

RECEIVED

FEB 20 1933

FISH DIVISION

Report
185-13

October 18, 1932

GENERAL COMMENTS ON LAKE INVESTIGATIONS AND LAKE IMPROVEMENT

The work of the Institute in its lake investigations consists chiefly of two major items: (1) the examination of the lakes to determine the conditions for fish life and (2) the recommendations for the improvement of these conditions. A general discussion of these two items follows.

Lake Examination

This work is carried on by the field party. This party generally consists of seven men, some of whom have specialized in certain phases of the work. Those factors which are known to influence fish life, directly or indirectly, are given consideration and are recorded on maps and field notes. Unless good maps or air-plain maps of the lakes are already available, the lakes are surveyed. Depths are taken at many localities and are recorded. The kind of bottom and kinds and abundance of aquatic vegetation are listed. A chemical analysis is made to determine the amount of oxygen present at various depths, the acidity or alkalinity of the water, and the carbon dioxide and certain other substances. Temperatures are taken at all depths. A study of the food and shelter is made. Spawning beds are given special consideration during spawning seasons. An investigation of the predators is made. Some netting is carried on to determine the growth of the fishes. Certain minor factors are also considered.

Area, depths, kind of bottom, location of weed beds, abundance of weed beds, spawning areas, shelter, and amount of shoal area are recorded on the maps. Other information is listed on cards especially prepared for these items.

Lake improvement recommendations

The improvements ~~to~~ wanted depend on the conditions of the lake. They are

based primarily on three factors which are essential to fish life. A fish must have food, it must have protection and, unless we depend entirely on stocking, it must have proper conditions for reproduction. Certain chemical conditions are also essential. If, however, a lake is not suited, chemically, or in temperature conditions, for certain species, nothing can ordinarily be done to alter conditions.

The several items are given separate consideration:

1. Stocking The requirements of the more common fishes are fairly well known. An examination of the fauna already present, and of various factors in the lake indicates which fish may be expected to do best in that particular body of water. Generally conditions are favorable for a number of species and, in such cases, the kind of fish recommended to be planted depends to some extent on the desires of those who fish the lake.

The number of fishes recommended for stocking depends on the number already present, on the amount of food available, on the amount of protection, on spawning conditions, predators, amount of shoal area, general depth of lake, size of lake, amount fished and on certain other items. The improvement work and survey work are not intended to take the place of all stocking. They are intended, partly, to make intelligent stocking possible. It is possible that fish may be placed in lakes which need no stocking or are already over-stocked, they may be placed in waters for which they are not suited, or, they may be placed in lakes with little or no protection, only to be consumed by the larger fish very soon thereafter.

No definite formula for stocking is available. After the various conditions are given due consideration, the number of fish which is considered desirable is recommended.

Consideration is also given to the danger of over-stocking, which often results in the dwarfing of the species planted, or in unfavorably affecting the growth and survival of other fish. Thus a heavy overstocking with perch fingerlings will doubtless lead to a great increase in the destruction of bass fry.

2. Food The growth rate of a fish, within certain limits, depends largely on the amount of food consumed. Food also has a direct relationship to the fishability of a lake—waters containing many fish need not necessarily be good fishing lakes. An ideal lake, for fishing, is one in which the fish have food enough to grow well, but in which the food is limited enough so that the fish can be tempted readily by the angler. In lakes where food is present in large enough amounts for the fish population, it may be desirable to increase both fish and food. This is especially true of some more or less barren lakes.

In water, as on land, all food depends primarily on the basic fertility. The elements are used by the microscopic plants, and by the coarse vegetation. The minute plants are eaten by the small animals which, in turn, are eaten by larger organisms and these are eaten by still larger ones. Some species of fish eat the very small organisms, and a few feed on larger vegetation, most of the food fishes, however, live on larger organisms which have received their food, directly or indirectly, from the microscopic plants.

The fertilization of lakes to increase basic fertility is not recommended except locally or experimentally. After more experimental work has been carried on in this connection, it is possible that means of increasing basic fertility at reasonable cost may be developed.

Studies of minnows and other food organisms are made, but, the most satisfactory means of determining food appears to be by an indirect method—by determining the growth rate of the fish. If a fish grows fast, it may be assumed that it is obtaining proper nourishment.

Food may be increased in a number of ways. In lakes containing few weed beds the increase of vegetation aids in providing suitable conditions for growth of aquatic insects. If suitable forage fish are not present certain species of desirable minnows can be introduced. Brush shelters increase food.

One of the best ways of increasing food is through the providing of proper facilities for the spawning of blunt-nosed minnows and certain other species. Such

spawning places may be provided easily and economically. These very desirable and non-predaceous minnows lay their eggs on the underside of flat objects which are resting on the bottom in shallow water. They lay their eggs on the under side of most any objects found in water from 3 inches to 20 inches deep, provided the under surface is flat or nearly flat.

The accompanying diagram shows one method of providing suitable spawning areas. Slabs are generally available near most of our northern lakes. These are excellent if submerged with the flat side downward. The arrangement shown is considered more desirable than individual slabs because, in this arrangement, conditions will still be favorable for spawning even after the device sinks into the bottom for a few inches. Any other flat objects are useful in this method of increasing the fish food.

Resorters have a tendency to "clean up" the shores and, in so doing, they remove those objects which are highly desirable for the minnows. It is generally recommended too that persons refrain from "cleaning up" the lake shores to too great an extent. If necessary the material can be removed from in front of cottages or bathing beaches but it should be moved elsewhere in the lake rather than be removed from the water entirely. The slab devices should prove to be unobjectionable except, possibly, on bathing beaches.

The slab arrangements have proven so successful that they are recommended for most lakes. Since construction of these devices is generally demonstrated where lakes are examined, the methods of installing slabs are not discussed here.

3. Shelter This item, an extremely essential one, is quite often overlooked. If a man wished to raise foxes, chickens, rabbits, and hounds he would not put them all in one enclosure and expect good results from all four kinds of animals. The fishes in a lake cannot be separated, but, conditions can be so adjusted that the young fish may find safety and may keep from becoming the food of other species or of the adults of their own species. Many fish are cannibalistic.

Many have highly predaceous tendencies. Whether young fish be planted or result from natural reproduction, many of the young must survive if fishing is to remain at a constant level or if it is to improve.

At one time a considerable quantity of logs, brush and deadheads were found in the shallow water of most of our lakes. With resort development this shelter has been gradually removed and today many lakes offer no protection except that which the weed beds may afford. In winter most of the vegetation dies and the smaller fish may have no protection at all. Even in summer the coarse weeds offer only a limited amount of safety.

A very satisfactory device, easily and economically made, serves excellently to protect young fish. Experimental brush heaps have proven successful to an almost unbelievable extent, in sheltering young fish.

The construction of these shelters depends to a large extent on the kind of material available. One way of constructing a brush shelter is illustrated in the accompanying diagram. This type of shelter is especially desirable in some lakes because the open sheltered center of the heap offers the opportunity for establishing weed beds. Silt tends to collect here and the current action is more or less broken, giving weeds a better chance here than elsewhere to become established. Other types of structure may be used. On barren shores rich soil may be placed in the open areas and vegetation may be planted.

The shelters designed primarily for protecting the growing fish should be placed in fairly shallow water where the small fish are found but should be placed just deep enough so that they will not interfere with boating and with the scenic aspect, and so that they will not be damaged too much by ice action. (Experiments to determine the effect of ice action on the brush shelters were not conclusive during the last winter because of the mild conditions and resulting lack of the usual amount of ice.) Other shelters may be placed in deeper water, to attract large fish for angling.

Orchard trimmings, because of their hardness and "kinkiness" are especially desirable but, where not readily available, other brush may be used. Green brush will last much longer than dry brush. The brush should not be packed but should be loosely woven or put together.

Algae and insects are usually found on and among the brush, providing food. The two chief items in the life of small fish are thus provided,—they have the necessary shelter and have access to food without leaving their protected area.

Incidentally, fishing is also improved, where food is limited, since larger fish tend to concentrate around the shelters. This concentration is due, of course, to the fact that the large fish are looked for food. Experience in many countries and states has proved that fishing is made easier and better by the installation of shelters.

Brush shelters tend to improve all lakes but are most essential, especially in summer, where vegetation is not abundant.

4. Spawning Beds Various fish have different spawning requirements. The nest building fishes, especially bass and bluegills generally spawn in water from 1 to 6 feet deep. Large-mouth bass and bluegills may build their nest on gravel, chips of wood, roots of vegetation, and on other substances. Gravel is considered most desirable but these fish do not always use it even when it is available. Smallmouth bass almost invariably use gravel for their nests. The introduction of gravel in the spawning areas, if little or no gravel is present, is desirable especially for small-mouth bass, and to some extent also, for large mouth bass and bluegills.

Where the bottom is firm, gravel may be placed directly on the shoal bottom, either evenly strewn or in piles not more than 2 or 3 inches high at the center. The piles are especially needed if small-mouth bass spawning is to be increased.

Where the bottom of the shoal is very soft, gravel will sink out of sight. Here waterlogged chips or sticks can be strewn over the bottom to form the bottom of the

excavated nests, if spawning conditions for bluegills or large-mouth bass are being improved. If the spawning of small-mouth bass is to be increased in lakes with soft-bottom shoals, coarse gravel should be put in spawning boxes. Fine gravel and some sand mixed with the coarse gravel is satisfactory. The boxes should be about 3' x 3', with walls about 3" high. The gravel should fill the box even with the edge.

5. Predator control Gar and dogfish and other objectionable predatory species may have a decided affect on keeping down the fish population.

Where such fish are abundant control measures are desirable.

The fish-eating birds, such as kingfishers, bittern and heron do some damage.

Studies now being made will indicate, more or less, the extent of the injuries done.

The killing of these birds, on lakes, will not now be recommended, since the full extent of their damage is not yet known. It is possible that their value to ornithologists and nature lovers may more than balance their destructive tendencies.

There has been much discussion on the snapping turtle. It is well known that it will kill shore birds and swimming birds, that it will take fish without hesitation from stringers or nets, and that it will eat dead fish. Those who have studied snappers do not doubt that the turtles are perfectly willing to include fish in their diet. However, it is not known to us, how capable the animal is of obtaining live, healthy fish under natural conditions. Whether or not it is destructive to spawn must also still be determined. If it eats chiefly dead or weak fish, good rather than harm results. Since many persons regard the snapper as a desirable food item, it must be regarded as having a definite economic value. It is possible that the snapper is a serious menace to fish life but, until further evidence has been obtained, we have no grounds for making recommendations for the control of this creature.

Predatory control is recommended where such control is considered necessary. Objectionable fishes are usually best reduced in number by spearing or by netting.

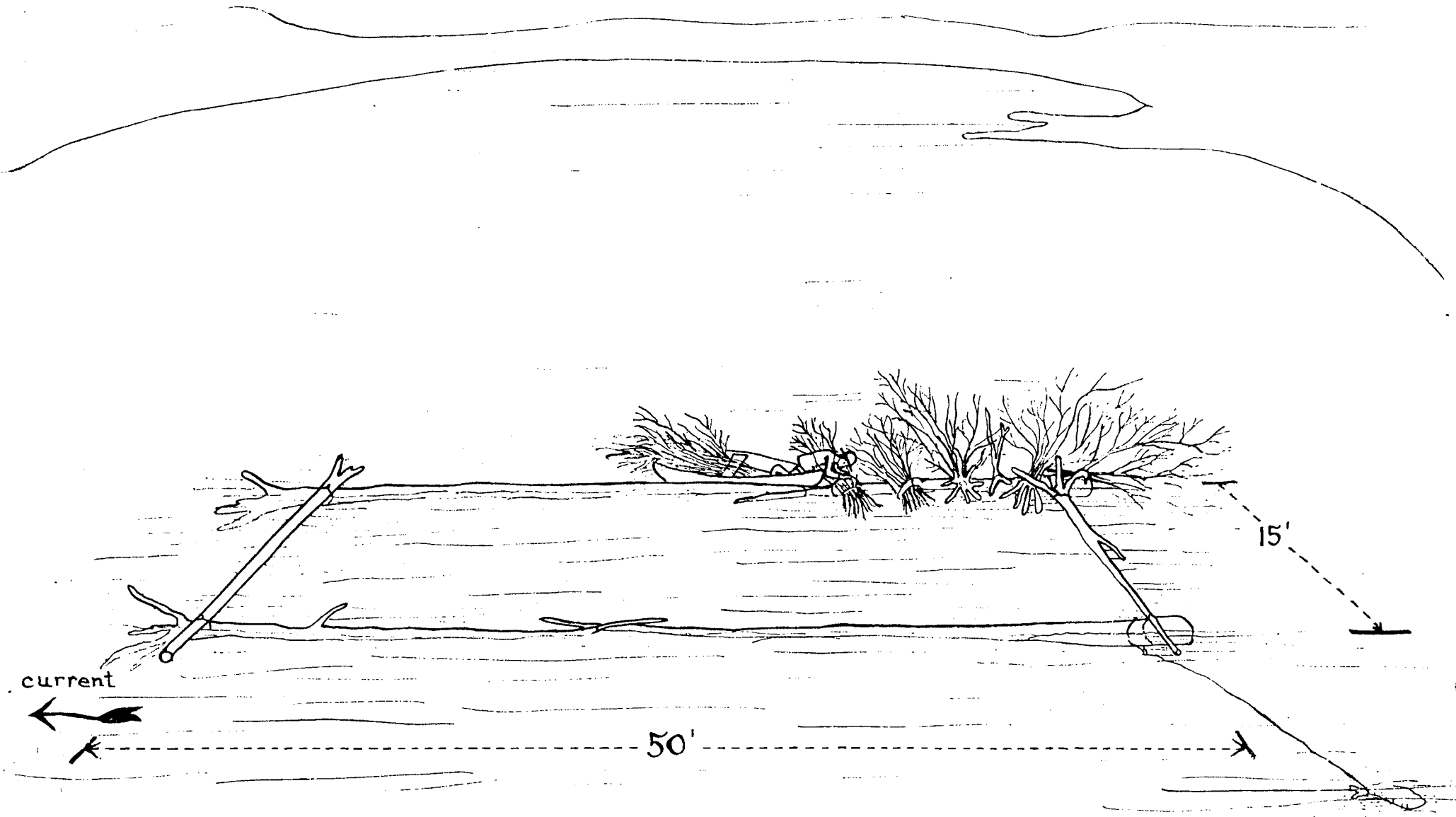
6. Water Level The raising and lowering of water level, in lakes where this is possible, presents a problem which must be given consideration. This item will be discussed under separate reports of those lakes in which the water level is artificially controlled.

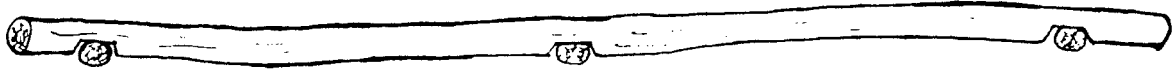
7. Other A discussion of other items needing consideration will be found recommendations in the reports on individual lakes. This includes such matters as planting of vegetation, removal of vegetation, etc.

The improvements recommended are not radical ones. They have been used successfully in other countries, or have been studied and considered carefully. The improvements are based on a study of the needs and habits of the various fishes.

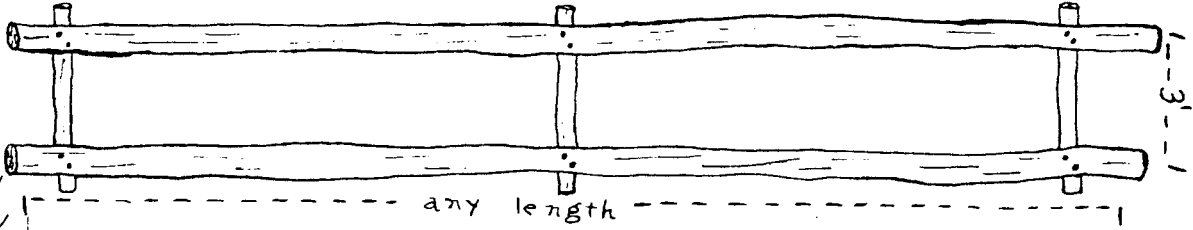
The practicability and costs of improvement work has not been overlooked and the esthetic side has been given due consideration. The extent of improvement work suggested is based on the needs of the fish, but is limited to what we consider a reasonable expenditure of time and money.

The Institute for Fisheries Research is always willing to try to answer any questions concerning our lakes. Many questions are still unanswerable and some problems are now being worked out. The organization, however, is quite optimistic as to the value of improvement work in building up fishing ⁱⁿ our lakes.

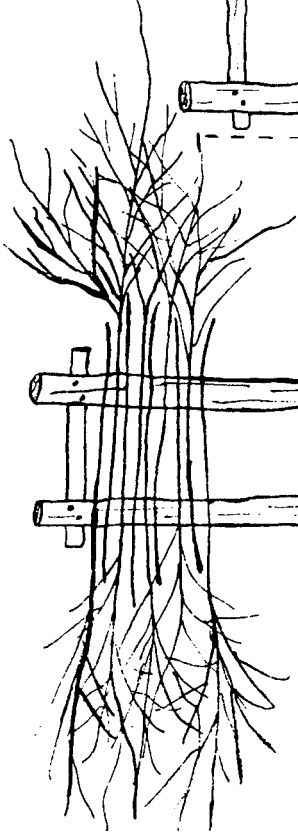




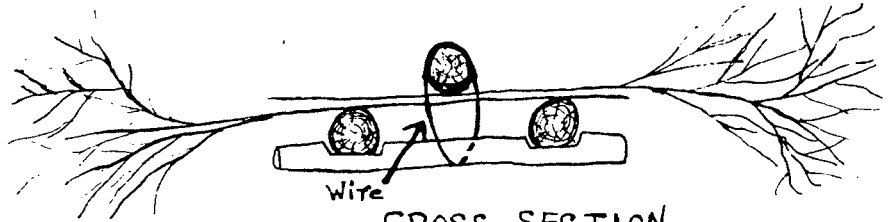
SIDE VIEW OF BASE



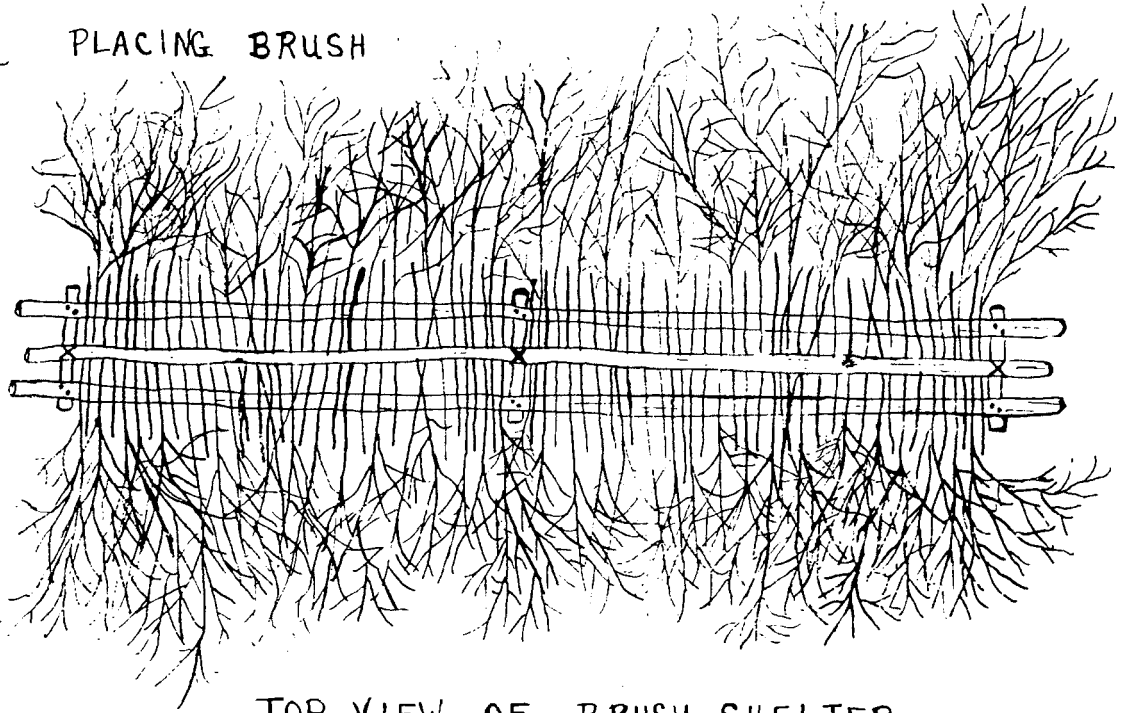
TOP VIEW OF BASE



METHOD OF
PLACING BRUSH

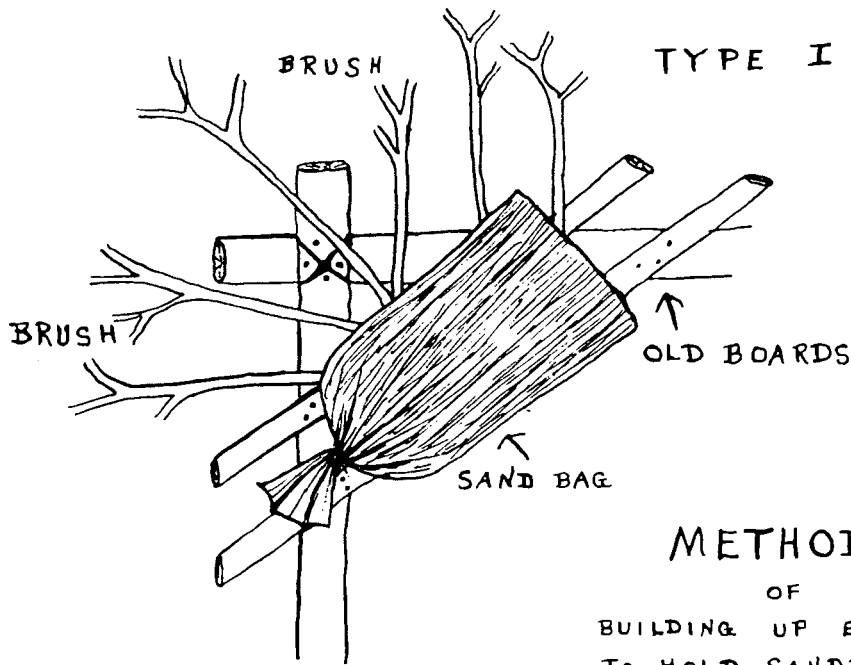


CROSS-SECTION

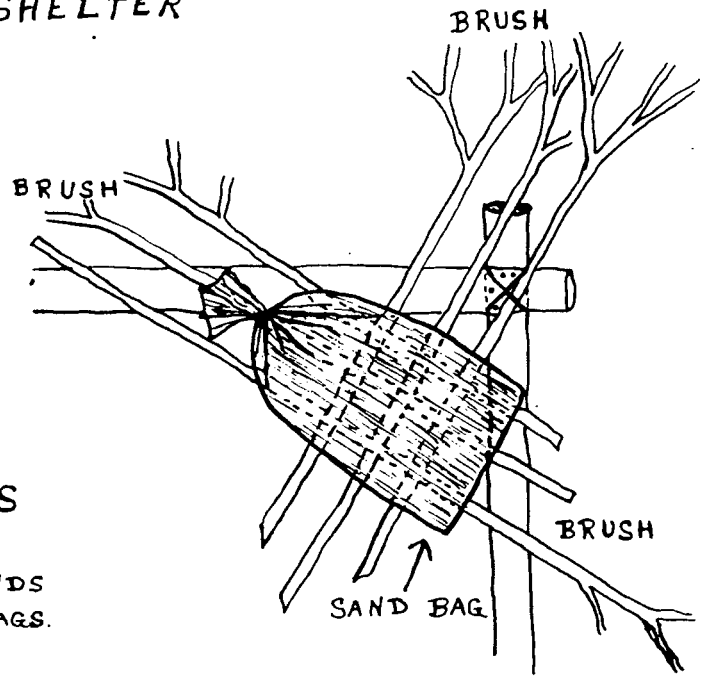


TOP VIEW OF BRUSH SHELTER

BRUSH SHELTERS

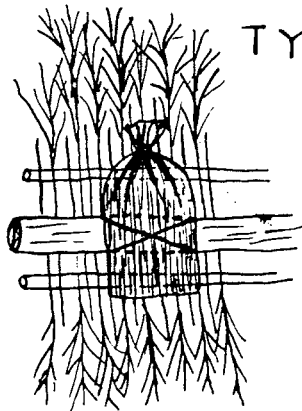


TYPE I SHELTER



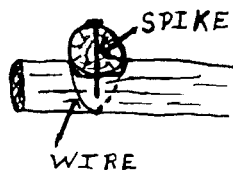
METHODS
OF
BUILDING UP ENDS
TO HOLD SANDBAGS.

Calcium chloride bags can often be obtained from highway departments. These bags are ideal when filled with sand.



TYPE II SHELTER

SAND BAG WIRED ON
CROSS PIECE.



METHOD OF FASTENING
FRAMES AT ENDS.

