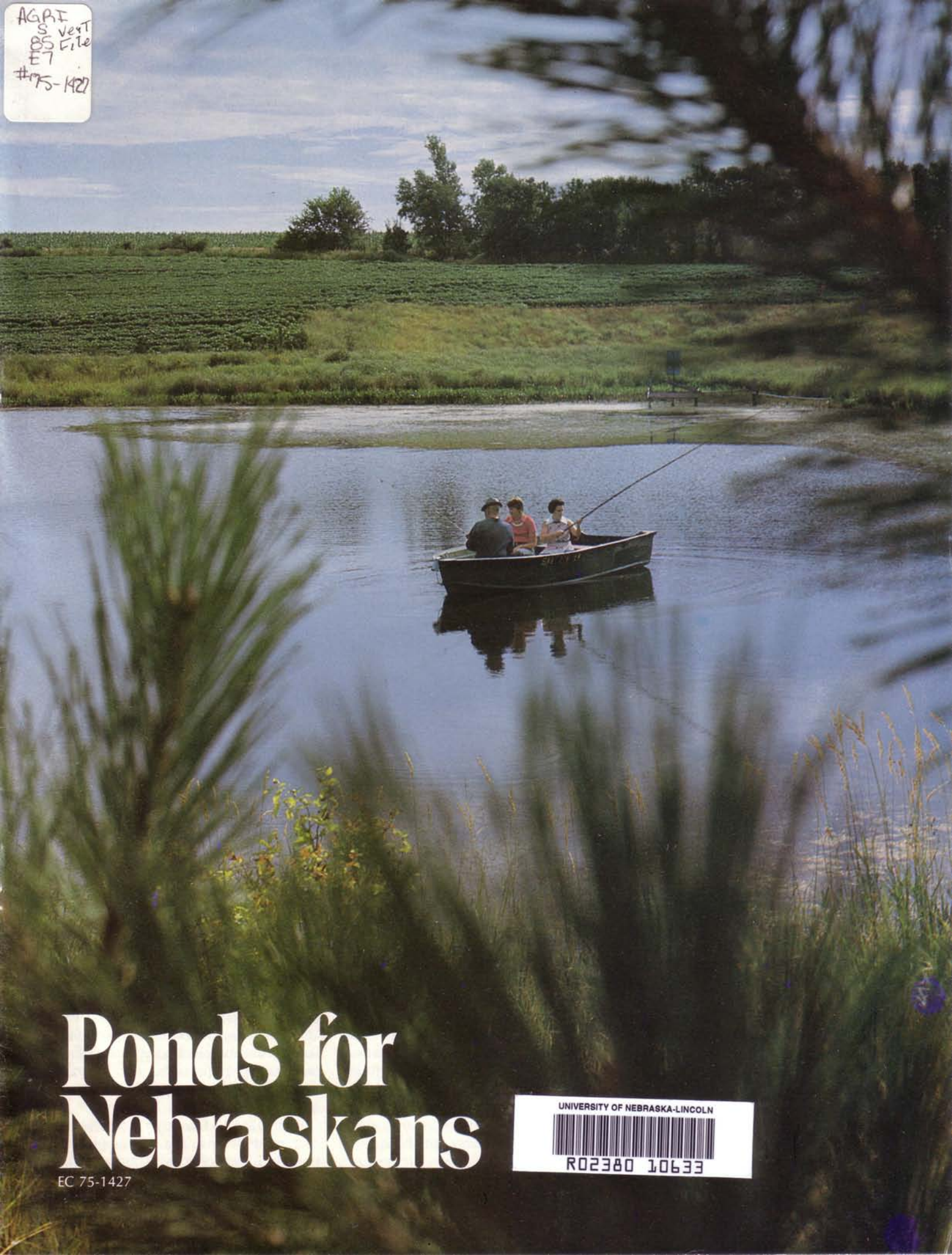

Ponds for Nebraskans

EC 75-1427

UNIVERSITY OF NEBRASKA-LINCOLN
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Ponds protect valuable agricultural land from the ravages of erosion

Water recreation is one of many side benefits of farm ponds

photos by Greg Beaumont

Extension work in "Agriculture, Home Economics and Subjects relating thereto." The Cooperative Extension Service, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, Cooperating with the Counties and the United States Department of Agriculture Leo E. Lucas, Director

NEBRASKANS construct ponds for a variety of reasons. Early ponds were usually constructed to provide water for livestock. Today they are for soil and water conservation, livestock water supply, and recreational activities such as fishing, hunting and picnicking. The trend is to design ponds for multiple use and benefit.

Well managed ponds and adjacent areas provide hideaways to escape the pressures of today's intense farming. Hunters, fishermen and nature lovers can all find retreat there.

Wildlife, like domestic livestock and crops, is a product of the land. For this reason, the manner in which farmers and ranchers manage their land affects wild animal populations as well as the yields from their fields. Wild creatures respond favorably to things done in their behalf. Noticeable changes in populations are possible even when relatively small areas are enhanced.

Ponds can also be financial assets. They increase property values and provide water for livestock. Properly located ponds control erosion and gully formation. Pond areas are often ideal for bee colonies, since many wildflowers, vines and shrubs growing near ponds are nectar producers. User fees may provide income during spring, summer and autumn months. Fur-bearing animals that can be harvested for extra earnings may also be attracted to ponds.

There are, however, requirements that must be met if a multi-purpose pond is to be successful. The pond has

Gentle sunsets reward the conservation-minded landowner

to be properly constructed; vegetation should be established but properly controlled in and around the pond; a reasonable combination of fish should be stocked; and owner interest must be maintained to insure continued management.

Assistance in designing a pond and information about cost-sharing programs may be obtained from the Soil Conservation Service. Information about developing wildlife cover around ponds is available from the Nebraska Game and Parks Commission, Soil Conservation Service, and the University of Nebraska Cooperative Extension Service or County Extension Agents. Plants may be purchased from local seed dealers and private nurseries, or ordered from county extension agents, Natural Resource Districts and the Game and Parks Commission. Technical assistance in managing ponds for fish and some fish for stocking are available from the Game and Parks Commission. Fish may also be purchased for stocking from private fish hatcheries.

This bulletin was written to help design a functional pond to supply farm needs, and at the same time provide a pleasant place to relax. Ω

Farm Ponds

Where and How to Build

SELECTING the proper site is an important first step in building a useful multi-purpose pond. The area being considered should have a dependable, but not excessive, water supply. Landowners should consult with their local Soil Conservation Service to determine the proper watershed size for their pond. In some instances, springs, artesian wells or even run-off from irrigated fields will supply adequate amounts of pond water. Terraces can often be used to increase or decrease the size of the watershed by directing drainage.

Topography of the site should permit construction with a minimum of earth movement to save on costs. Suitable sites can often be found where hills come close together in the headwaters of small streams.

To provide good habitat for game fish, a pond should cover one-half surface acre or more and have a stable water level. The pond should be at least 10 feet deep over one quarter of its area, and additional depth is desirable. Deep water is necessary to retain sufficient water to prevent winterkilling of fish and to withstand evaporation and seepage losses.

Ponds constructed on dry watersheds impounding 15 or more acre feet of water (an acre foot is water one foot deep covering one acre) in per-

photo by Greg Beaumont

To provide good habitat for game fish, a pond should cover one-half surface acre or more

manent or gated storage must be registered with the Nebraska Department of Water Resources and must be constructed under a permit issued by that department. Construction of ponds, regardless of size, on flowing streams must also be approved by the Nebraska Department of Water Resources.

The best soils for a pond bottom are clay, clay and sand loam, and loam. When compacted and moistened, particles in these soils enlarge and thus reduce seepage. Sand and/or limestone areas with shallow soils should be avoided because of their poor water-holding qualities. The best type of pond for sandy areas such as the Sand Hills is one dug below the water table to hold groundwater.

The watershed should be free of contamination from industrial and chemical wastes or domestic livestock. In like manner, the pond itself should be located in an area where it will not be exposed to excessive siltation. Siltation resulting from soil disturbances during construction can usually be controlled by establishing vegetation on the site immediately after the work is completed. A woodland or grassland watershed is desirable to reduce silt run-off. Grasses are especially valuable in this regard because they catch and hold about twice as much water as woody vegetation.

Before dam construction, soil depth at the pond site should be checked. If the soil is 20 feet or more deep, the dam material may be removed from the pond area to increase the depth of the pond. If the soil is shallow, less than 15 feet, fill should not be removed because there is danger of cutting through the water-holding layer of soil, causing leakage. When soils are shallow, fill material for the dam should be obtained from a nearby

area. In areas where soils are porous and seepage is a potential problem, construction of the dam should include a center section of impervious material such as clay. It may be necessary to seal the floor of the pond with soda ash or bentonite, or by packing the bottom with heavy equipment. If soil examinations indicate seepage is likely, perhaps a more suitable site could be found. The top of the dam should be at least 10 feet wide to protect it from burrowing animals such as muskrats.

Faces of dams should generally be built with a 2½ to 1 slope on both the upstream and downstream sides. These slopes meet Soil Conservation Service standards for most silt and clay soils, but may need to be modified for local soil conditions.

A spillway is needed for overflow during heavy rains. The floor of the spillway should be at least 3 feet below the top of the dam. It is important to maintain a good sod cover in spillways to prevent washout during floods. An overflow pipe large enough to handle normal run-off is also desirable. Screens and/or trash racks on spillways are not recommended since they may become plugged with debris. Excessive water buildup can occur, thus increasing the possibility of the dam being washed out.

Ponds should have a drainpipe installed to permit complete draining. Such drains are invaluable when removing undesirable fish. The drain intake pipe should be placed at the lowest point in the pond. A 4-inch drain will empty a one-acre pond having an average depth of 6 to 8 feet in about 120 hours. A 6-inch drain requiries about half that time and a 12-inch pipe will empty the pond in 13 to 14 hours. Additional time will be required if water is running into the pond while it is being drained.

The drainpipe should have a 1-foot drop for every 100 linear feet. Several types of pipe are suitable: asbestos-cement, cast iron, galvanized or plastic. Regardless of pipe used, care should be taken to insure tight connecting joints. Concrete cut-off collars, 10 to 15 feet apart, will prevent loss of water along the pipe.

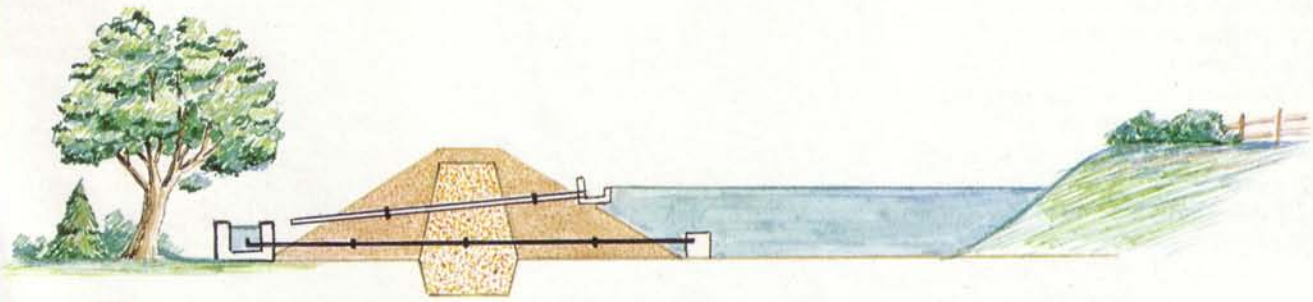
Ideally, in areas near the dam, pond banks should be on a 3 to 1 slope at normal water line, with this grade extending 10 feet below the waterline. A steep slope near the water's edge limits growth of aquatic vegetation. It may be desirable to have one or two shallow arms in the pond where aquatic vegetation is permitted to grow for waterfowl and small-game cover.

Impounding run-off water on some Great Plains soils may be difficult. In ponds where the water level drops 12 to 18 inches in a period of 3 to 4 weeks, there is probably a seepage problem. Evaporation also removes water, but at a much slower rate.

Seepage can usually be corrected by the application of soda ash (sodium carbonate) or bentonite. The general procedure is to drain the pond (a drainpipe helps the process) and allow the soil in the bottom to dry so it can be worked. All holes and irregular ditches should be filled to make the pond bottom smooth. Remove all debris from the bottom. Disc or plow the basin up to the permanent waterline. Bentonite or soda ash should then be spread carefully and evenly over the area to be treated. Usually the application of one pound of bentonite for every square foot of area in the pond will be sufficient. One pound of soda ash is applied to five square feet of pond bottom. Disc or rake the area to a depth of 3 to 4 inches to incorporate the material into the soil. Then use a sheepsfoot or roller to compact the soil.

If previous recommendations concerning construction and watershed management have been followed and turbidity persists, it may be due to fine clay particles which settle out very slowly. Muddiness may keep sunlight from penetrating the water, reducing desirable plant growth.

To settle out the minute clay particles, loose prairie hay, alfalfa or straw can be scattered evenly over the surface of the pond on a calm day. Approximately one ton of dry vegetation should be applied for every surface acre of water. A weak acid is produced during the rotting process, which will cause the silt particles to gather together and settle out. This should result in considerable clearing in three to six weeks. No controls should be applied after July 1. Ω



Farm Pond Design

The best soils for a pond bottom are clay, clay-and-sand loam, and loam. In some areas, where soils are porous and seepage is a potential problem, the dam should have a center core of impervious material such as clay. An overflow pipe large enough to handle normal run-off is desirable, and a drainpipe should be installed to permit complete draining. The drainpipe is also used to supply a stock tank below the dam

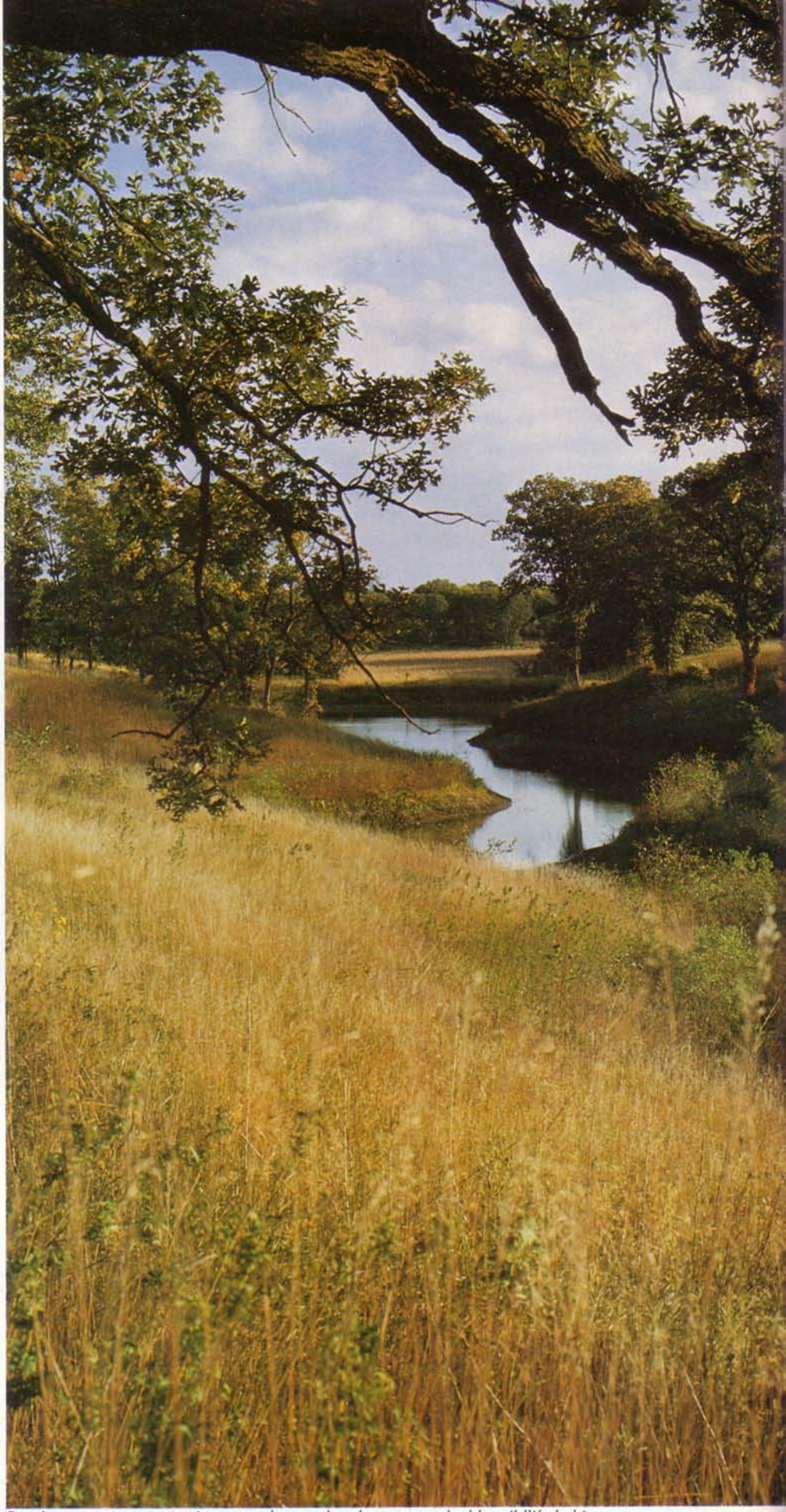
Farm Ponds

Wildlife Planting and Erosion Control

SOUND conservation practices are needed to insure and maintain high quality pond water and desirable wildlife cover. Fences around the pond and dam are especially important in this regard. A fenced strip with a good vegetative cover extending 20 to 50 feet beyond the high water mark is desirable. The vegetation serves as a silt filter for water running into the pond from plowed fields, and provides good wildlife cover.

Fencing prevents overgrazing, silt run-off, and keeps cattle from bogging down in mud or falling through weak ice. Fences also prevent destruction of fish spawning areas by wading livestock. Complete fencing with a tank below the dam for watering livestock is ideal (see diagram on previous page). This protects the pond area while providing a fresh supply of water for livestock. An alternate plan is to fence the pond and dam but permit livestock to drink from the pond through a gap in the fence.

Fencing also helps prevent the spread of livestock diseases such as leptospirosis, footrot and mastitis. Pond water becomes very warm during the summer months and provides a favorable environment for the growth of bacteria, fungi and other organisms.



Fencing prevents overgrazing around a pond and protects valuable wildlife habitat

photos by Greg Beaumont

Puddle ducks may nest in emergent vegetation at the pond's edge

photo by Jon Farrar

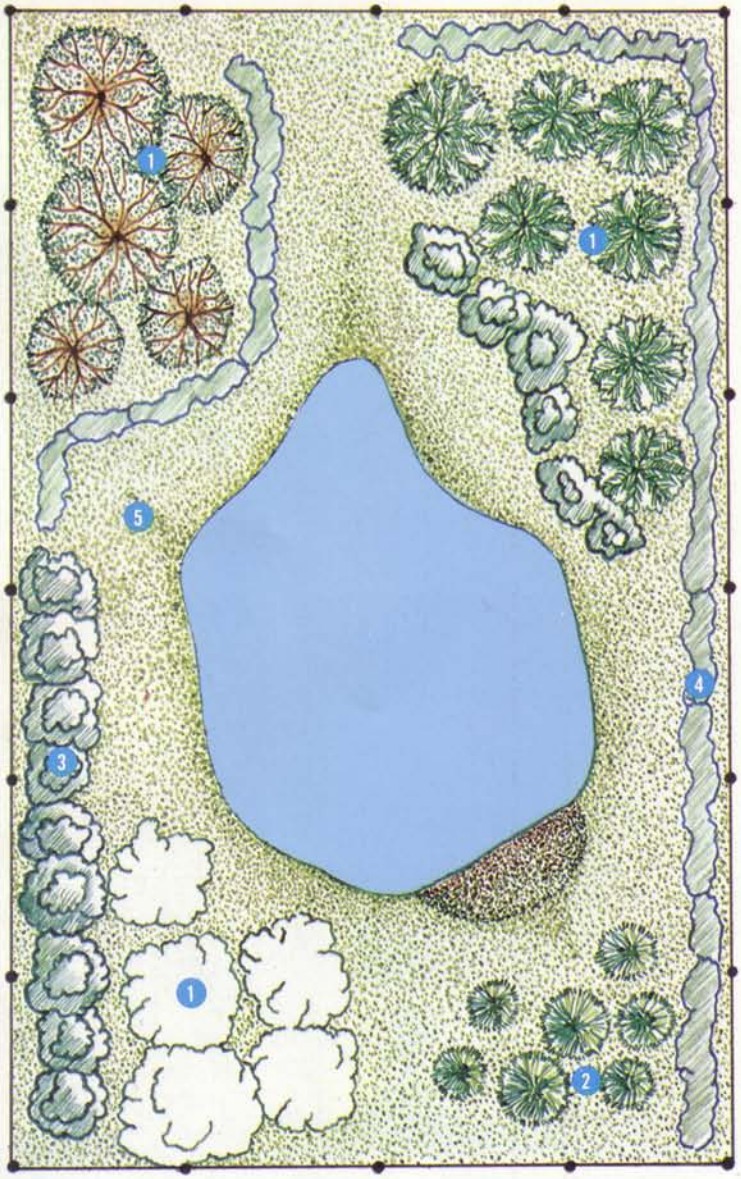
White-tailed deer, and other mammals, water at farm ponds

Control of Water Plants

PLANTS	CONTROL
Algae—Primitive plants without true leaves or flowers. When excessive, water appears soupy green or brown. Filamentous forms may cause scum over pond. Advanced forms grow from bottom in long branching strains.	Sprinkle copper sulfate crystals (Blue Stone) on algae beds, ½ to 2 pounds per surface acre of water treated.
Floating plants—Not attached to the bottom and floating on the water surface. Duckweed is a common type that forms a green blanket on the pond.	Liquid Aquathol or Aquathol Plus at 1 gallon per acre foot of water. Light film of kerosene or diesel fuel may be effective.
Submersed rooted plants—Rooted to the bottom and growing to or near the surface, often called "moss," "seaweed," or "water grass." Common examples are pondweed, coontail, elodea, and water buttercup.	Aquathol or Aquathol Plus at 1 gallon per acre foot of water, Diquat at 1 to 3 gallons per surface acre of water.
Emersed rooted plants—Extend above water in shallow areas and along shorelines. Common examples include cattail, water lily, and smartweed.	2-4-D (40 percent) at 2 to 4 pounds active ingredients sprayed on foliage per surface acre, Diquat at 1 to 3 gallons per surface acre of water treated.

Wildlife Plants for Farm Ponds

PLANTS	PERCENT OF AREA	APPROXIMATE HEIGHT	MAJOR WILDLIFE USES
Tall Grasses and Legumes Indiangrass Big Bluestem Switchgrass Alfalfa Sweet Clover	30%	3 to 6 feet	Roosting, loafing, brooding, feeding, winter protection, escape
Medium Grasses and Legumes Intermediate Wheatgrass Western Wheatgrass Little Bluestem Alfalfa Birdsfoot Trefoil	30%	2 to 3 feet	Nesting, brooding, feeding, escape
Short Grasses and Legumes Blue Grama Buffalograss Kentucky Bluegrass Red Clover White Clover	15%	1 to 2 feet	Nesting, loafing
Shrubs and Trees Choke Cherry Autumn Olive Red Cedar Plum Cottonwood Walnut Oaks	25%	10 to 75 feet	Nesting, feeding, loafing, winter protection, escape



	Recommended Species
Large trees (1)	Walnut, bur oak, ash, black cherry, hackberry, pines
Small coniferous trees (2)	Rocky Mountain juniper or Eastern red cedar
Small deciduous trees (3)	Russian mulberry, Russian olive, osage orange, amur maple, crab apple
Shrubs (4)	Cotoneaster, honeysuckle, American plum, chokecherry, silver buffaloberry, skunkbush sumac, dogwood, bush junipers, elderberry, raspberry
Herbaceous plants (5)	Alfalfa, hairy vetch, birdsfoot trefoil, other clovers and grasses as suited to planting site

Farm Pond Design

Bare areas of the watershed and dam should be seeded to grasses and legumes to prevent erosion and provide wildlife cover. Choose varieties that are adapted to your particular area. Permanent watershed plantings should include a mixture of shrubs and trees. Native species of trees are most apt to survive. Short belts of trees can be used to shelter a pond from the prevailing wind and the eroding wave action it creates. Large deciduous trees can be grouped to make a private recreation spot for picnics or camping. Avoid planting trees on the dam; roots may cause seepage

Water-tolerant grasses such as reed canarygrass, switchgrass, orchardgrass and big bluestem provide ideal shoreline cover. Species that develop dense stands or mats such as bulrushes, reeds and smartweed are also valuable for wildlife cover and food. In shallow arms of the pond, marsh plants such as cattail, bulrush and horsetail may provide important waterflowl brood habitat and feeding areas. Well-managed ponds in Nebraska can produce two to four young ducks per acre of water each year and provide habitat for native fur bearers.

Marsh plants are widely distributed and will often establish themselves in new ponds. Desirable species may be obtained with landowner permission from local streams and established ponds. They should be planted during the early spring.

Bare areas of the watershed and dam should be seeded to grasses and legumes as soon after construction as possible to retard erosion and to provide wildlife cover. Most mammals and all ground-nesting birds require a variety of cover for nesting, brooding, feeding, protection from winter weather and escape. Grasses, legumes, and early succession plants such as foxtail, cheatgrass, ragweed and sunflower are preferred cover plants. Trees and shrubs increase habitat diversity.

Many planting options are available; the main consideration should be landowner preference for the wildlife species that he wishes to attract. Select a desirable mixture of grasses and legumes choosing those varieties best adapted to the pond locality. Use certified seed for best results. Varieties of big bluestem, switchgrass, little bluestem, Indiangrass, blue grama, buffalograss, and others are available from seed dealers.

photo by Steve Kohler

Herons will be drawn to a pond's shore to stalk frogs

photo by Greg Beaumont

Mourning doves, and other birds, will nest in nearby shrubs

Aquatic life, snakes, frogs and turtles, will hunt and be hunted

To prepare a seedbed, use methods similar to those for establishing a pasture. If possible, allow a residue of old plant material to remain on the surface of the soil as protection for new grasses and legumes. A special grass drill is recommended for seeding, especially when native grasses with fluffy seeds are included in the mixture. In most localities, such grass drills can be rented from Natural Resource Districts, through county extension agents or from local seeding contractors.

Permanent watershed plantings should include a mixture of shrubs and trees. Clarke-McNary trees are available at a nominal cost from the Extension Forester, Nebraska Cooperative Extension Service. Tree and shrub species for wildlife are available from the Game and Parks Commission. Fruit trees, ornamentals and many common trees are also available from private nurseries. Stocks of woody plants suitable for the pond area are often found growing wild on farms. In moving seedlings, it is important that their roots be kept moist during the entire period of handling. Seeds of some woody plants, such as walnuts and acorns, may be planted directly on the pond site or within the protection of a vegetable garden and then transplanted after 1 or 2 years.

Care should be exercised in planting trees. Each seedling should be put in a hole deep enough to enable the roots to extend straight down, and wide enough to prevent crowding of the roots. The earth should be firmly packed and tamped. Shrubs and vines may be spaced from 1 to 6 feet apart. Trees generally require a spacing of 6 to 15 feet. Trees may require watering to get them started. It is unwise to plant trees on dams because their roots may eventually cause seepage.

photos by Jon Farrar

And, along the pond's edge, wildlife will flourish; redwings will seek mates

As a rule, cover plantings should be made in fairly dense clumps to obtain effective cover quickly. Food plantings of woody species should be spread farther apart, 6 to 15 feet, to allow maximum growth of individual plants. It is best to plant woody species during fall or early spring when plants are dormant.

Eroded gullies are sometimes found around the pond and require special care. Planting several rows of shrubs in belts across gullies, with more widely spaced trees and a good grass cover, will normally control erosion. Gully banks may be planted in belts parallel with the bottom, or plants may be scattered wherever a planting site affords opportunity for growth. Vines planted at the foot or top of steep banks are especially helpful.

As indicated, a reasonable amount of aquatic plants is beneficial, but a surplus means trouble. Excessive vegetation interferes with angling and prevents adequate cropping of bluegills by largemouth bass. In this situation, bluegill numbers increase dramatically while their average size decreases and they become unacceptable to anglers. Mosquito larvae and other tiny animals important in the diet of small fishes may also be afforded too much protection by large mats of aquatic vegetation.

Uncontrolled aquatic plants affect game populations as well. For example, heavily vegetated shores offer few loafing sites for ducks. As a rule of thumb, there is probably too much vegetation if the plants cover more than 25 percent of the pond surface. Common water plants and methods of contolling them are listed in the table on page 26.

The treatment of aquatic vegetation is a never-ending cycle. If algae are the problem, their removal will permit sunlight to penetrate to the bottom of the pond allowing growth of rooted plants. If the rooted plants are treated, algae will usually take their place. Usually two treatments are required per year, one for rooted plants and one for algae.

Copper sulfate may kill a few small fish if used along the shoreline. Continued heavy use of copper sulphate will decrease fish food production. Aquathol and Diquat are safe to fish, but they are expensive. The application of these chemicals is to be done by the landowner, with technical assistance furnished by the Game and Parks Commission.

All listed chemicals are either toxic or irritating to human beings and should be applied according to manufacturer's recommendations. Contact with the chemical should be avoided. Goggles, respirator, rubber gloves and protective clothing should be worn by the applicator. After treating vegetation, cattle and other animals should not be allowed to drink water from the pond for approximately three weeks. A 2-4-D spray can be expected to give fish an "off-flavor" for some time after treatment.

Lowering the water level of the pond is not recommended for vegetation control. Largemouth bass and bluegill utilize the pond's shallow edges for spawning, and if the water is lowered before July 1, all of that year's fish production may be lost.

In summary, aquatic weed treatment is not a sure thing and is expensive. It is usually recommended that weeds be removed mechanically from small spots to allow fishing. In coming years, research should provide more positive and inexpensive methods of weed control. Ω

Farm Ponds

Managing for Sport Fishing

WHEN THE preceding construction requirements are met, the pond will qualify for stocking. However, a Game and Parks Commission fishery manager will consult with the pond owner before approving the state stocking application.

Fish for stocking Nebraska ponds are available from either the Game and Parks Commission or private fish culturists. A list of private culturists in Nebraska may be obtained by contacting a Game and Parks Commission office. Priority of state hatchery production is given to Nebraska public waters, and the demand may be so great at times that applications for private ponds cannot be filled. A copy of the Game and Parks Commission policy on private pond stocking may be obtained upon request. Fish furnished for stocking by the state are fingerlings, 1 to 2 inches long. These fish are hatched in May and June and stocked in late summer of the same year.

The Game and Parks Commission recognizes that a pond qualifying for and receiving fish from the State of Nebraska is subject to the control of the landowner under Nebraska trespass laws. However, a balanced yearly harvest of fish is strongly encouraged because this is the best means of sustaining high quality angling year after year.

Largemouth bass, bluegill and channel catfish are the fishes most often recommended for stocking Nebraska warm-water ponds because they furnish a good quality fishery appealing to all age groups. Stocking rates and ratios are determined by Game and Parks fishery managers. A typical stocking includes 100 largemouth bass, 500 bluegills and 100 channel catfish per surface acre of water.

Occasionally, fathead minnows are stocked along with largemouth bass and channel catfish. In these ponds, the fatheads rather than bluegills serve as forage for bass. This combination, however, does not provide the all-around fishery available when bluegills are present.

In unfenced ponds or ponds where silt does not settle out, channel catfish-only stockings (200 per surface acre of water) may be recommended. Channel catfish are especially adapted for life in turbid water because their barbels (whiskers), which lend them their feline appearance, are sensory aids for locating food. Largemouth bass and bluegills, on the other hand, are sight feeders and as such do best in fairly clear water.

Some pond owners request that northern pike and walleye be included in initial stockings. In most instances, reproduction is not sufficient to maintain a continuing population. It is not practical to restock northern pike or walleye in established ponds because resident bass, bluegill and other fishes devour the fingerlings. This makes restocking expensive and wasteful.

Most sandpits or spring-fed ponds in southeastern and south-central Nebraska will not support trout because of high summer water temperatures. However, in northern and western Nebraska, many spring-fed ponds are suitable for trout. The rainbow trout is the most popular species, although both brook and brown trout have been stocked experimentally. Natural reproduction will not occur in ponds or sandpits. Advice on restocking may be obtained from a Game and Parks Commission fishery manager.

Bluegills are stocked to provide food for bass and recreation for anglers. Sustained yields of both species depend mostly upon the ability of largemouth bass to consume enough bluegills to keep their numbers in check. Problems arise when bluegills

Farm pond bluegills provide winter-time sport

become too numerous. A "stunted" population of many small bluegills and few if any large ones, is the result. In addition to annoying anglers, small bluegills disrupt the largemouth bass population by harassing spawning fish and eating their eggs. In a short time, few bass remain and quality angling is only a memory.

Regulated angling helps maintain the proper balance between largemouth bass and bluegills in new ponds. Bluegills must be cropped starting the summer after they are stocked, when they begin spawning. Angling for largemouth bass should not begin

A modest craft and warm spring day meet pond fisherman's requirements

photos by Greg Beaumont

until one year later when they reproduce for the first time. By then, unless bluegill numbers are controlled, largemouth bass reproduction may be seriously limited.

For every pound of bass removed, four or more pounds of bluegills should be taken out. A fish crop is produced every year and the surplus should be harvested. A reasonable amount of fishing will not be harmful if this balanced harvest is maintained. Well-managed ponds may contain 50 pounds of largemouth bass per surface acre of water. Approximately 40 percent or 20 pounds of largemouth bass per surface acre may be harvested each year. Additional harvest of largemouth bass will upset the balance between bass and bluegills.

Channel catfish provide an additional bonus to farm pond anglers when stocked with largemouth bass and bluegills. They are not serious competitors for food or space with either species, and they provide a different variety of sport fishing. Channel catfish must have an enclosed place or chamber for nest building and egg deposition. In many ponds, such habitat must be provided by the landowner before spawning can occur. Sewer tile, 6 to 8 inches in diameter with one end plugged, or 10-gallon cream cans, placed horizontal to the bottom in 2 to 6 feet of water, make excellent artificial spawning chambers. Spawning chambers need not be placed in ponds until two years after channel catfish are stocked. Channel cats are not sexually mature until three years old. In some instances, tree roots and stumps left in the upper end of the pond may provide natural spawning sites. Self-sustaining populations of channel catfish do not occur in all ponds, even though adequate spawning habitat is available. Maintenance

A pond provides many things; erosion control, wildlife habitat and recreation

stockings of 4 to 6-inch channel catfish may be necessary.

Growth rates vary a great deal from pond to pond throughout the state as shown in table on page 33. The upper limits for bass, bluegill and catfish at one year of age would indicate a good well-managed pond. The lower limits show the influence of a muddy or poorly managed pond. Usually, growth of fish in new ponds is quite rapid for two or three years after they are stocked. Later, as the expanding fish population stabilizes, growth rates slow down.

Fertilization is not recommended or needed for most Nebraska ponds. In addition to being expensive, fertilization may also cause problems such as excessive growth of algae or "pond scum". The water in ponds reflects the fertility of the land from which it drains, and in Nebraska the soils are quite fertile. Furthermore, the natural fertility of the watersheds of many ponds is enhanced by the application of agricultural fertilizers during the growing season. Thus, additional nutrients to encourage the growth of natural foods for fish production are not needed.

Just as in the fertilization of land, water fertilization is expected to give an added yield in return for the investment. This added production in relation to cost will not be obtained in most Nebraska waters. Exceptions would be a newly pumped sandpit or a pond with little or no drainage area. Before any fertilization program is started, the landowner should contact a Game and Parks Commission fishery manager.

Artifical feeding, using a prepared fish food or waste grain, is also not recommended unless the pond is used for commercial fish production. If a pond is well constructed and well managed, natural foods such as insect larvae, snails and worms will be abundant.

Bullheads, carp, crappie, green sunfish, white perch and yellow perch are found in many Nebraska ponds. These species rarely provide satisfactory fishing because of overpopulation and stunting. Carp and bullheads are also troublesome because their bottom-feeding activities cause the water to become cloudy. Under no circumstances should any of these fishes be introduced into a well-managed pond.

Their presence results from stocking by well-meaning but uninformed anglers, or from waters above or below the pond. Anglers should never dump minnows or any other kind of fish into a pond. Probably more Nebraska ponds have been ruined by unintentional and misguided stockings than by any other factor. A large watershed containing ponds contaminated with undesirable fishes presents a serious threat to the landowner wishing to enjoy quality fishing.

Once established, undesirable fish populations are difficult to control. Seining or partial removal of fish using chemicals offers only temporary relief and must be done annually. Draining the pond to a low level in the fall so winterkill may reduce the population provides similar results. Restocking is not the answer because fingerling largemouth bass, bluegill and channel catfish are subject to predation and competition for food and space from the existing population. For this reason, ponds should not be stocked when other fish are present.

Pond owners having problems with unwanted fishes should contact a Game and Parks Commission fishery manager. He will provide technical assistance and suggest a program to

GROWTH RATES OF STOCKED FISH

SPECIES	LENGTH WHEN STOCKED		LENGTH ONE YEAR LATER		
	MINIMUM	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM
Largemouth bass	2"	3"	5"	9½"	14"
Bluegill	1"	1½"	4"	5¾"	7½"
Channel catfish	2"	3"	6"	9"	12"

bring the pond back to desirable fishing standards. In most cases his recommendation includes removal of all fish followed by restocking with desirable species.

Ponds that can be completely drained are especially easy to rehabilitate. Subject to approval by the Game and Parks Commission, rotenone may be used to kill fish in ponds that cannot be drained. This chemical is useful because it does not affect warm-blooded animals. Assistance in applying the chemical may be provided by the Game and Parks Commission. Landowners pay only for the cost of the rotenone.

A fish kill may occur in some Nebraska ponds during hot summer months. Excessive fertility and cloudy weather can cause the dissolved oxygen content of the water to become too low for fish. A pond receiving feedlot drainage is especially subject to this condition. In addition, a few species of algae when present in large amounts are toxic to fish during hot weather.

Winter periodically takes its toll of fish populations in many ponds. Winterkill is caused by insufficient amounts of dissolved oxygen in water under cloudy ice and/or snow cover. This cover prevents addition of oxygen to the water from the air. Ice and snow prevent sunlight penetration into the water, limiting oxygen production by aquatic plants. Under normal daylight conditions, oxygen is produced and liberated into the water where it becomes available to fish. Under darkened conditions, the plants cease oxygen production. Shallow ponds, less than 10 feet deep, and ponds with excessive amounts of vegetation, are especially prone to winterkilling.

Preventing winterkill is a difficult task. Chopping holes in the ice is wasted effort because there is little aeration or circulation of the surface water. In some locales, irrigation wells have been used to replenish dissolved oxygen supplies. Complete or partial removal of snow from ice is effective because sunlight penetration starts oxygen production. Wind-driven pond mills which circulate water and keep at least a portion of the surface free of ice and snow have also proven useful.

In recent years, chemicals have been used extensively in controlling agricultural pests in Nebraska. Many of these chemicals are lethal in minute quantities to fish and wildlife. Careless use of pesticides has caused serious fish kills in some Nebraska ponds and will undoubtedly continue to be a major problem in pond management.

Landowners should follow the directions on labels and should use extreme caution when applying agricultural chemicals in pond watersheds. Organo-phosphates in particular, along with other insecticides used for insect control near ponds, may kill fish. Any fish loss where chemicals are involved should be immediately reported to the nearest Game and Parks Commission fishery manager or conservation officer.

Fishes may be raised and sold for human consumption, stocking, and bait with a permit issued by the Game and Parks Commission. A variety of species are grown to satisfy these needs.

Commercial production involves much more than ownership or control of one or more ponds. Hatch houses, raceways and additional facilities may be needed. Ponds must be constructed to facilitate harvest of the fish crop. A thorough understanding of fish culture, including prevention and treatment of disease, is required.

Pond owners thinking of starting a fish farm should first visit a private or state hatchery and become familiar with its operation. Then as their knowledge increases, they may decide whether or not to proceed.

The use of proper angling methods helps insure an adequate yearly harvest of fishes. In order to be effective, anglers should be familiar with the food habits of the fish they are trying to catch. Bluegills, largemouth bass and trout feed by sight while channel catfish use their barbels to locate food.

To catch pond fish offer baits of their normal foods or imitations. Bluegills and trout feed primarily on insects. Worms, grasshoppers, small flies and poppers are effective on bluegill while artificial flies that "match the hatch" will catch trout. Small spinners and spoons will also take trout.

Largemouth bass feed primarily on small fish, crayfish and insects. The best bass fishing is in the spring and fall or during morning and evening hours in the summer. Small plugs, plastic worms, and spinners are popular offerings. Casting with artificial lures is productive at night.

Channel catfish are bottom feeders that can best be caught at night on crayfish, dead or live minnows, chicken entrails and prepared baits.

Anglers should present the bait or lure they are using in a natural manner. Large hooks and heavy sinkers are not good tools for harvesting a fish crop. Ω

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