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SURVIVAL

Compiled by

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INTRODUCTION

The purpose of this document is to help insure your survival in all areas where Department of National Development field parties operate. The information herein, together with your initiative and will to live, could save your life.

Generally, the basic ingredients for survival are wits and water. Retain your wits and find water - the rest will follow. You may exist for thirty days or longer without food but, without water and adequate precautions to preserve your body fluids, you will die in three days or less in some of our areas of operation.

Much of the information in this document was reproduced by kind permission of Department of Army, whose manual on survival includes coverage for conditions in Australia and Papua New Guinea.

Survival in the Antarctic is not included because a special course is provided for personnel programmed for duty in that region.

PRE-PLANNING

Survival in the field depends to a large extent on pre-planning and preparedness. Before leaving home-base, party leaders should ensure that survival aspects, appropriate to the forthcoming field task and environment, are provided for adequately. They should always notify the Police (or other) authorities of their intended movements and timing, along the route to and from remote areas

At field-bases the planning of each sortie should include a course of action to cover emergencies. Team leaders should make sure that survival equipment, including food and water, is properly distributed and controlled. Each member of a field party should understand what he must do in an emergency.

This survival manual, although intended as an item of field equipment, should be read and understood before personnel venture forth on field activities.

SURVIVAL ON LAND

IMMEDIATE ACTION

During field operations an emergency could arise, for example, from a vehicle mishap or aircraft forced landing. Your immediate action is to provide medical aid where necessary, but only the most urgent cases should be treated. Broken limbs and lesser injuries can wait; it is more important to salvage water, food, radio, vehicle fuel and oil etc., as these could be necessary for survival.

A decision to stay on-site, or to move out, must follow and this will depend in part on your pre-planned arrangements with the field-base. Generally, the best advice is to stay on-site and await rescue. Leave the site only when:

a. it was pre-planned that you do so, or

b. you are certain of your position and know that you can reach help with available equipment, food and water, or

c. after waiting several days you are convinced that rescue is not coming and you are equipped to travel.

Remember that, particularly in our continental hot dry areas, you will last much longer without water by staying in the shade near your vehicle/aircraft than by exhausting yourself trying to walk out.

If you come down in dense jungle - e.g. helicopter forced landing in Papua New Guinea - it is advisable to walk out because your aircraft and signals will not be seen from the air. Also, food, water, and shelter are usually available in that region.

SUBSEQUENT ACTION

If you have water, food, and shelter you can survive indefinitely whether you remain on-site, or move out.

The ability to signal and communicate (even by primitive methods) with search parties is another important aspect of survival. Further, a knowledge of navigation could increase your chances of reaching safety.

Once you have taken stock of your immediate circumstances you should become vitally conscious of these primary ingredients for survival.

WATER

GENERAL CONSIDERATIONS

INTRODUCTION

Survival depends on an adequate supply of drinking water and you can expect to survive for about three weeks on water alone. In areas with high temperatures, without water and resting in the shade, you can expect to live for two to five days. If you rest during the day and walk at night, this period is reduced to one to three days. This expectancy of life increases with cooler conditions but it is generally accepted that life expectancy without food and water and resting in shade at all times is, at the outside, 10 days.

Therefore, learn to use water intelligently, especially if it is scarce. It may be necessary to impose water discipline. When thirsty or hot from exercise, it is advisable to sip small amounts of water at a time. When water is available in quantity you should drink your fill, but not to excess.

Finding water in jungle and in temperate zones is usually simple. It is important, however, to remember that water is a germ carrier and is usually polluted near human habitation, particularly in warm and tropical climates.

When water is not available on the surface, other means of obtaining it are by digging, especially along a flat sea-shore and in the flood plains of rivers, but more particularly from water-giving plants and climbing vines.

PURITY

Do not drink impure water, no matter how overpowering the thirst. Water-borne disease is one of the worst hazards to survival. Impure water teems with disease organisms.

Water can be purified in a number of ways:

a. By using sterilization tablets and allowing the water to stand for about 30 minutes.

b. By adding two or three drops of iodine to one quart of water, and allowing to stand for 30 minutes.

c. By adding a few grains of permanganate of potash (Condy's crystals) to one quart of water and allowing to stand for 30 minutes.

d. By boiling for at least three minutes.

Running water is preferable to water from pools. If all other sources have been exhausted, water may be drawn from muddy or stagnant pools even though evil smelling and otherwise obviously objectionable.

Water from pools must be purified. Muddy water can be cleared by using one of the following methods:

a. Let it stand for 12 hours.

b. Pass it through about three feet of bamboo filled with sand. Stuff grass in one end to retain the sand.

c. Pour into a cloth filled with sand.

d. Use a sand and charcoal sieve.

Availability of Water

Remember, water is possibly the most important factor when considering any cross-country movement in the tropical zone.

FINDING WATER

SOURCES OF CLEAN WATER

Fresh water, not usually in need of purification, can be obtained from the following sources:

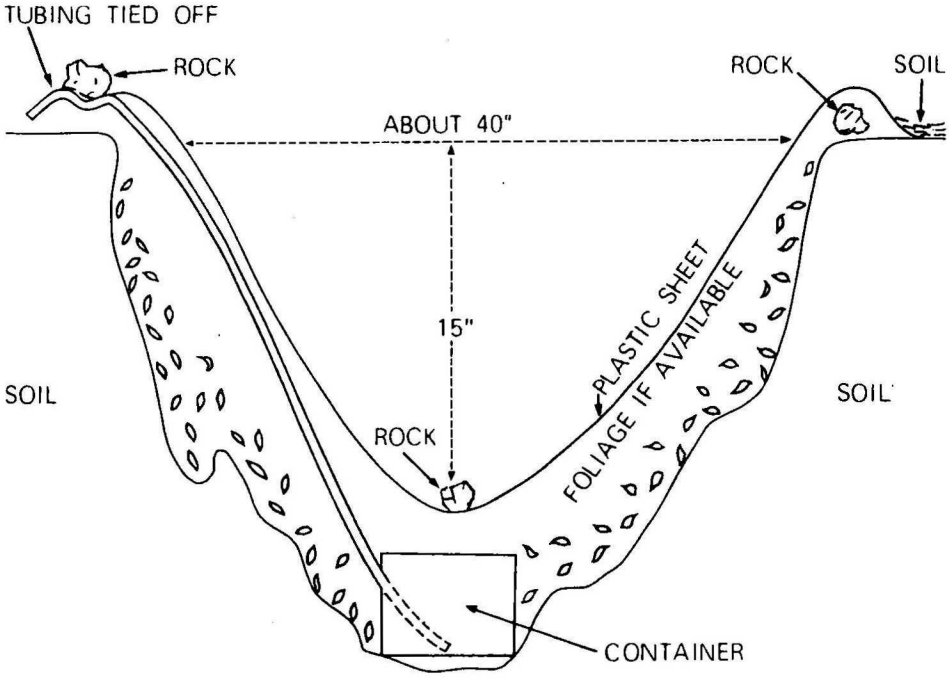
a. Rain. Rain can be collected as it falls, by several methods:

(1) Collecting the run-off from large leaves.

(2) Building a rain trap with large leaves over a framework of bamboo or branches. A piece of clean plastic material is even better.

(3) Using a plastic sheet with an outlet tube attached to the centre through which water can be drained. This may be suspended in the air with a clean weight in the centre, or spread over a depression in the ground.

b. Evaporation. Up to three pints of water a day can be obtained even out of hot desert sands by a simple water still made with a sheet of clear plastic and a tin can. The still is made by digging a hole about two feet deep and three feet wide, placing a can or other container on the bottom, then covering the hole with a sheet of plastic. The centre of the plastic is pushed down to form a cone aimed at the container. As air under the plastic gets hot, moisture from the ground evaporates and condenses on the underside of the plastic. The drops run down the cone and into the container. A tube can be inserted into the container and run to the surface. This allows drinking from the container without disturbing the still.



SOLAR STILL

c. Streams. Fast flowing streams with a mixed sand and stone bed provide clean water. If there are no signs of animal deposits, habitation or sewerage within half a mile or so up stream, this water may be pure and ready for drinking. Always take the water from the centre of the stream and below the surface.

d. Plant Receptacles. During the monsoon or wet season, water can be collected from natural receptacles found on various plants. This will be fresh rain water and fit for human consumption.

SOURCES OF WATER WHICH SHOULD BE PURIFIED BEFORE DRINKING

a. Water-holes. Water found here will probably be muddy and contain pieces of rotten vegetation. Filter it first, then allow to stand for a few hours; filter again, then purify.

b. Digging. Treat water as for sub-paragraph a. Water collected on the sea-shore by digging should be fairly free from salt; the fresh water floats on the top of salt water, so do not go too deep. The water obtained in this way may taste slightly brackish, but it will be safe to drink. If it is very salty, filter it a few times or dig again farther up the foreshore.

c. Stagnant Water. This is not necessarily infected, but in order to make sure, filter then purify it. Stagnant water may be found in small pools, among rocks, dead tree stumps, etc.

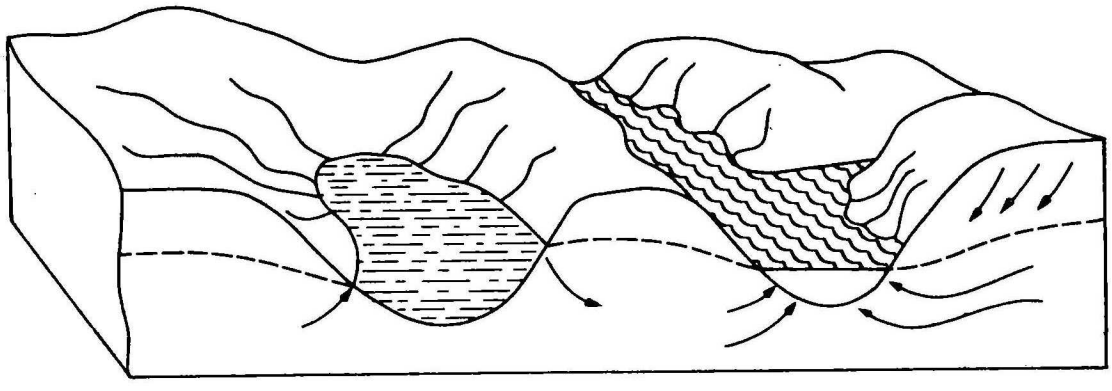
d. Water from Animal Watering Places. At times it may be necessary to use water for cooking and drinking which has been obtained from animal watering places. This is not necessarily dangerous and can be purified. It is advisable also to filter this water, to clear it.

e. Large Rivers. This water will be muddy and probably infected, so treat as for water-holes.

f. Jungle Plants with Receptacles. In certain cases, such as the cups of pitcher plants, the water will be foul with decaying insects. It may be impossible to drink it, but, if not, treat as for stagnant water.

WATER TABLE

When no surface water can be found, tap through the earth's water table for water that has seeped into the ground. Access to this table and its supply of generally pure water depends upon the contour of the land and the character of the soil.



Water table indicated by dotted line

ROCKY SOIL

a. Springs and seepages may be found in most rocky soils. Limestone has more and larger springs than any other type of rock. Because limestone is easily dissolved, caverns are readily etched in it by ground water. Look in these caverns for springs.

b. Because lava rock is porous, it is a good source for seeping ground water. Look for springs along the walls of valleys that cross the lava flow.

c. Be on the lookout for seepage where a dry canyon cuts through a layer of porous sandstone.

d. In areas with abundant granite rock, look over the hill sides for the green grass. Dig a ditch at the base of the greenest area and wait for the water to seep in.

LOOSE SOIL

Water is usually more abundant and easier to find in loose soil than in rocks.

a. Look for ground water along valley floors or on the slopes bordering the valley because it is in these areas that the water table is most likely to surface. Land above river valleys also yields springs or seepages, even when the river is dry.

b. If you decides to dig for water, first look for signs of a valley under a steep slope, or dig out a green spot where a spring was present during the wet season. In low forests, along the sea-shore and in river plains, the water table is close to the surface. Very little digging usually yields a good supply of water.

c. Run-off water is found above the water table and includes streams, stagnant pools and water in bogs. Consider it contaminated and purify it even if it is away from human habitation.

SEA-SHORE

a. Water may be found in the dunes above the beach or even on the beach itself. Look in the hollows between sand dunes for visible water and dig if the sand seems moist. On the beach, scoop holes in the sand at low tide about 100 metres above the high tide mark. This water may be brackish, but is reasonably safe. Run it through a sand filter to reduce the brackish taste.

b. Do not drink sea water, the salt concentration is high and body fluids must be drawn off to eliminate it.

c. If insufficient fresh water is available, a temporary measure is to add one half pint of sea water to six pints of fresh water and boil the mixture.

IN DESERT OR ARID COUNTRY

When isolated in desert or arid regions, watch for water indicators. Some of the signs include:

a. Converging game trails.

b. The direction in which certain birds fly; parrots and pigeons must live within reach of water.

c. The location of plants. Cattails, greasewoods, willows, rushes and salt grass grow only where ground water is near the surface; so dig for water there.

Desert natives often know of lingering surface pools in low places. They cover them in various ways, so look under likely brush heaps or in sheltered nooks, especially in semi-arid and brush country.

Places that are visibly damp, where animals have scratched or where flies hover, indicate recent surface water. Dig there for water.

ON MOUNTAINS

Dig in dry stream beds. Water is often present under the gravel. Improvise tools from flat rocks or sticks if digging equipment is lacking.

FROM PLANTS

If the search for ground or run-off water is unsuccessful, or if there is no time to purify the water, a water-yielding plant may be the best answer. Clear, sweet sap from many plants is easily obtained. This sap is pure and chiefly water. Check the following sources in an emergency:

a. Plant Tissues. Many plants with fleshy leaves or stems store drinkable water. Try them wherever you find them. Practically all eucalypts are sources of water. A eucalypt sapling if cut down and stripped of leaves and small boughs will, if the end is cut to a pencil point and held over a receptacle, provide about half a cup of water. Quite a number of saplings may need to be cut to provide an adequate water supply but they may mean the difference between dying of thirst and surviving.

b. Pig Face and Pig Weed. These plants contain a large proportion of drinkable moisture. Thirst may be alleviated by chewing them raw, the residue being spat out.

c. Roots of Desert Plants. Desert plants often have their roots near the surface. The Australian "water tree", desert or she-oak and bloodwood wattle are some examples. Pry their roots out of the ground and cut them into three to four foot lengths. Remove the bark and suck out the water.

d. Vines, Palms, Coconuts:

(1) Vines. Not all vines yield palatable water, but any found are worth testing. In particular, avoid those with milky or dark-coloured sap; they may be poisonous. Use the following method for tapping a vine:

(i) Cut the vine as high up as possible; then cut it off close to the ground so that a length of about three to four feet is obtained.

(ii) Let the water drip direct into the mouth or into a container. If drinking direct from the vine do not allow it to touch the lips as an irritant may be present.

(iii) When the water ceases to drip, cut about a foot off the top. Repeat this until the supply of fluid is exhausted. Six feet of rattan vine gives about three cups of water which can be drunk immediately.

(2) Palms. Burie, Coconut, Sugar and Nipa palms contain a drinkable sugary fluid:

(i) To start the fluid of a coconut palm flowing, cut off the tip of the flower stalk after bending it downward.

(ii) If a thin slice is cut off every 12 hours, the flow is renewed and up to a quart collected each day.

(3) Coconut:

(i) Select green coconuts. They open easily with a knife, and have more milk than ripe coconuts. Be careful not to drink more than three or four cups a day from ripe coconuts; the juice is a violent laxative.

(ii) To open a coconut without a knife, drive a stick into the ground and sharpen the protruding end. Bring the nut down on the point with enough force to crack the outer fibrous covering. Smash the hard inner shell against a tree or rock.

(4) These vegetable 'waters' should not be kept for more than about 24 hours. The fluid will deteriorate and become dangerous to drink.

PLANTS THAT CATCH AND HOLD WATER

Bamboo often has water in the hollow segments. Shake the stems of old, yellowish bamboo; if a gurgling sound is heard, cut a notch at the base of each joint and catch this water in a container, or alternatively cut above and below the segment and carry it as a reserve of water.

Other water-holding trees include the traveller's tree of Asia and the baobab tree of northern Australia.

DEW

Collect dew on clear nights by sponging it up with a handkerchief or other cloth, and squeezing it into a container. Dew may sometimes be collected by scooping a small hole in the ground, covering it with a piece of waterproof material and then filling it with stones.

Dew may also form on the cold outer part of motor vehicles and aircraft, and on rafts and boats particularly on cold metal surfaces; this can be mopped up. Movable surfaces should be arranged so that any dew will not run off and be lost.

VEHICLE RADIATORS

The water in the radiator of a motor vehicle can be used only if it is first strained through a cloth to remove the oil and rusty sediment.

FISH

It has been claimed that a long deep slit cut in the sides of large fish will soon fill with a drinkable fluid. It has also been claimed that drinking water can be squeezed from fish. These statements need confirmation. They certainly are not true of some small coastal fish from which it is most difficult to obtain appreciable amounts of water using those methods or with equipment likely to be available to survivors at sea.

Some water, however, may be obtained by chewing the flesh and spitting out the residue. The fish could be diced and the small portions placed in a piece of material, such as cotton, and the moisture wrung out. The liquid is not excessively salty and it could sustain life for a limited period.

WATER INDICATORS

a. Bees in an area are a certain indication of water. However, the area of search might be quite wide for hives are sometimes as far as four miles from water.

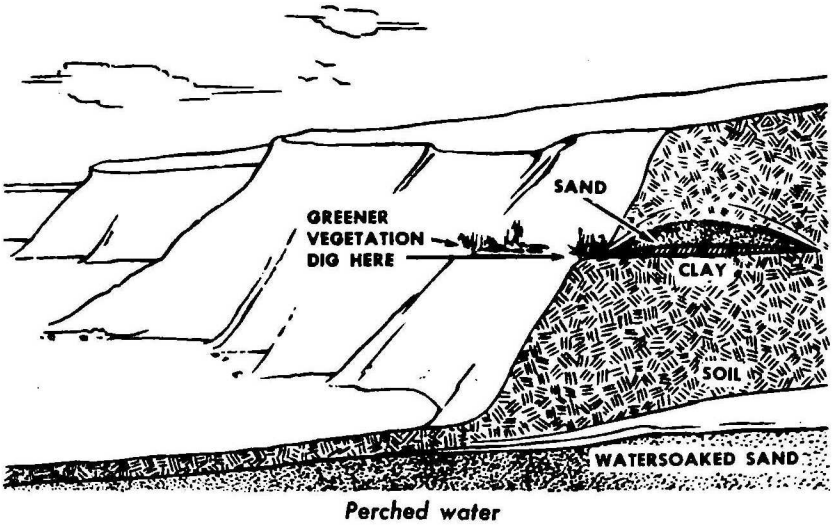
b. Many ants require water so, if a column of ants is observed marching up a tree, a small water reservoir is sure to be hidden in the tree.

c. Flies generally indicate a wet soak near by. Mason flies look like hornets and build nests within a few hundred metres of a soak. Watch one wheeling or hovering. It will suddenly dive to the ground to roll up a tiny pellet of mud for its nest. Drinkable water is always below where the mason fly landed.

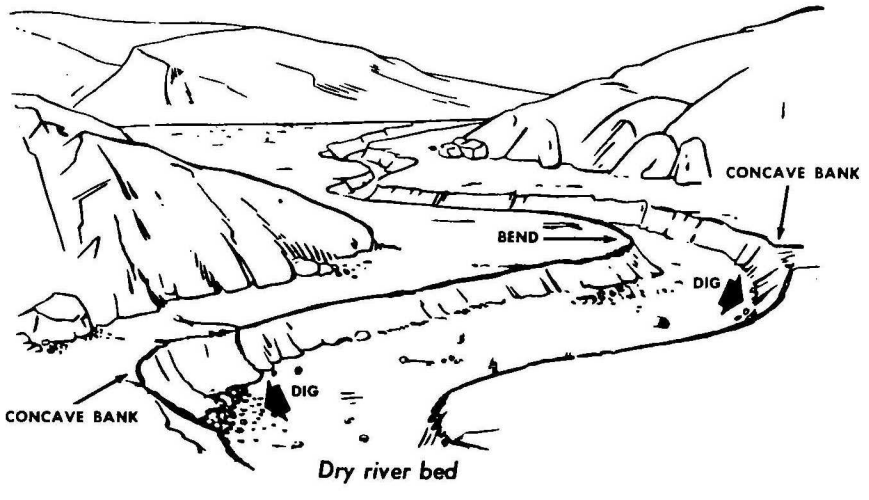
d. Grain-eating birds generally indicate water within a few miles and by carefully observing the direction of flight, especially near dawn or dusk, a general indication of the direction to the water source can be obtained. Finches, for example, feed on grain and drink water. Colonies always stay close to both. Wild pigeons feed on grain by day. At dusk they make for a waterhole, then fly back to their nests. If they are flying fast and low they are heading to water. If they are flying slowly from tree to tree they are returning. Parrots and cockatoos, and the flesh-eating birds such as eagles and kookaburras, are not reliable water indicators.

e. Animals generally need water; they can travel long distances, however, so it would be wiser to follow a regular trail. Fresh tracks of wild pigs, kangaroos and other grazing animals mean that water is near by.

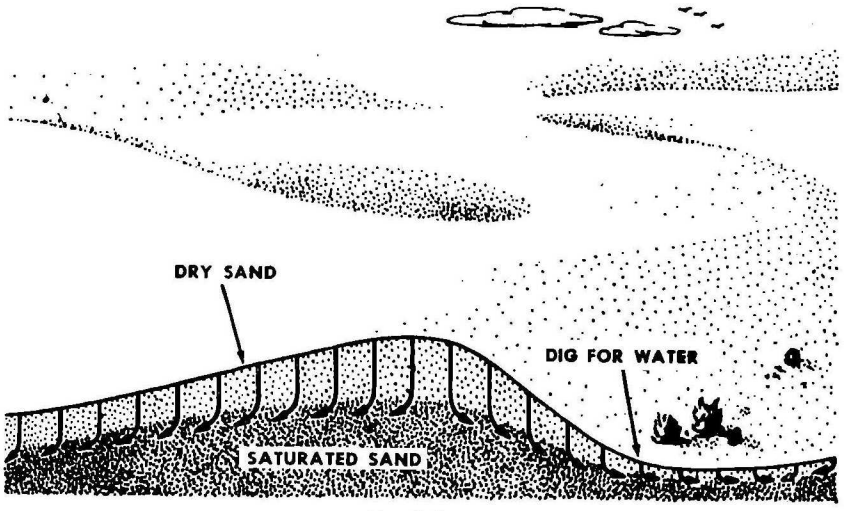
f. Reptiles are not a good indication of water.



Perched water



Dry river bed



Sand dunes

WATER CONSUMPTION

If water is plentiful, thirst should be quenched at all times. It is a fallacy that water taken during the heat of the day is immediately lost through an increase in the amount of sweat.

Water and Salt Intake. These are required in quantities sufficient to replace amounts lost in sweat and urine. Under conditions of heavy perspiration, as much as a pint of water an hour is required and the average man doing an average day's work in hot climates needs about 12 pints daily. The best indication that enough fluid is being drunk is the passage of urine; if an individual is passing more than a pint of clear urine in the 24 hours, it may be assumed that he is taking enough fluid.

There is enough salt in the standard meal to balance that normally lost and in hot climates it is generally advisable to increase the salt intake only on a medical officer's advice. This could be done by taking extra salt with meals and by adding salt to drinking fluids. Salt added to the strength of two level teaspoons to the gallon, or two salt tablets per water-bottle, is hardly perceptible to the taste.

No economy can be achieved by reducing the consumption of water below that required to cover minimum losses from the skin, respiratory tract and urine required. The deficiency would be made good simply by the withdrawal of water from the body tissues, to their detriment. Furthermore, it would mean that a survivor who is rescued while he still has drinking water left would be in a poorer condition than if he had met minimum bodily requirements from the beginning.

WATER CONSERVATION

INTRODUCTION

A man walking in the sun in tropical conditions may lose up to 20 pints of water a day, mostly in the form of sweat. In shaded or more temperate conditions, the loss may be up to 16 pints a day. Either this water must be replaced, or steps taken to reduce the loss.

LOSS RATE

During a period of 24 hours, a man sitting exposed to the sun in an open boat in the tropics may lose up to 10 pints of water mostly in the form of sweat. Losing water at this rate, where supplies are limited to one or two pints per day, could bring about death by dehydration in about three days. Physical exertion would increase the loss which could reach 25 pints or more for a man working strenuously under tropical conditions. This would be almost entirely a sweat loss, the urinary loss being only about three quarters of a pint. At this rate, and with only one or two pints of drinking water, a survivor would be in very poor condition after one day.

CONSERVATION

There are several ways in which body water can be conserved. In the first place, when water is available but in insufficient quantities, none should be consumed during the first day unless the sweat loss

during this period is excessive. This is most important because, initially, the kidneys may not be conserving water fully and this will ensure that water consumed later will be used more economically. On subsequent days, the whole allowance may be consumed every day, preferably in small amounts at frequent intervals.

SWEAT

Further conservation of water may be effected by preventing the body from becoming hot. When the amount of heat absorbed by the body through sitting or moving about in the sun or produced in the body by physical exertion or exercise reaches a certain level, an involuntary attempt will be made to reduce it by the production of sweat. Sweat, on evaporation from the surface of the skin, has a cooling effect, but the environment must be dry enough to enable evaporation to take place. By this method of cooling the body, considerable amounts of water may be expended as previously indicated. Hence, if there is already a water deficit, sweating would cause it to reach a dangerous level much more rapidly.

Sweat could be consumed to advantage if it could be collected, and whenever available in sufficient quantity. Some survivors have consumed the water in blisters with apparent benefit. However, during periods of water deprivation, you should concentrate on reducing losses from the body to the absolute minimum, as quickly as possible, and then keeping them at this level.

Some methods of reducing sweat are as follows:-

a. Keep clothes covering your body. Clothing helps ration your sweat by not letting it evaporate too fast. You would be more comfortable without a shirt admittedly but your sweat would evaporate faster.

b. Keep your head and neck covered.

c. Wear light-coloured clothing.

d. Remain in the shade as far as possible and avoid exertion during the heat of the day.

e. When resting during the heat of the day rest above the ground. The temperature can be up to 30° cooler one foot above the ground and this could save you a lot of sweat.

f. When drinking to replace perspiration, drink enough to satisfy your needs. Sipping water does not raise the water level of the body to its proper level, and you gradually dehydrate. It is possible to die of thirst with a half full water bottle.

URINE

There is little benefit to be gained by drinking urine. During the first day without water, urine could perhaps be consumed to advantage but there is nothing to be gained from drinking urine after it has become maximally concentrated. A survivor would merely be requiring his kidneys to repeat work that they had already done and could not be expected to do any better.

SALIVA AND SMOKING

Chewing a button or other small object may, for a while, assist in keeping the mouth moist as the jaw movements increase the salivary flow, but will give no real benefit during a shortage of water. On the contrary, it may tend to increase the insensible water loss and, during a period of several days, would cause a considerable amount of energy to be expended unnecessarily.

Likewise, smoking is of no benefit and may result in an uncomfortable dryness of the mouth. On the other hand, for habitual smokers, it may have value in maintaining morale.

SEA WATER

DEHYDRATION

When a survivor has insufficient drinking water, and he is in a state of dehydration, his condition is made worse by drinking sea water.

There are popular accounts of men having drunk sea water for various periods, but there are no records of how much better these men would have been if they had not consumed sea water, or to what extent their judgment was impaired by the drinking of sea water. Small amounts of sea water in the form of spray on the lips and fingers will almost certainly be consumed, but this is unavoidable and relatively insignificant.

DRINKING SEA WATER

Salt in excess of bodily requirements would be mostly excreted in the urine and, as the maximum concentration of salt in the urine is less than that in sea water, the body is robbed of water to assist in excreting the salt. The salt concentration in body fluids approximates a one per cent solution, whereas human urine never contains more than about 2¼ per cent, and sea water 3½ per cent. The position is the same whether sea water is consumed as such or mixed with fresh water. Not all the extra salt consumed in sea water is excreted, however, for small quantities gradually accumulate in the body. This will eventually lead to salt poisoning, which could also cause survivors to collapse earlier than if sea water had not been consumed.

SWEAT

Because sweat contains salt, it may be thought that sweating is justification for drinking sea water. Sweat is a very dilute solution of salt, containing less than one-tenth the concentration in urine. If the salt loss in sweat was replaced without the large volume of water lost with it, matters would only be made worse.

FOOD

INTRODUCTION

Animal Foods

All animal foods such as birds and their eggs, frogs, snakes, lizards, rats and mice, grubs, locusts, crickets, termites and even cats and dogs are edible and vary only in toughness and taste. To augment these are the various types of fish and molluscs, both fresh and salt water varieties, including crabs, crayfish, lobsters, shrimps, prawns, yabbies and snails.

VEGETABLE FOODS

In the vegetable world edible plants and grasses, such as sweet potatoes, taro, tapioca (manioc), breadfruit and various types of ferns, are numerous. It is advisable to remember that there are some plants like the Strychnine Plant and the Milky Mangrove or Blind-Your-Eyes, Cowitch and Nettle tree which can be extremely dangerous and upsetting.

Rules of Survival

When isolated, you should apply the following rules:

a. Check your rations and estimate the length of time you will be without support.

b. Divide the available food, two-thirds for the first half of isolation and one-third for the remainder.

c. If less than one quart of water is available each day, try to avoid starchy and highly flavoured foods and meats unless nothing else is available. Remember, eating causes thirst so if any choice is available eat foods high in carbohydrate, such as dried fruits, fruit bars, sweets.

d. Keep strenuous work to a minimum. The less work performed the less food and water are required.

e. Eat regularly if possible, but do not nibble. Plan on one good meal a day; cooking makes food safer, more digestible and palatable. Use the fluid as soup.

f. With a few exceptions, everything that walks, crawls, swims or grows from the soil is edible. The safety rules and some of the exceptions are explained in the next section.

TESTS FOR PLANT EDIBILITY

Testing

These tests have been drawn up with a view to simple efficiency and are without botanical names or descriptions. Provided they are applied closely and with common sense, the warning reactions should be only of a minor nature. Some of the tests may be thought unnecessary or even funny. Yet disregard of any one of them could result in serious trouble.

Learn the tests by heart; try to follow them in the order they are set down.

The tests are standard to all forms of plant life. Make a separate test for each part of any particular plant - a test for the leaves, another for the roots, one for the fruit, etc.

Assuming that you are isolated in an area where plant life is strange to you, a start has to be made somewhere, so scout around for plants which appear likely to prove suitable as spinach.

First Test - Smell

Take some of the leaves, as a test portion, and crush them. If there is any definite smell of almonds or peaches (what may be called a peachy-almond smell) it is a strong indication of prussic acid which is highly poisonous. It is better to play safe and discard the plant or, if there is a scarcity of plant life, continue the tests only with extreme caution.

Second Test - Skin Irritation

Rub lightly or squeeze some of the juice of the test portion on to the underarm between the elbow and armpit. In the case of a plant with little juice, crush or pulp it with or without water until it is in a juicy state. If there is any reddening or irritation, it is wise to discard the plant for the time being; but make a definite mental or written note of the plant for further retesting when circumstances permit.

Third Test - Lips, Mouth and Tongue

If there is no irritation or reddening from the second test, carry out the following, stopping the test as soon as any irritation is noticed:

a. Place the test portion cautiously on the lips. Wait for a few seconds for some possible irritation.

b. Place the test portion cautiously into the corners of the mouth. Wait a few seconds again.

c. Place the portion cautiously on the tip of the tongue. Wait a few seconds and then if there is still no irritation, carefully introduce the plant into the mouth and chew steadily without swallowing.

d. While chewing slowly, wait for any of the following symptoms:

(1) Any definitely bitter taste (which indicates alkaline poisoning).

(2) Any irritation or soreness of the tongue or throat.

(3) Any other disturbing reaction.

It is sometimes necessary to judge carefully in deciding a difference between irritation and the ordinary acid or tart tastes. Experience is the best guide in reaching a decision.

Fourth Test - Swallowing

If there is no irritation or other disturbing reaction, the next test is to eat a small quantity, and then wait for any reaction.

The part of the plant being tested should first be boiled, if equipment is available. Boil the plant in plenty of water if possible, until it is obviously cooked, saving the fluid for separate testing. Boiling very often dissolves harmful juices. Also it often renders the plant edible where it may not have been edible raw, for example, tapioca (or manioc).

When any part of a plant is tested, boiled, and proved edible, retest it raw when time permits. If boiling is impracticable and the plant must first be tested raw, retest it boiled at the first opportunity. The resultant knowledge may prove useful.

Eat a mouthful only of the cooked plant and, if forced to test it raw, take a small mouthful only.

In either case wait four hours and watch closely for the following symptoms:

a. Any soreness of the mouth, tongue or throat.

b. Any inclination to belch repeatedly.

c. Any nausea or sickness.

d. Any other stomach pains or distressing symptoms.

e. After some time has passed, is there any griping pain in the lower stomach or abdomen?

During the four hour wait, it is unwise to eat or drink anything else.

Fifth Test - Eating a Quantity

Provided there are no reactions from the fourth test repeat this test, increasing the quantities of the first four hour period five or six times. If the portion of the plant tested has passed all the above tests, it may be accepted that the tested part is edible in reasonable quantities; whether it is palatable or nourishing, time and experience will decide.

Mistakes in Testing

Should stomach trouble occur through a mistake in testing, the simplest form of relief is the old one of drinking plenty of warm or hot water and starving for some hours. However, with care and observation, the possibility of continued stomach trouble is slight.

Warning

a. Never short cut the tests. This is dangerous.

b. Do not assume that, because birds or animals eat a plant or part thereof, it is edible to man.

c. Learn the rules for testing.

d. If in doubt do not eat.

PLANT FOODS

Illustrations

Certain edible plants likely to be encountered are described in the supplement. You should become familiar with these 'pilot plants' as they will enable you to evaluate the possibilities of other plants of the same variety. For example, the colour of the juice of one plant might lead you to try another one in which the juice seems to be the same colour and consistency.

The Many Varieties

You should not limit yourself to studying the illustrations and descriptions of plant food in this manual. You should take every opportunity to see these plants in their natural habitat; then, if forced into a survival situation in any area of Papua New Guinea or Australia, you will know where the best plant foods of a region are likely to be found and how to identify them.

Many of the edible plants described in this manual will be found throughout the world. Blackberries and raspberries grow in the Philippines and Siberia as they do in Australia, and persimmons thrive in Guam just as they do in Australia.

In primary jungle the height of the trees makes it difficult to collect fruit and edible leaves, while the lack of sunlight on the ground suppresses the growth of smaller plants. The more open areas on the margins of clearings, the clearings themselves, alongside tracks, and on the banks of streams - anywhere where sunlight penetrates the canopy - are the best places to search for food plants.

Wild Plants

Those most commonly found are:

a. Ferns.

b. Palms.

c. Coco Yam or Taro.

d. Lilies.

e. Pit or Pit Pit.

f. Wild Durian.

g. Pandanus.

h. Wild Passionfruit.

i. Wild Ginger.

j. Bamboo.

k. Acacia.

l. Jungle Cabbage.

m. Wild Raspberries.

n. Rubber Nuts.

Cultivated Plants

Those most commonly found growing wild are:

a. Bananas and Plantains.

b. Tapioca (or manioc).

c. Yams and Sweet Potatoes.

d. Papaya or Paw Paw.

e. Mangoes.

f. Coconuts.

Roots and Other Underground Parts. These starch storing foods include tubers, roots, root-stalks and bulbs.

Tubers. All tubers are found below the ground; cook them by boiling or roasting.

Roots and Root-stalks. These plant parts are storage devices rich in starch; edible roots are often several feet long and are not swollen like tubers. Root-stalks are underground stems; some are several inches thick and relatively short and pointed.

Bulbs. All bulbs are high in starch content and, with the exception of the wild onion, are more palatable if they are cooked.

FISH FOODS

Introduction

Of all the life found around or in fresh or salt water, fish, to the unskilled, are probably the most difficult to catch. Success will come

though, even with crude equipment, with patience and a knowledge of where, when and how to fish.

When to Fish

It is very difficult to state the best time to fish because different species feed at different times, both day and night. As a general rule, look for fish feeding just before dawn and just after dusk; also just before a storm as the front is moving in, and at night when the moon is full or waning. Rising fish and jumping minnows may also be signs of feeding fish.

Where to Fish

The place selected for fishing depends on the type of water available and the time of day. In fast running streams in the heat of the day, deep pools that lie below the ripples or in the backwaters offer good prospects. Toward evening, or in the early morning, float the bait over the ripple aiming for submerged logs, undercut banks or overhanging bushes. On lakes in the heat of the summer, fish deep as the fish seek the coolness of deeper water. In the evening or early morning in summer, fish the edges of the lake, since fish are more apt to feed in shallow water. Lake fishing in the spring and late autumn is more productive on the edge in shallow water because fish are either bedding or seeking warmer water. With practice the beds of most species of fish can be located by their strong, distinctively fishy odour.

Bait

Most methods of catching fish require the use of bait. This is very much a matter of experiment. Scavenger fish, such as the fresh water variety of catfish, and redfin greedily take pieces of meat, offal or raw fish; ants and other insects may be tried. The cleaner fish will sometimes take these baits, but they seem to do so reluctantly; berries, pieces of fruit, small crumbs of food, if these can be spared, should all be tried.

As a general rule, fish take bait which has been taken from their native water. Look in the water near the shores for crabs, fish eggs and minnows, and on the banks for worms and insects. Examine the stomach of a caught fish to see what it has been eating; then try to duplicate this food. Use its intestines and eyes if other sources are unproductive. When using worms, cover the hook completely. With minnows, white-bait, bluebait, sardines, etc, pass the hook through the body of the fish under its backbone in the rear of the dorsal fin.

Artificial bait can be made from pieces of brightly coloured cloth, feathers or bits of bright metal fashioned to duplicate insects, worms and minnows, etc. Strive to make artifical bait look natural by moving it slowly or copying the actions of natural fish food.

Hooks and Lines

If no hooks are available, they can be improvised from suitable pieces of metal, pins, bone, hardwood or bamboo. By twisting bark or cloth fibres, a sturdy line can be fashioned. Using the inner bark of a tree, knot the ends of two strands and secure them to a solid base. Hold a strand in each hand and twist clockwise, crossing one above the other counter clockwise. Add fibre as necessary to increase the length of the line.

Nets and Scoops

Nets may be improvised using a sweat rag or face veil threaded onto a suitably bent stick, or a hammock may be used.

Scoops can be made using thin twigs or slivers of bamboo or rattan vines woven together and mounted on a frame. A segment of a thick bamboo stem may be split finely down to the base and splayed out, with creeper or thin rattan vine woven in and out of the ribs to preserve the shape, and a handle finally attached.

Catching Fish

There will be times when the most elaborate hand line and suitable bait will not yield a single fish. Do not become discouraged because other methods may prove productive:

a. Set Lines:

(1) Set lines provide a practical method for catching fish. Simply tie several hooks on to a line. Bait them and fasten the line to a low hanging branch that will bend when a fish is hooked. Keep this line in the water continuously, checking it periodically to remove the fish and rebait the hooks.

(2) An excellent hook for a set line is the gorge or skewer hook. Sink the skewer into a piece of bait. After the fish swallows the bait, the skewer swings crosswise and lodges in the stomach, securing the fish to the line.

b. Jigging. This method required an eight to 10 foot bamboo or similar kind of pole, a hook, a piece of brilliant metal shaped like a commercial fishing spoon, a two to three inch strip of meat or fish intestine, and a piece of line about 10 inches long. Attach the hook just below the spoon on the end of the short line, and tie the line to the end of the pole. Working close to the edge near lily pads or weed beds, dabble the hook and spoon just below the surface of the water. Occasionally slap the water with the tip of the pole to attract large fish. This method can be effective at night.

c. Using the Hand. This method may be effective in small streams with undercut banks or in shallow ponds left by receding flood waters. Place the hands in the water and allow them to reach water temperature. Reach under the bank slowly, keeping the hands close to the bottom if possible and moving the fingers slightly until a fish is contacted. Then work a hand gently along its belly until its gills are reached, grasp the fish firmly just behind its gills and pull it out.

d. Muddying. Small isolated pools caused by the receding waters of flooded streams often have fish. Disturb the mud off the bottom of these puddles by stamping in them or using a stick until the fish are forced to seek clearer water at the surface. Then, if possible, throw them out or club them.

e. Spearing. This method is difficult except when the stream is small and the fish are large and numerous, such as in the spawning season, or when the fish congregate in pools. Tie a knife on the end of a pole, sharpen a piece of bamboo, lash two long thorns on a stick, or fashion a bone spear point, and take up a position on a rock over the fish run. Wait patiently and quietly for a fish to swim by.

f. Netting. The edges and tributaries of lakes and streams are usually abundant with fish too small to hook or spear but large enough to net. Scoop upstream around rocks or in pools with the improvised net if materials are available.

g. Traps and Weirs:

(1) These are useful for catching both fresh and salt water fish, especially those that move in schools. In lakes or large streams, fish approach the banks and shallows in

the morning and evening. Sea fish travelling in large schools regularly approach the shore with the incoming tide, often moving parallel to the shore and guiding on obstructions in the water.

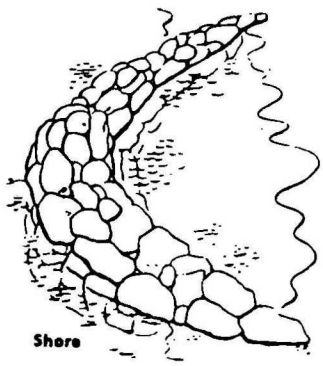
(2) A fish trap is an enclosure with a blind opening where two fence-like walls extend out like a funnel from the entrance.

(3) If near the sea, select the trap location at high tide and build it at low tide. On rocky shores use natural rock pools. On coral islands use natural pools on the surface of reefs by blocking the openings as the tide recedes. On sandy shores, use sand-bars and the ditches they enclose. Fish in the lee of off-shore sand-bars. Build the trap as a low stone wall extending out into the water and forming an angle with the shore.

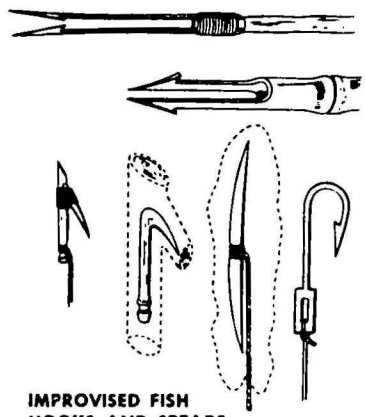
(4) In small, shallow streams, make the fish trap with stakes or brush set into the stream, anchoring the trap in a gap where the water flows slowest and is deepest. It is immaterial whether the mouth faces upstream or downstream. The trap must be baited with pieces of rotten meat, or a handful of cooked rice in a small bag. The bait must be so arranged that the fish cannot reach it from the outside. The trap should be inspected at least once a day.

h. Shooting:

If armed, and sufficient ammunition is available, try shooting fish. Aim slightly under fish in water less than three feet deep.



TIDAL FLAT FISH TRAP



IMPROVISED FISH
HOOKS AND SPEARS

Maze-type fish traps

Characteristics of Sea Foods

The safest fish to eat are those from the open sea or deep water beyond the reef. Silvery fish, river eels, butterfly fish and flounders from bays and rivers are good to eat. Remember that any fish caught in the tropics will spoil very quickly. Details of poisonous fish are in later paragraphs.

Coral rocks along beaches, or extending out into deeper water as reefs, provide the greatest amount of survival food. The more exposed surface of the reef bears clinging shellfish. Be sure that all shellfish collected are healthy. Do not select them from colonies where some are dead or dying.

Fish, crabs, lobsters, crayfish, sea urchins, squids and small octopi can be poked out of holes, crevices and rock pools. Be ready to spear them before they move off into deep water. If they are in deeper water, tease them shoreward with a baited hook, piece of string or stick. Flower-like sea anemones will be found in pools and crevices. They close up when touched; detach them with a knife. Wash well to remove slime and dirt, on the outside of anemones, then boil or simmer them.

A small heap of empty oyster shells near a hole may indicate an octopus. Drop a baited hook into the hole and wait until the octopus has entirely surrounded the hook and line, then lift it up quickly. To kill the octopus, pierce it with a fish spear or knife. Octopi are hunters, fond of spiny lobster and other crab-like fish. At night they come into shallow water and can be easily seen and speared.

Sea snails and limpets cling to rocks and seaweed from the low water mark upwards. Large snails, called chitons, adhere tightly to rocks just above the surf line. Mussels usually form dense colonies in rock pools, on logs and at the base of boulders.

Sluggish sea cucumbers and conchs (large snails) live in deep water. The sea cucumber shoots out his stomach when excited; boil and eat the five strips of muscle inside the body.

Land crabs are common on tropical islands and are often found in coconut groves. Use an open coconut for bait.

Crustaceans

Crabs, crayfish, lobsters, shrimps and prawns are generally found in fresh and salt water throughout the world. All are edible, though they spoil quickly. Like most types of fresh water fish, crustaceans contain parasites harmful to man, and must therefore always be cooked before eating. Many species are nocturnal in their habits, and are thus caught more easily at night. All meat within the skeleton of crabs, crayfish and lobsters can be eaten, but gills are usually discarded. Freshwater shrimps or yabbies are abundant in temperate and tropical streams, and can be seen swimming or found standing stationary on the rocks and sand of stream beds. Look for them in the quieter parts of a stream where the water is sluggish, especially the backwaters. They can be caught quite easily with a small cane, with a loop at the end made from the skin or bark of a tree. Drop the loop over the shrimp or prawn, catching it in the loop with a quick movement. Shrimps and prawns will rise to the surface at night, if a light is placed close to the surface, and may be scooped up with your hands.

Molluscs

These include fresh and salt water invertebrates such as snails, clams, mussels, bivalves, periwinkle, and chitons. Most members of this group are edible; however, make sure that molluscs are fresh, and boil them before eating. To eat them raw is to risk eating harmful parasites.

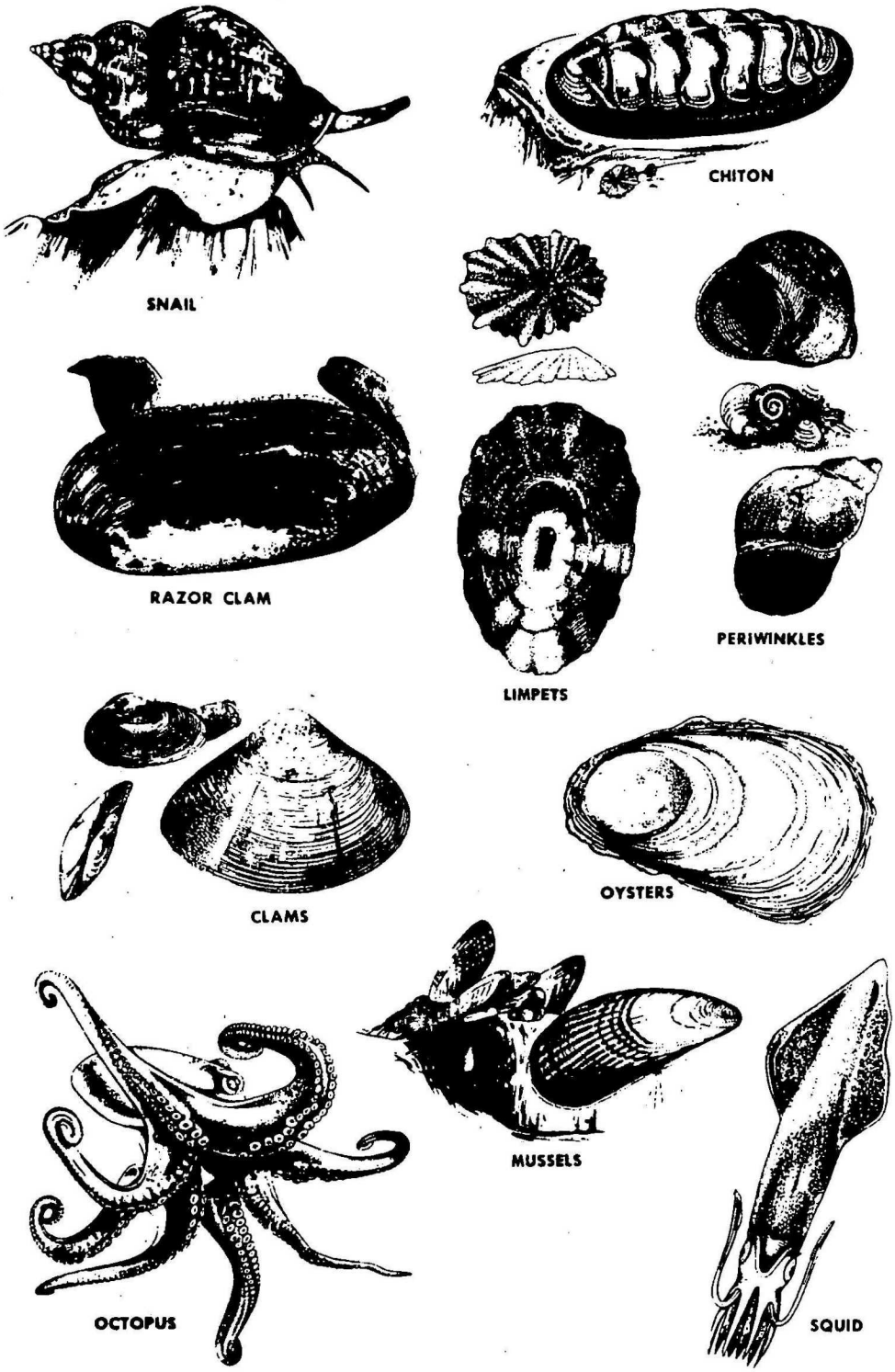
In fresh water look for food sources in the shallows, backwaters, and especially in water with a sandy or mud bottom. Near the sea, wait for the low tide and check the tidal pools in the sand.

Frogs, Newts and Salamanders

These small amphibians inhabit areas surrounding fresh water in warm and temperate climates throughout the world. To catch them:

a. Hunt frogs at night when they can be located by their croaking. Club or catch them or snag the larger ones on a hook and line, then eat the entire body after skinning.

b. Find newts and salamanders under rotten logs or under rocks in areas where frogs are found.


SNAIL
CHITON
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LIMPETS
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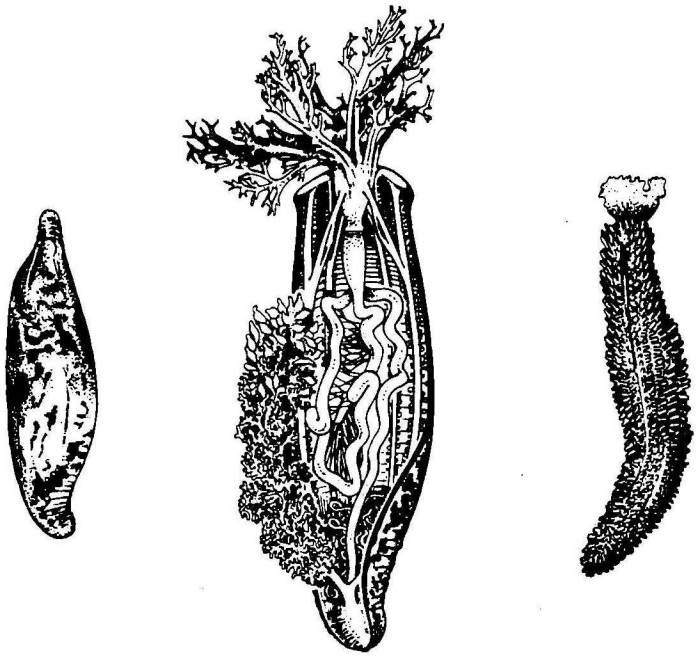
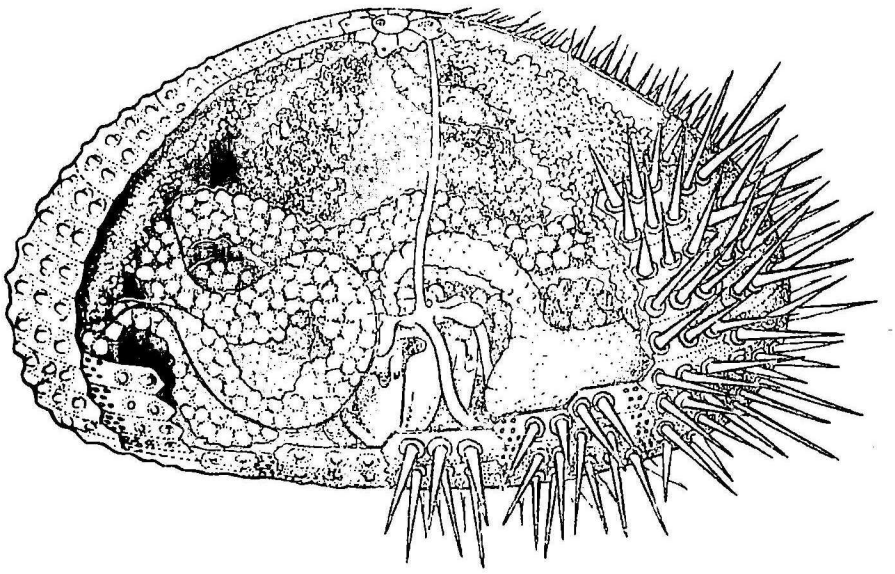
CLAMS
OYSTERS
OCTOPUS
MUSSELS
SQUID



SEA CUCUMBER



SEA URCHIN

Seaweeds

Many seaweeds are edible, but never eat large quantities; most seaweeds are violent purgatives although none is poisonous. They may be eaten without fear in small portions as flavouring in other foods. All seaweeds are rich in iodine, minerals and vitamins and prevent scurvy. Some have too much lime carbonate or are too horny to be eaten. A course, dark green seaweed with large air bladders is rockweed. It does not have food value but in and under it, small crabs, shrimps and shellfish are to be found. It will stay moist and keep the shellfish fresh for a while.

When selecting seaweed for food, choose plants attached to rocks or floating free because beach seaweed may be spoiled or decayed. The thin, tender varieties can be dried over a fire or in the sun until crisp, then crushed and used as flavourings in soup. Wash the thick leathery seaweeds and soften them by boiling.

Some of the edible seaweeds are:

a. Green seaweeds often called sea lettuce, which grow in the Pacific Ocean. Wash in clean water and eat like garden lettuce.

b. Edible brown seaweeds include kelp. This seaweed is found in the Pacific Ocean below the high tide line on submerged ledges and rocky bottoms. It has a short cylindrical stem and thin, wavy, olive-green or brown fronds from one to several feet long. Boil before eating; then mix with vegetables or soup.

c. Red Seaweeds. These have a characteristic reddish tint. The most common is Laver, which is found in the Pacific area, and is usually red, dark purple or purplish-brown in colour with a satiny sheen or filmy luster. Boil gently until tender, or pulverize and use as a relish; add to crushed grains and fry in the form of flat cakes. Look for this plant on the beach at low tide.

d. Fresh Water Algae. A familiar variety is Nostoc, which can be found during the spring in pools. It forms green, round, jelly-like globules about the size of marbles. Dry this plant and use it in soup.

Fish with Poisonous Flesh

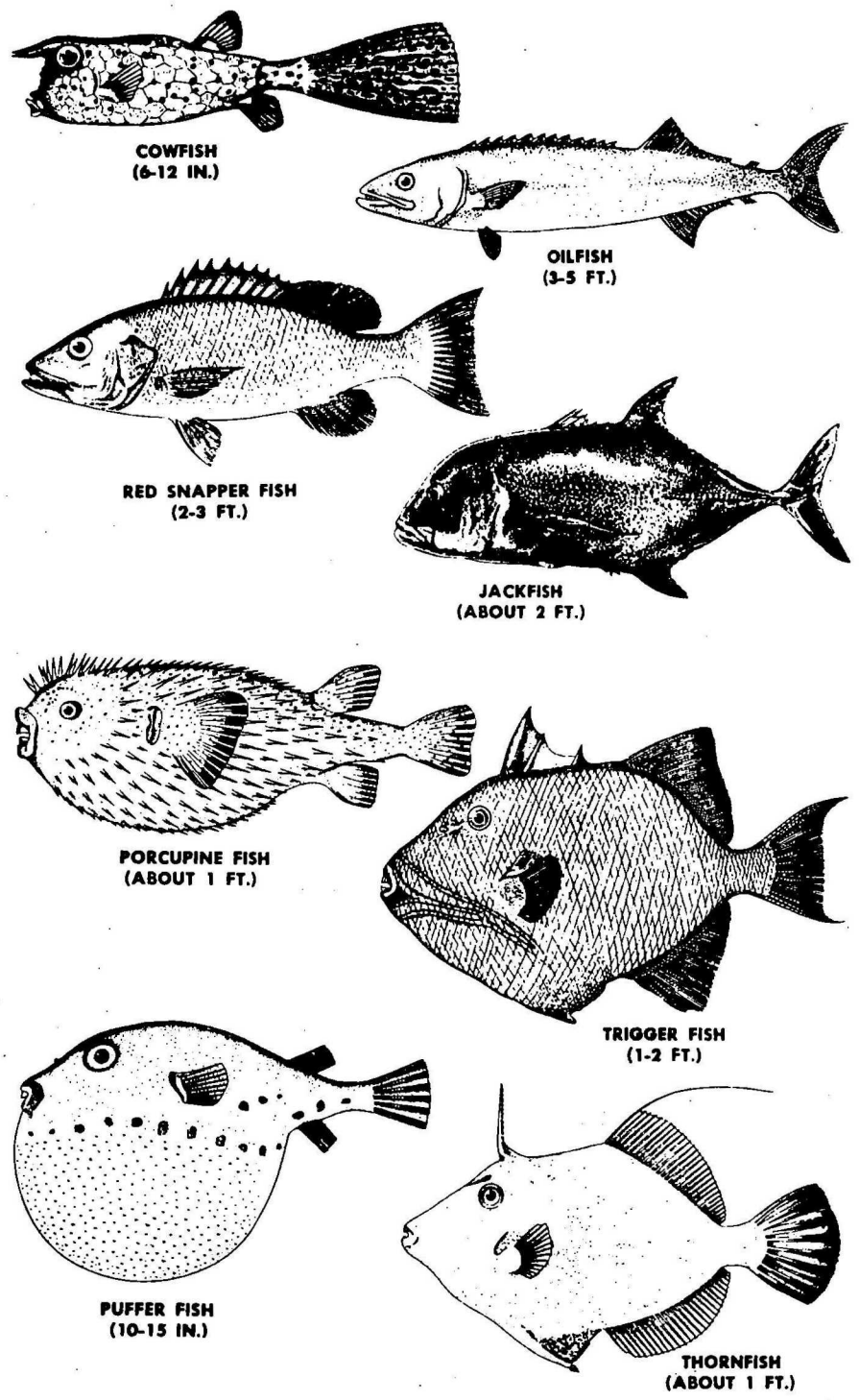
There are no simple rules for telling undesirable fish from the desirable ones. Often those considered edible in one locality may be unwholesome elsewhere depending on the place, the food they eat or even the season of the year. Cooking does not destroy the poison.

Large barracuda can cause serious digestive illness, yet those of less than three feet have long been eaten with safety. The oilfish of the South West Pacific has a white, flaky, rather tasty flesh which is very poisonous. All great sea eels should be avoided. Never eat entrails or eggs of any tropical fish.

Undesirable fish generally have certain characteristics:

a. Almost all live in shallow waters of lagoons or reefs.

b. Almost all have round or box-like bodies with hard, shell-like skins covered with bony plates or spikes. They have small, parrot-like mouths, small gill openings, and the belly fins are small or absent. Their names suggest their shapes - puller fish, file fish, globe fish, trigger fish, trunk fish.



Fish with poisonous flesh

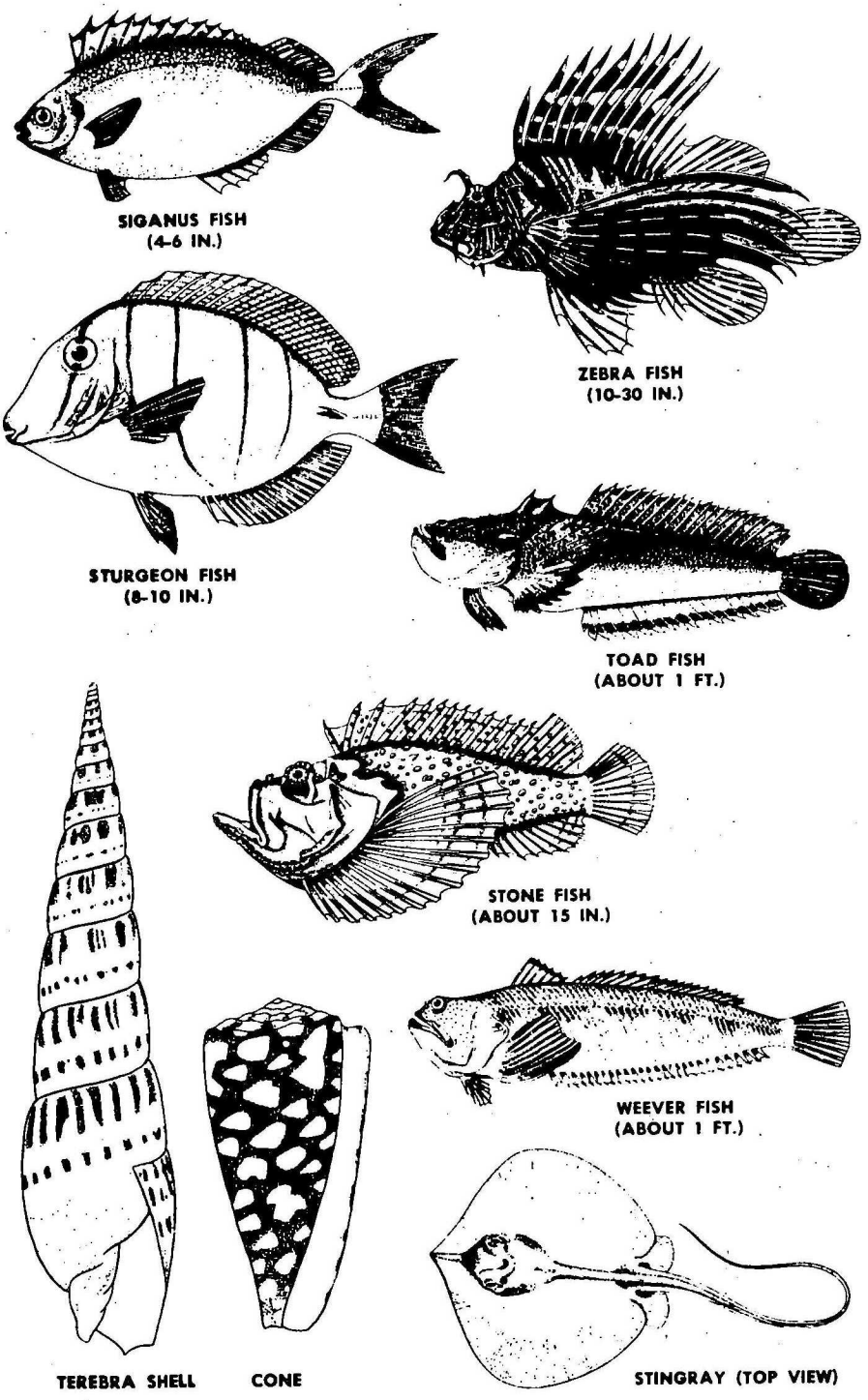
Fish and Shellfish with Venomous Spikes

Reefs are no place for bare feet; coral, dead or alive, can cut them to ribbons. Seemingly harmless sponges and sea urchins can slip fine needles, of lime or silica, into the skin and this causes festering; do not dig the needles out but use lime juice, if available, to dissolve them. The almost invisible stonefish will not budge from a man's path; it has 13 poisoned spines that will cause agony and death.

Don't probe with hands into dark holes; use a stick. Don't step freely over muddy or sandy bottoms of rivers and sea-shores; slide the feet along the bottom. In this way, stepping on sting-rays or other sharp-spined animals will be avoided.

Cone shells and long, slender, pointed Terebra snails have poison teeth and can bite. Cone snails have smooth, colourful mottled shells with elongated narrow openings; they live under rocks, in crevices of coral reefs and along rocky shores of protected bays; they are shy and most active at night. They have a long mouth and a snout or proboscis which is used to jab or inject their teeth. These teeth are actually tiny hypodermic needles with a tiny poison gland on the back end of each. The effect is swift, producing acute pain, swelling, paralysis, blindness, and possible death in four hours; therefore, avoid handling all cone snails.

Handle the big conchs with caution. These snails have razor sharp trap doors with which they may suddenly jab out. Don't use hands to gather large abalones and clams; pry them loose with bars or wedges as it is hard to break free once they have clamped down on fingers.



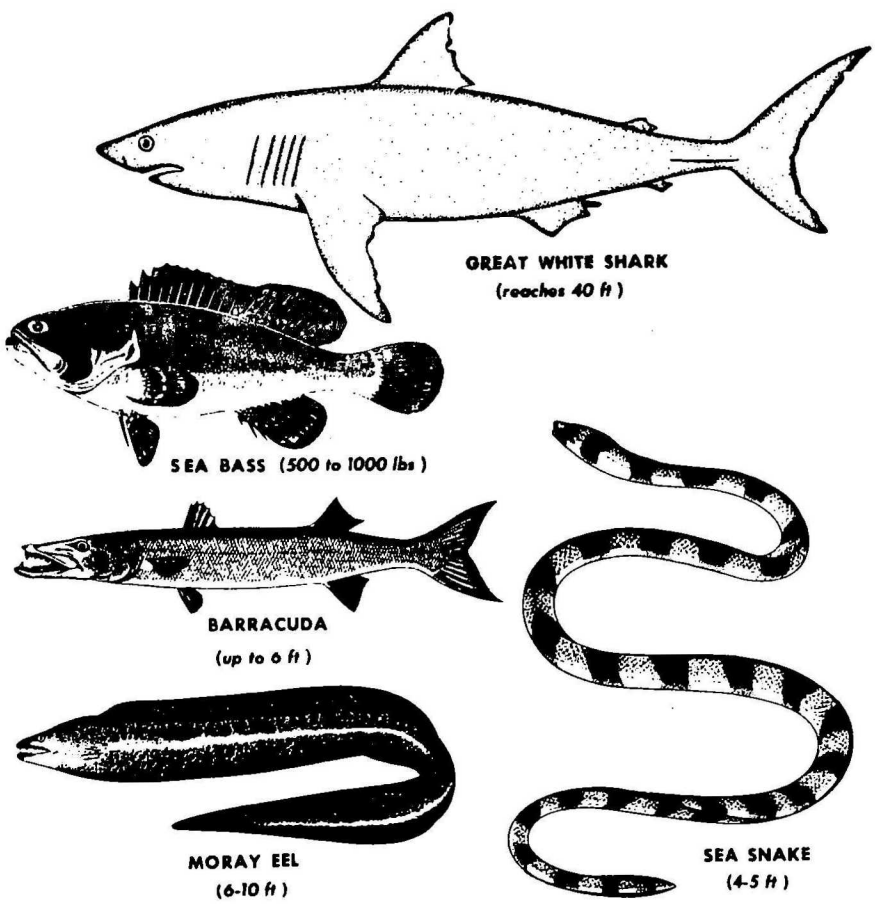
Venomous shells

Venomous fish

Ferocious Fish

In crossing deeper portions of a reef, check the reef edge shadows for sharks, barracuda, and moray eels. Moray eels are angry, vicious and aggressive when disturbed; they hide in dark holes among the reefs.

In salt-water estuaries, bays or lagoons, man-eating sharks may come in very close to shore. Many sharks have attacked in shallow water on bathing beaches in the tropic seas. Barracuda have also made such attacks. Usually sharks of four feet and less are timid. Beware of large sharks including the hammerhead.



ANIMAL FOODS

Introduction

Hunting animals and birds is no easy task even for experienced hunters. Find a place where animals pass, such as a game trail, watering place or feeding ground. Always hide down wind so the animal cannot smell you, and wait for game to come within weapon range or to walk into a trap. If stalking is attempted, do so up-wind, moving slowly and noiselessly when the animal is feeding or looking the other way. The hunter should freeze when the animal looks his way. Hunt in the early morning or at dusk and look for animal signs such as tracks, a game run or animal pad, trampled underbrush and droppings. Remember animals depend upon their keen sense of sight, hearing and smell to warn them of danger.

Birds can see and hear exceptionally well but lack a sense of smell. During nesting periods they are less fearful of man; because of this they can be caught more easily in spring and summer especially in temperate areas. They nest in cliffs, branches, marshes or trees and, by watching the older birds, their eggs or young can be located.

Hunting

Finding Game. The secret of successful hunting is to sight the quarry before he sights you. Keep alert and watch for signs that indicate game. When approaching a ridge, lake or clearing, slow down and examine the far distance then the closer ground. At water-holes that show signs of game, hide and wait until an animal approaches even though it may take hours.

Shooting Game. When the opportunity to use a weapon occurs, whistle sharply to encourage the quarry to stop, thus providing a chance for a standing shot. On large game, aim for neck, lung or head. If an animal is wounded and runs, follow its blood trail slowly but deliberately. If the quarry is wounded severely, it will soon lie down if not followed; when it lies down, it will usually be weakened and unable to rise. Approach it slowly and finish it off. After killing a large animal, gut and bleed it immediately. Cut the musk glands from between its hind legs and at the joints of its hind legs; be careful not to burst the bladder while removing it.

Trapping

Know Your Game. Before a hunter can trap with any luck, he must decide what he wishes to trap, and anticipate his quarry's actions.

He must determine the kind of food the animal eats and bait his trap accordingly. Rats, mice, rabbits and squirrels which have regular habits and confine themselves to limited areas of activity are easy to trap. Simply locate a hole or run, then bait and set the trap.

Trapping Hints

Some tricks that may increase prospects of trapping game are:

a. To catch an animal that lives in a hollow tree, try inserting a short forked stick in the hole, twisting it so that the animal's loose skin wraps around the fork; keep the stick taut while pulling it out.

b. Smoke burrow-living animals, such as rabbits, out of their dens or warrens; then, using a noose attached to the end of a long pole, snare the animal as it emerges from the hole.

c. Use the noose method to snare birds that are sitting on eggs or roosting. After finding a roosting or nesting area, the hunter should conceal himself and wait quietly for the bird to return; then slip the noose quickly over the bird's head and pull to the rear and upward.

d. Bait a fish hook with a minnow or other small fish and place it on the shore near the water. A bird may well snatch it.

e. Set snares or traps at night in the runs or animal pads containing fresh tracks or droppings. If an animal has been butchered, set a snare in the same spot using the animal's entrails for bait.

Tracks

Tracks, if read correctly, reveal the pattern of an animal's habits. Correct reading demands continuous and careful observation. Animals, like human beings, are creatures of habit. An animal will generally follow the same track to and from water day after day. It will hunt in the same area continuously leaving it only when driven out by fire, flood or drought. It will usually return when conditions once again become favourable.

This habit pattern makes it possible for an experienced hunter to predict animals' movements and select sites for his traps or snares.

Snares and Traps

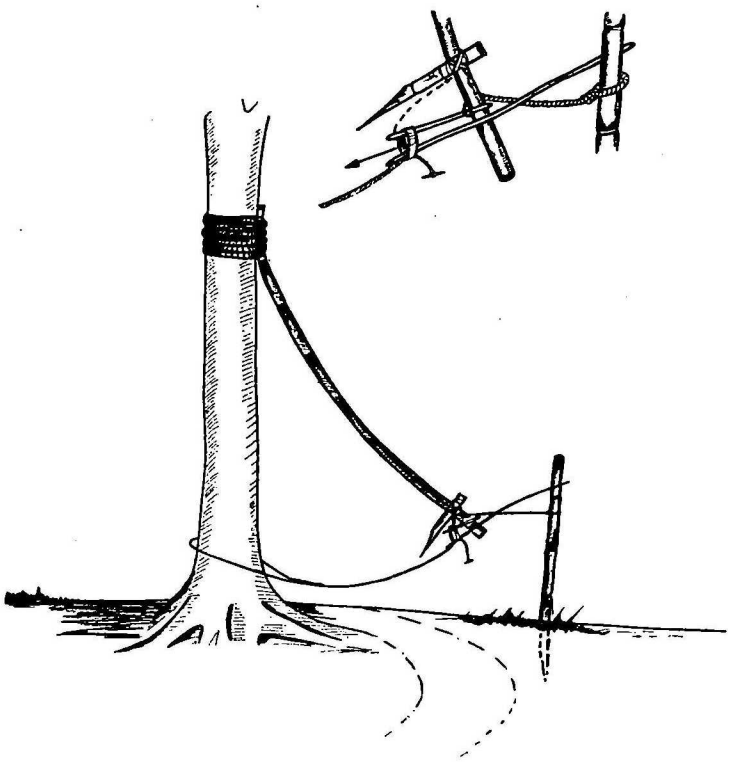
Place snares and traps where the trail is narrow. Arrange pickets, brush or obstacles in such a manner as to compel animals to pass through a particular spot. Be sure that any loop is large enough for the head to pass through but not so large that the body will also pass. Disturb natural surroundings as little as possible.

Small rodents and animals may be snared with a string noose laid around a hole or burrow. Hide or lie flat on the ground a short distance away and down wind from the hole. Jerk the noose tight when the animal pops its head out or steps into the noose.

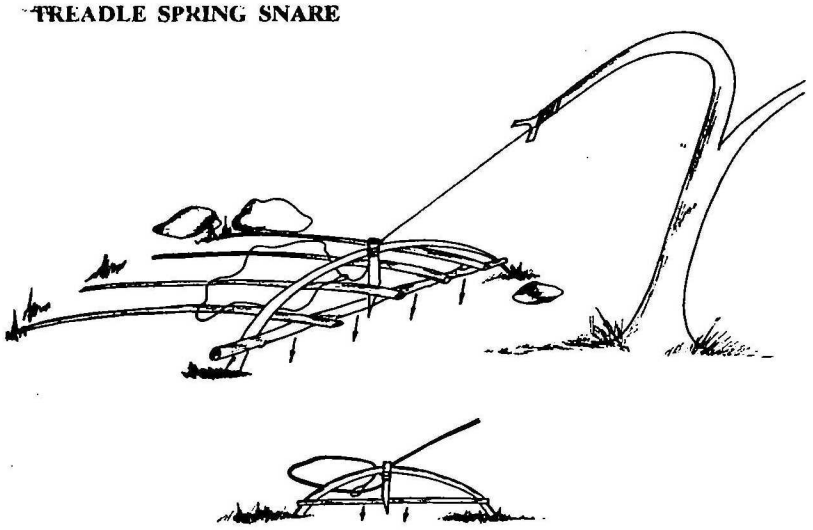
The twitch-up snare, a noose attached to a sapling, jerks an animal up into the air, kills it promptly and keeps its carcass out of reach of other animals. This type of snare is not recommended for cold climates, since the bent sapling may freeze in position and fail to spring up when released.

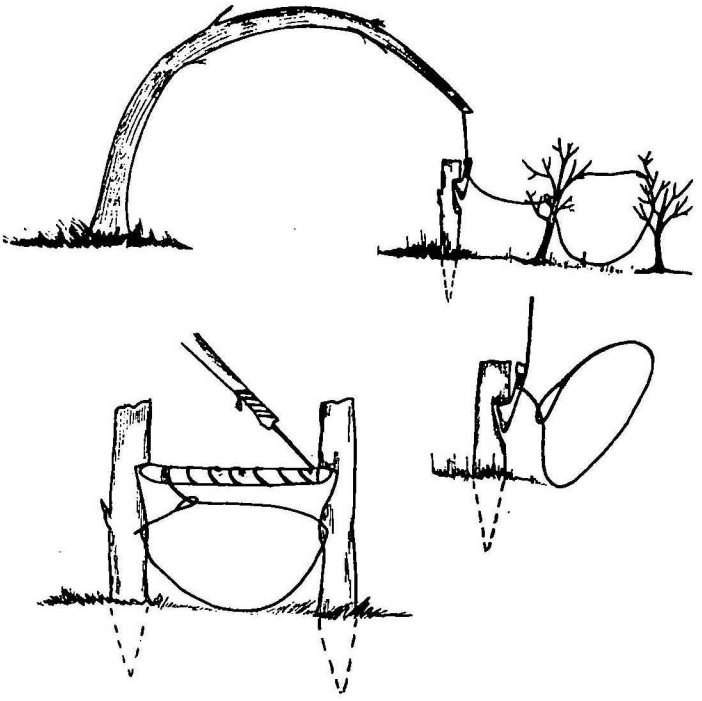
Medium to large animals can be captured in deadfalls, but this type of trap is recommended only where big game exists in such quantities as to justify the time and effort spent in construction.

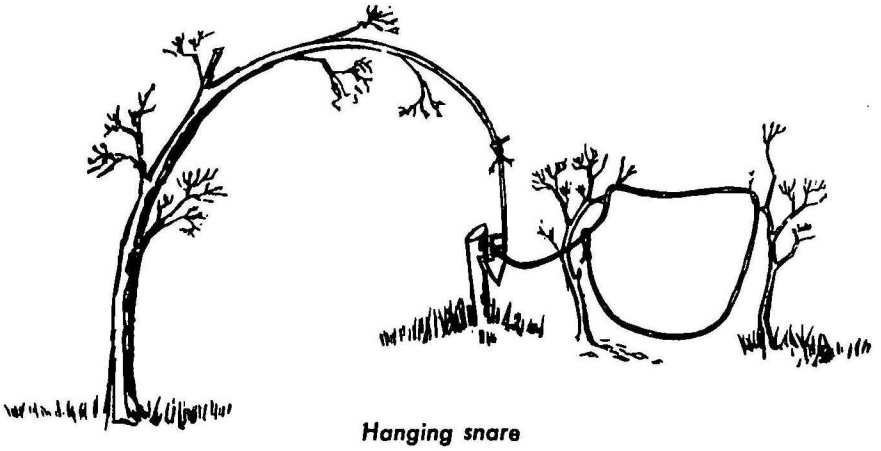
SPRING AND SPEAR TRAP



TREADLE SPRING SNARE







Hanging snare

Fixed Snare

This snare is particularly useful for catching rabbits. Fasten a loop to a log, tree or forked stake and set it near a bush or limb as shown in the diagram. After the trap is sprung the animal will strangle itself.

Hanging Snare

Fasten a slip noose to the end of a bent sapling. Open the noose wide enough to fit over the animal's head but not wide enough for its body to slip through. Secure the trigger so that it holds the sapling. Make it sufficiently loose so that a slight jerk on the noose will free the trigger.

Spring and Spear Trap

Animals can be trapped in the jungle with a bamboo spring and spear trap. As the quarry strikes the cord or wire that secures the trigger mechanism, the trigger is released and the spear driven in by the force of the bamboo spring.

Treadle Spring Snare

This is effective for small animals and birds. Cover the treadle with leaves or grass.

REPTILE, INSECTS AND SNAIL FOODS

Many people regard grasshoppers, hairless catapillars, wood boring beetle larvae and pupae, spider bodies and termites as delicacies. The time may come when there may be no choice but to eat insects such as these; if so, they will be found much more palatable cooked until dry or disguised in a stew.

The term reptile generally includes:

a. Snakes.

b. Iguanas.

c. Turtles.

d. Tortoises.

e. Lizards.

f. Crocodiles.

All these are edible. Snakes are not easily found or caught but the whole length of a snake does provide good meat. By removing the head the poison sacs are removed and the remainder is then as edible as any non-poisonous snake. Taken orally the poison is not harmful unless there is a break in the tissues of the tongue or palate.

Lizards

Lizards are found in the tropics and sub-tropics and all are edible; the scaly skin should be removed and the flesh either boiled or fried. Young crocodiles should be heated over a fire before skinning to loosen the plates.

Turtles

Marine fresh water and land turtles are edible and are found on land or in waters of the temperate and tropical zones. Club the smaller fresh water turtles or catch them in a net. Some turtles have a poison sac or bag under the neck which should not be eaten. Turtles bury their eggs in the sand above the high water mark; their eggs should be boiled as the white does not set.

Insects

Natives consider white ants a delicacy, either cooked or raw, with the wings removed. Also the white grubs of wood-infesting beetles are edible, and are quite palatable if split and boiled over a fire. They are found in decaying and rotten wood. Such insects as grasshoppers and crickets may be roasted over a fire, the wings and legs having first been removed.

Snails

Large edible snails are now common throughout the tropical zone of the South East Asian area. These snails, reaching plague proportions in various places, were introduced by the invading Japanese between 1942 to 1944. They make excellent food and cooking is simple. Boil and eat after removing shell.

FOOD COOKING AND PRESERVATION

Cooking Plant Food

Pot Herbs. Boil leaves, stems and buds until tender. If the food is bitter, several changes of water will help to eliminate the bitterness.

Roots and Tubers. They can be boiled but are more easily baked or roasted.

Nuts. Most nuts can be easten raw, but some, such as acorns, are better crushed then parched. Chestnuts are good roasted, steamed or baked.

Grains and Seeds. Grains and seeds are more tasty when parched but they can be eaten raw.

Sap. Sap containing sugar can be dehydrated to a syrup. Simply boil away the water.

Fruit. Bake or roast tough, heavy skinned fruits. Boil succulent fruits. Many fruits are better raw.

Cooking Animal Food

General. Boil animals larger than a domestic cat before roasting or grilling them. Cook the meat as fast as possible when grilling because it toughens over a slow fire. When cooking larger animals, cut them into small pieces. If the meat is exceptionally tough, stew it with vegetables. If it is intended to grill or bake any type of meat, use some fat wherever possible. In the case of a bake, put the fat on top so that it melts over the bake.

Small Game. Small birds and mammals can be cooked whole or in part, but entrails and sex glands should be removed before cooking. Wrap a large bird in clay and bake it. The clay removes the feathers when it is broken from the cooked carcass. Boiling is the best method of cooking small game because there is less waste. Add taste to the bird by stuffing it with coconut, berries, grains, roots (including onions), and greens.

Fish. Fish may be roasted on an improvised grill of green sticks or baked in leaves and clay, or cooked over direct heat using a spit.

Reptiles and Amphibians. Frogs, small snakes and lizards can be roasted on a stick. Large snakes and eels are better if boiled first. Boil turtles until the shell comes off. Cut the meat and mix it with tubers and greens to form a soup. Salamanders roasted on a stick are edible. Skin all frogs and snakes before cooking as the skin may be toxic. In the case of poisonous snakes be sure to remove an extra two inches when taking off the head.

Crustaceans. Crabs, crayfish, shrimps, prawns and other crustaceans require cooking in order to kill disease-producing organisms. They spoil rapidly, however, and should be cooked immediately after capture. Cook them alive by dropping them in boiling water.

Molluscs. Shellfish can be steamed, boiled or baked in the shell. Shellfish make an excellent stew with greens or tubers.

Eggs. Edible at all stages of embryo development, eggs are among the safest of foods. Hard boiled eggs can be carried for days as reserve food.

Preserving Foods

Drying. Food can be dried by wind, sun, air or fire, or any combination of these four. The object is to get rid of the water content so that the food will keep for a period. Some preserving methods are:

a. Meat. Cutting meat across the grain in quarter-inch strips and drying it in the wind or smoke will produce 'jerky'. Put the strips of meat on a wooden grate and dry until the meat is brittle. A tent makes a good smoking house when the flaps are closed. Hang the meat high and build a slow smouldering fire under it. Perhaps a quicker way of smoking meat is to dig a hole in the ground about three feet deep and 18 inches wide. Make a small fire at the bottom of the hole (after starting the fire use green wood for smoke). Place an improvised wooden grate about three-quarters of a yard up from the bottom. Use poles, boughs, leaves or any available material to cover the pit.

b. Fish and Birds. Fish and birds are preserved in much the same way as other meats. To prepare fish for smoking, cut off the heads and remove the backbones. Then spread the fish flat and skewer in that position. Thin willow branches with bark removed make good skewers. Fish also may be dried in the sun. Hang them from branches or spread them on hot rocks. When the meat dries, splash it with sea water to salt the outside. Do not keep sea food unless it is well dried and salted.

c. Plant Food. Plantains, bananas, breadfruit, leaves, berries and other wild fruits can be dried by air, sun, wind or fire, with or without smoke. The fruit should be cut into thin slices and placed in the sun or before a fire. Mushrooms dry easily and may be kept indefinitely. Soak them in water before using to leach out any worms or parasites.

Conclusion

Knowing which plants and animals can be eaten safely may well mean the difference between death from poisoning or starvation and survival. Learn which ones are edible, now.

SNAKES

Introduction

The reptiles described in this section include those found in Australia, Papua New Guinea, and the Solomon Islands, as well as those of the South East Asian area.

How to Kill Snakes

On encountering a snake you will instinctively become very cautious and wisely give it a wide path. However, you might need to kill snakes for food.

If a longish stout branch or similar weapon is available strike the snake first across the middle of the back; this will usually break the back bone and render the animal immobile. Finish it off by pounding its head.

Without such a weapon you might be reduced to using rocks or even a knife or machete; your desire to live will determine the safest tactics to adopt for the kill.

Dangerous Snakes

Tropical mainland regions characteristically possess extensive and varied snake populations. Most are non-venomous or virtually innocuous ; only a few of the larger venomous kinds can be regarded as dangerous to man. In Malaya, for example, there are more than 100 different kinds of snakes, but of these the majority such as blind snakes, pythons and some tree snakes are non-venomous, and the venomous types include a great number of small species which are practically

harmless. In islands there are fewer species of snakes, venomous or not. However this does not necessarily mean that there are fewer individuals: do not relax your vigilance just because you are on an island.

The Malay archipelago and the Philippines lie near the Asiatic land mass and the snake populations resemble those of South East Asia. The snakes of Papua New Guinea, on the other hand, resemble those of the continent of Australia.

Passing eastwards and southwards from the area as here defined, there are no dangerous snakes in New Caledonia, Fiji, Samoa or the adjacent islands. These, and many of the smaller islands of the Pacific generally, have a lizard population and possibly frogs, but few have snakes. What snakes do occur are mainly non-venomous, such as green tree snakes, fresh water snakes, pythons and boas, a tree form of the latter being very common and widely distributed. In New Zealand, there are no snakes of any kind.

Table of Dangerous Snakes

The table below shows the distribution of the dangerous land snakes of the area.

Northern Australia

The most dangerous snake is the taipan which is not very common and is found only in the north east. The death adder, which is not a viper though it looks somewhat like one, is also dangerous. Tiger snakes are rarely seen north of Brisbane but they are certainly there. Of the brown snakes, only large species (four to six feet in length) are to be feared. The bites of various kinds of black snakes, though causing severe symptons, are unlikely to be fatal to man.

New Guinea Area

For convenience this area is considered as embracing the Bismarck Archipelago, from New Britain westward to the island of Ceram, and the smaller islands surrounding New Guinea. The snake population resembles that of the Australian mainland, but follows the general rule in containing fewer species. As in Australia, there are no vipers. In New Britain the only deadly species recorded is the Australian Death adder, but in New Guinea this snake is restricted to a coastal belt and uplands. The taipan has been seen in the country

surrounding the mouth of the Fly River, and may possibly be found east or west of that point. The genus Pseudechis, represented by brown or black coloured snakes, occurs mainly in the Port Moresby area.

The Solomon Islands

The venomous snakes likely to be found throughout this area, more particularly on Guadalcanal, Ysabel, Malaita and Bougainville, belong to the genera Denisonia and Micropechis. Snakes of the former group are allied to the Australian Denisonia, of which only one large species, Denisonia superba (the Australian copper-head), is dangerous. The Denisonia of the Solomons is probably not dangerous but it is advisable to treat bites by large specimens with first aid and antivenene. Micropechis is represented by a black and white species which is not dangerous to man.

Malaysia and the Philippines

Among the dangerous snakes in these regions are groups which are also present on the Asian mainland, notably vipers, cobras and kraits. It will be noted that only in this part of the area are vipers found, and of these by far the most dangerous is Russell's viper.

Sea Snakes

There are a large number of sea snakes in these waters, all of which are poisonous and some extremely so. Almost all sea snakes live entirely in water and are specially built for this life. The body is somewhat flattened vertically and keel-like below, the tail being shaped like the blade of a paddle. The nostrils generally open on the upper surface of the snout and are provided with a valve to enable the snakes to feed under water. They live on fish and mostly frequent shallow sheltered waters not far from the coast and river mouths in tropical regions. They may be caught on a fishing line or be entangled in nets, and in such cases should be handled with great care. If seen basking on the surface or washed up on a beach, they must be treated cautiously. The venom of some species is extremely potent, having a powerful poisoning action on the nervous system; but their biting apparatus is poor and it is doubtful if they could inflict a fatal bite except on an unclothed or thinly clothed part.

TABLE OF DANGEROUS SNAKES

Genus	Australia	New Guinea	New Britain	Solomons	Philippines	Sumatra	Java	Borneo	Lombok	Flores	Timor	Celebes	Ceram	Kei	Aru	Jobi
VIPERA (Russell's Viper)						X	X									
TRIMERESURUS (Pit Vipers)					X	X	X	X		X	X	X				
AGKISTRODON (Hump nosed pit Viper)						X	X									
BUNGARUS (Kraits)						X	X	X								
NAIA (Cobras)					X	X	X	X	X	X	X					
DOLIOPHUS (Sunbeam Snakes)					X	X	X	X				X				
ACANTHOPIS (Death Adder)	X	X	X										X	X	X	X
NOTECHIS (Tiger Snake)	X															
PSEUDECHIS (Black Snakes)	X	X														
DEMANSIA (Brown Snakes)	X															
OXYURANUS (Tiapan)	X	X														
DENISONIA				X												
MICROPECHIS				X												

Note: Denisonia (except D. superba in Southern Australia) and Microphechis are not deadly, but are included here as the only venomous species in the Solomons.

SURVIVAL AT SEA

Personnel operating from ships, or in aircraft over the sea, could be faced with the problem of survival following a mishap.

As a rule the Sea Air Rescue organization automatically initiates a search following a prescribed period of radio silence from aircraft and ships. Your survival, therefore, depends largely on being seen particularly from aircraft within about one week.

For information on sea foods see the section on 'Survival on land'.

IMMEDIATE ACTION

Survivors should stay clear of the aircraft or ship but in the near vicinity until it sinks.

They should search for floating men.

Equipment floating in the vicinity should be salvaged and all items stowed and secured. Rafts should be checked for inflation, leaks and points of possible chafing. Rafts or lifeboats should be bailed out with care taken not to snag them with shoes or sharp objects.

In cold oceans, exposure suits should be donned if available and wind-break, spray shield and canopy rigged.

The physical condition of all aboard should be checked and first aid rendered where necessary. Seasickness pills should be administered if available, and petrol, oil, blood, vomit, etc, removed by washing.

Where there are more rafts than one they should be linked together with at least 25 feet of line. Rafts should be linked only at the lifeline around the outer periphery of each raft. Unless the sea is very rough, the line should be shortened when an aircraft is seen or heard. Two or more rafts tied close together are easier to spot than scattered rafts.

The emergency radio should be put into operation if available. Directions normally accompany the equipment. The emergency transceiver should be used only when aircraft are known to be in the area. Other signalling devices should be prepared for instant use.

Compasses, watches, matches and lighters must be kept dry by placing them in waterproof containers.

The situation must be calmly appraised and a course of action carefully planned.

Water and food must be rationed and duties allocated.

SUBSEQUENT ACTION

Remember that rescue at sea is a co-operative project. Search aircraft contacts are limited by the visibility of survivors. Increase the likelihood of being sighted by using all possible signalling devices.

Personnel. Make a thorough search for missing men. Carefully patrol the entire area near the crash or sinking, especially in the direction toward which waves are moving. Look very carefully; some of the missing men may be unconscious and floating low in the water. If men are in the water and sharks are in the vicinity, use shark repellent if available.

Equipment. Inspect all debris that comes from the aircraft or ship. Salvage all rations, canteens, thermos jugs and other containers, seat cushions, extra clothing, maps and any other item likely to be of help.

Secure equipment by lashing it to raft or lifeboat and storing it in raft pockets and kit containers where provided. Keep these closed when not in use. Keep dry such items as flashlights, signal guns and flares.

PROTECTION AGAINST EXPOSURE

In cold oceans, to keep dry is to be half-way to keeping warm. If wet, get down behind the wind-shield. Remove, wring out and replace outer garments or don dry clothing if available. Dry out hat, socks and gloves.

The survivor who is dry should consider those who are wet, allowing them to occupy the most sheltered positions, or to warm their hands and feet against his body.

Extra clothing, if available, should be donned. If no exposure suits are provided, extra clothing should be draped around the shoulders and over the head. Clothes should be loose and comfortable. The floor of the raft or lifeboat should be kept dry. For insulation, cover the floor with canvas or cloth.

Give extra rations to men suffering from exposure to cold.

In warm oceans, protection against the sun is most important. Exposure to the sun increases thirst thereby wasting precious water and reducing the body's water content. The sun also causes serious burns. Survivors on a 20-man raft should erect the canopy and furl the sides. Use the tarpaulin, light side up, to attract attention. In rigging a sun shade, leave some space for ventilation.

Keep the body well covered. Do not discard clothing. Keep sleeves rolled down and socks pulled up. Button up shirt to collar. Wear a hat or improvised headgear. Use a piece of cloth to shield the back of the neck. Wear sun-glasses or improvise eye cover from cloth.

CARE OF RAFT

Make sure that the raft is fully inflated. If the main buoyancy chambers are not firm, top off with a pump or mouth inflation tube. See that the valve is open before pumping; to open, turn to the left. Inflate cross seats where provided unless there are injured men who must lie down. Do not over inflate. Air chambers should be well rounded but not drum tight. Close valves firmly. Regularly check inflation. Hot air expands, so on hot days release some air; add air when the weather cools.

Always throw out the sea anchor or improvise a drag from the raft case, bailing bucket or roll of clothing. A sea anchor will help to keep the raft from drifting and so make it easier to find. Wrap the sea anchor rope with cloth so that it will not chafe the raft.

Take pains not to snag the raft. In good weather, remove shoes and tie them to the raft, Keep fish-hooks, knives, ration tins and other sharp objects off the bottom of the raft.

In stormy weather, rig the spray and wind-shield without delay. In a 20-man raft, keep the canopy erected at all times. Keep the raft as dry as possible and properly balanced. All men should stay seated, the heaviest men in the centre.

Leaks are most likely to occur at valves, seams and underwater surfaces. They can be repaired with the repair plugs provided. Most multi-place rafts have buoyancy tubes separated into two chambers. If one chamber is damaged, keep the other fully inflated. Adhesive plaster, tape and chewing gum are useful means of repairing leaks.

SIGNALLING

Emergency Radio. Transmit radio distress signals at frequent intervals or otherwise follow briefing instructions. Send signals as indicated in instructions packaged with the transmitter. Send steadily when using hand energized transmitters. Exercise discretion in using battery operated transceivers.

Radar. A corner reflector or other radar signalling device should be set up and left up except during storms. Handle such devices carefully.

Mirror. Practise signalling with the mirror in the craft kit. As a subsititute, use an ordinary pocket mirror or any bright piece of metal. Punch a hole in the centre of the metal piece for sighting. On hazy days, aircraft observers can see the flash of the mirror before survivors can see the aircraft; flash the mirror in the direction of a plane when it is heard even if it cannot be seen. When the airplane is sighted, keep signalling. Some raft paddles and oars are coated with material which will reflect the beam of a searchlight at night.

Pyrotechnics. Use smoke signals in the day time and red signals at night. Keep signal flares dry and conserve them for emergencies.

Sea marker. Use a sea marker during the day time. Except in a very rough sea, these dye indicators remain conspicuous for about three hours. Conserve by rewrapping when not in use.

Lights. At night, use flashlights, recognition light or the blinker signal light of the radio. Any light can be seen over water for several miles.

Whistle. At night or in fog, use the whistle from the emergency kit to attract surface vessels or people on shore, or to locate another raft if it becomes separated.

HEALTH

Apply the first aid section of this manual. In addition, the following conditions may have to be treated:

a. Seasickness. When seasick do not eat or drink. Lie down and change the position of the head; take seasickness remedy at once if available.

b. Salt Water Sores. Do not open or squeeze them; use antiseptic. Keep sores dry.

c. Immersion Foot. This condition is caused by exposure to cold, immersion in water, cramped quarters, restricted circulation. Tingling numbness, redness and swelling are the noticeable symptions. Blotchy red areas and blisters eventually appear. Keep the feet warm and dry; maintain circulation by exercising toes and feet; loosen foot-gear. Elevate feet and legs for 30-minute periods several times a day. A survivor suffering from immersion foot should keep off his feet after landing.

d. Sore Eyes. Glare from the sky and water may cause eyes to become bloodshot, inflamed and painful, Wear sunglasses or improvise an eye shield from cloth or bandage. If the eyes are painful, bandage them lightly. Moisten a piece of gauze or cotton with sea water and lay it over the eyes before bandaging.

e. Constipation. Lack of bowel movement is normal on rafts. Do not take laxatives even if available. Exercise as much as possible.

f. Difficulty in Urinating. Dark coloured urine, and difficulty in passing it, are quite normal occurrences.

g. Mental Disturbances. Fear is normal among men in dangerous situations. Accept fear and carry on in spite of it. Fatigue and exhaustion resulting from severe hardships often lead to mental disturbances, which may take the form of extreme nervousness, excessive and violent activity or depression. The best preventative is sleep and rest. When not resting, keep busy with routine raft duties. Seeing mirages is not a sign of mental unbalance. Cheerfulness is a tonic and will spread to others.

h. Cracked and Parched Lips and Skin. Use chapstick or any oil or salve.

i. Frostbite. Frostbite may occur when wet skin is exposed to wind during winter. The face, ears, hands and feet are most susceptible. Try to keep them dry and covered. If shoes or boots are tight, remove them and wrap the feet in dry cloth.

j. Sunburn. Keep the head and skin covered. Stay in the shade. Use cream or chapstick from kit. Remember that reflection from water causes sunburn too.

WATER

Do not Drink Sea-water

Sun Stills. When sun stills are available, read instructions and set them up immediately. Use as many stills as possible, depending on the number of men in the raft and the amount of sunlight available. Secure the sun stills to the raft with care.

De-Salting Kits. When de-salting kits are available in addition to sun stills, use them only for immediate water needs or during long periods of overcast sky when sun stills cannot be used. In any event, retain de-salting kits and emergency water stores for those periods when sun stills cannot be used or rain water cannot be caught.

Sea Ice. In Antarctic waters, use old sea ice for water. This ice is bluish, has rounded corners and splinters easily. It is almost free of salt. New ice is grey, milky, hard and salty. Water from icebergs is fresh, but icebergs are dangerous to approach and should be used as a source of water only in emergencies.

SHARKS

Avoid attracting or annoying sharks. Most of them are scavengers, continuously on the move for food. If none is available, they will lose interest and swim on. The risk of being attacked by sharks is small. Even in warm oceans the risk can be reduced by knowing what to do and how to do it.

When immersed in the sea, keep a sharp lookout for sharks. Use shark repellent, if available, and if sharks are in the vicinity. Do not remove clothing or shoes. If a shark threatens to attack, survivors should bunch together in a tight circle, facing outward so that approaching sharks can be watched. In rough seas, survivors should tie themselves together. Actual attacks may be warded off by kicking or stiff-arm tactics.

If survivors are apparently undetected, they should stay as quiet as possible, floating to save energy. If forced to swim, they should use strong, regular strokes and avoid frantic or irregular movement. When swimming alone, avoid schools of fish.

When menaced at close range by a single large shark:

a. Use strong, regular swimming movements; a feint toward the shark may scare it off.

b. Avoid swimming away from the shark directly in its path; face it and swim quickly to one side to avoid it.

c. As a last resort, kick or stiff-arm a shark to push it away.

d. Make loud sounds by slapping the surface of the water with cupped hands. Shouting or screaming under water has been found to be effective by many skin divers.

e. In a showdown at close quarters use a knife. Stab the shark in the gills or eye.

If a shark threatens to attack or to damage the raft:

a. Discourage it by jabbing its snout or gills with an oar (be careful not to break the oar or to take roundhouse swings that may upset the raft).

b. Fire a pistol above a shark; this may frighten it away.

When in the raft do not dangle arms or legs over the side. Look for sharks around and under the raft before entering the water.

Remove bright objects which might attract a shark. Dark coloured clothing and equipment are preferable to light coloured ones.

Do not fish from the raft when sharks are near by. Abandon a hooked fish if a shark approaches.

Sharks are known to be curious and likely to investigate any large floating object, but after investigation, the shark will usually swim away. At other times it may approach or circle the object in the water and bump or nudge it. Sharks are attracted by blood and vomit, body waste and garbage. Discard these in small amounts and as far away from the raft as possible. Do not clean fish into water when shark are sighted.

Any contact with the rasp-like skin of a shark will cause brush wounds. The severity of these wounds will depend on the size of the shark and its speed at impact. Hit the shark with the bare hand only as a last resort.

The most important measure after shark bite is the control of haemorrhage and shock. Get aboard a raft or get ashore as soon as possible, stop the bleeding, and treat for shock. If one of a group in the water has been attacked and it is not possible to get him out, his companions should surround him during treatment.

In the event of death at sea, the body is best disposed of at night; the survivors should put as much distance as possible between them and the point of disposal.

WATCHES AND LOOK-OUTS

Allocate watches which should not exceed two hours. All survivors should participate except those badly injured or utterly exhausted. Keep at least one look-out posted at all times. He should watch for signs of land, passing vessels or planes, wreckage, seaweed, schools of fish, birds and signs of chafing or leaking of the raft.

TRAVEL

The course and movement of a raft will be influenced by winds, tides and ocean currents, modified to some extent by the use of oars, paddles, tiller, sea anchor and sails.

Ocean Currents. When ocean currents are moving in the desired direction against unfavourable winds, put out a sea anchor. Huddle low in the raft to reduce wind resistance. In the open ocean, currents seldom move faster than six to eight miles per day.

Using the Wind. Life rafts, not being equipped with keels, cannot be sailed into the wind even by experienced sailors. However, a raft can be sailed easily down wind and multi-place rafts (except 20-man types) can be sailed successfully 10 degrees off the course of a following wind. A raft should not be sailed unless land is near.

To take advantage of a following wind, inflate the raft fully, sit high, take in the sea anchor, rig a sail and use an oar as a rudder.

In multi-place (except 20-man) rafts, rig a square sail in the bow, using oars with their extensions as mast and cross-bar. If a proper sail is not available, a waterproof tarpaulin or one or two thicknesses of lighter material will serve as a substitute. When the raft has no regular mast socket and step, the mast can be erected by tying it securely to the front cross seat and bracing it. Whether or not a socket is provided, pad the bottom of the mast to prevent it chafing or punching a hole through the floor. The heel part of a shoe with the toe wedged under the seat will make a good improvised mast step.

Never secure both corners of the lower edge of the sail. Hold the line attached to one corner in the hand so that it can be readily released. Otherwise, sudden storms or wind gusts may rip the sail, break the mast or capsize the raft.

RAFTMANSHIP

Take every precaution to reduce the possibility of capsizing the raft. In rough weather, keep the sea anchor out from the bow; passengers should sit low in the raft with their weight distributed to hold the weather side down. Standing up or sitting on the sides of the raft must be avoided. Never make sudden movements without warning the other passengers. Do not secure fish lines either to yourself or to the raft; the sudden tug of a large fish may easily capsize the raft.

In rough seas the stern of the first raft should be tied to the bow of the second raft with a 25-foot line and with a sea anchor rigged to the stern of the second. The length of the securing line can be adjusted to suit the sea. Keep the sea anchor line long; adjust its length so that when the raft is at the crest of a wave, the sea anchor will stay in a trough. In very rough weather, keep a spare sea anchor rigged and ready for use in an emergency.

When the sea anchor is not in use, it must be secured to the raft and stowed in such a way that it will hold immediately if the raft capsizes.

To right multi-place (except 20-man) rafts, toss the righting rope over the bottom of the raft, move to the other side, place one foot on a floatation tube and pull on the righting rope. If the raft is not equipped with a righting rope, improvise one from the sea anchor line, a belt or a shirt. Failing that, clamber on to the bottom of the raft, reach across, grasp the life-line on the far side and then slide back into the water, pulling the raft back and over. Most rafts are equipped with righting handles on the bottom. Twenty-man rafts are identical on either side and therefore require no righting.

With a four to six-man raft, if several men are in the water, one should hold down the far side while the rest climb in singly from the other side, grasping the seat to haul themselves in, or using the boarding ladder provided on the newest types of raft. If unaided, the best place to board the raft is over the end. If the wind is blowing, survivors should board the raft with the wind at their back. The 30-man raft is equipped with a deflated boarding station which is hand inflated by the first survivor aboard.

LANDFALL

The look-out should watch carefully for signs of land.

A fixed cumulus cloud in a clear sky or in a sky where all other clouds are moving is often an indication of land.

In the tropics, a greenish tint in the sky is often caused by the reflection of sunlight from the shallow lagoons or shelves or coral reefs.

In the Antarctic, ice-fields or snow-covered land are often indicated by light coloured reflections on clouds, quite different from the darkish grey caused by open water.

Deep water is dark green or dark blue. Lighter shades indicate shallow water which may mean land is near.

In fog, mist, rain, or at night when drifting past a nearby shore, land may sometimes be detected by characteristic odours and sounds. The musty odour of mangrove swamps and mud flats and the smell of burning wood carry far. The roar of surf will be heard long before the surf is seen. Continued cries of sea birds from one direction indicate roosting places on nearby land.

In the tropics, mirages are likely, especially during the middle of the day. Care should be taken not to mistake a mirage for nearby land. A mirage will disappear or change its appearance and elevation if viewed from slightly different heights.

Usually more birds are seen near land than over the open sea. The direction from which flocks fly at dawn and to which they fly at dusk may indicate the direction of nearby land. During the day, birds are searching for food and the direction of flight has no significance.

ORIENTATION AND TRAVEL

A ground field team is normally able to pin-point its position at least to within a radius of a few miles at any time. This would not apply to a team which had been involved in an aircraft forced landing; a very large position error should be expected in such circumstances. These initial point errors must be taken into consideration when planning a walk-out.

NAVIGATION

Position and Direction

Position finding from a map or chart is relatively easy and the possession of a compass will further simplify the task. This instrument should not be regarded as the only aid to direction finding, however, as various other methods can be applied, such as the use of a watch or the study of the sun, stars, etc.

Most field teams will usually have a map which covers large areas and consequently fails to provide an accurate picture of any particular place. A map which contains detail can be oriented so that the features on the map coincide with those on the ground and thus will be far more useful. Care must be taken to avoid inaccuracies of compass reading due to the presence of metal objects in close proximity to the instrument. Compass errors, however, are usually slight and it is preferable to rely on this instrument rather than to depend on instinct. In strange territory without a compass, the tendency to wander is almost universal.

Rate of Movement

In most of Australia, two to three miles per hour is the average rate of movement. In Papua-New Guinea the rate of movement varies according to the density of vegetation. The approximate rates of movement through various types of vegetation are:

a. Through primary jungle - 1,000 to 2,000 metres per hour.

b. Through secondary jungle - 500 to 1,000 metres per hour.

c. Through fern and blukar - 200 to 500 metres per hour.

d. Through swamps (variable) - 100 to 200 metres per hour.

e. Through lallang (tall grass) - 500 to 1,000 metres per hour.

Navigational Aids

Maps. The following points should be considered when using maps:

a. Maps are reasonably accurate as regards features such as hills and streams but, in jungle areas, maps have generally been produced from air photos and tend to show the form of the tree canopy rather than the underlying ground formation. Therefore, relatively small features such as cliffs and waterfalls which are not shown on the map will often be found on the ground. Maps may also be inaccurate as regards cultivation and jungle boundaries, roads, tracks, villages and clearings, because these are features prone to continual change. In some areas, magnetic anomalies exist caused by minerals in the ground. Areas in which these anomalies occur are sometimes shown on the map as enclosed by a line of dashes.

b. Maps when carried must be well protected, particularly in the tropics. A suitable folding case can be made of plastic material.

Air Photographs. An air photograph is a valuable and often only means of bringing a map up to date; however, they are not always available in a survival situation.

Compass. A compass is the most accurate means of maintaining direction.

Protractor. A circular or semi-circular protractor with a string or gut line attached is the best type because, when taking a bearing, it is unnecessary to draw lines on the map, which may be damp. When using a protractor remember that:

a. The edge or centre line must be parallel with grid north.

b. The arrow must be accurately positioned over the start point.

Sun, Moon and Stars. In Papua-New Guinea, because of the close proximity of the equator, the sun is of little aid to direction finding after 10 am and before 4 pm and should not be used with the sun and watch method. The moon is of little help as an aid to navigation.

Trackers and Local Guides. Some races are natural trackers and are particularly useful. Local guides are usually unreliable with little idea either of time or distance.

Planning a Move

Study all available aids and note the main features in the general area to be traversed, for example, the direction of flow of rivers and streams, height of the hills, artifical objects and the changes in vegetation.

Unless experienced in navigation in close country, move in a straight line if the situation allows, as follows:

a. Take the bearing from the map with a protractor and set on the compass remembering the magnetic variation correction.

b. Study the line in relationship to the ground from the map.

c. Divide into bounds no more than one hour apart, utilizing check points in between, such as streams, ridges, etc.

d. Work out time and distance, according to the ground.

When experienced in close country navigation, select a route from the map as follows:

a. Keep to high ground if the situation permits, particularly when moving through country where bamboo is prevalent.

b. As far as possible, move against the grain of the country.

c. Move to definite bounds and check points.

d. Before starting out, note down the following details of each bound:

(1) Bearing.

(2) Distance.

(3) Time in relation to ground.

(4) Check points if any.

e. When moving to a small objective, aim off left or right, if possible, to a prominent feature or landmark. On reaching the point, move to your objective.

Keeping a Course

When planning a course first decide whether to use tracks, to go across country, or to use a combination of both. If tracks are to be followed, note the intersections and distinctive features to be crossed or likely to be seen on either flank. For a cross-country march, examine the most direct route and note obstacles to be avoided and likely whereabouts of food, water and shelter.

In general, first plan to move against the grain of the country and then exploit paths, trails and forest boundaries if within 20 degrees of the axis of advance.

In strange country, study outstanding features of the landscape constantly and make every effort to keep course. Nevertheless, one should not be afraid of making detours to overcome obstacles; travelling five extra miles is sometimes quicker than struggling for three hours through 100 metres of marsh or swamp. Observation from a high point will often permit a note to be made of the general pattern of the land and the vegetation in the area.

Prominent landmarks en-route should be identified and, as one is approached, another farther away should be noted. In dense forests where distant landmarks are not discernible, a course can be held by lining up three trees. As the first is passed, another beyond the next two should be lined up. It is helpful to look back occasionally to see the relative positions of landmarks, slope and contour of the ground, for the country may appear entirely changed when viewed from different observation points.

Periodical looking back is also useful should it later become necessary to retrace the route. Streams, ridges and trees will generally be guides in open country, though in some parts landmarks are few or even non-existent. On cloudy days, in dense vegetation, or wherever the country presents a sameness of appearance, a trail can be marked with blazes, bent bushes, overturned rocks or logs, etc. Bushmarks are easily made and should be cut or bent in such a manner that the under and lighter sides of the leaves are uppermost.

In jungle, sites marked as villages on the map may often be found to be no more than evergreen clearings; just as frequently a village will be found where virgin forest is shown in the map. As a consequence the network of tracks is ever changing. Nature also lends to the confusion by changing the course of streams and closing disused tracks with dense scrub, sometimes in the course of one rainy season. In such circumstances, the only safe landmarks are natural features such as rivers and hills; a consciousness of watersheds and contours and an instinct about the slope of the ground to be traversed, must be developed. The map is more likely to be wrong than the compass and the human more likely to be wrong than the map; therefore, when in doubt, call a halt and think out the problem. But don't worry unduly; sooner or later a recognizable feature will appear to help pin-point the position.

Night Travel

Eyes become adjusted to the darkness in time but a light blinds anyone to everything outside the small area of illumination. In open country, a reasonably accurate course can be held at night by selecting a fairly bright star near the horizon in the direct line of travel and lining it up with the trees and other skyline landmarks ahead. Stars appear to move from east to west owing to the earth's rotation. Direction should be checked frequently by the Southern Cross if visible. If you have a compass, you should check the magnetic bearing of your guide star every 15 minutes if the star is in the general direction of North or South, or every 30 minutes if East or West.

In unfamiliar wooded or jungle country, except in an emergency, do not travel by night.

Procedure when Lost

If lost, you should sit down and consider whether:

a. Your drift has been to left or right of the line of travel.

b. Your objective has already been passed, or the time and distances travelled badly estimated.

c. The ground has conformed to your mental picture and the facts noted concerning the route.

d. The map is in error (you should not be too hasty about assuming this).

e. Any features in the area would help you to fix position.

Summary

The following points summarize this section:

a. Check compass bearing regularly.

b. Keep checking the map against prominent landmarks.

c. Stay strictly on the bearing; there is always a tendency to take the easiest route when moving through close country. Most people have a tendency to swing off to left or right when attempting to move in a straight line.

d. When moving without the aid of a compass, maintain direction by aligning two or three objects ahead and in the direction of the advance. This method is particularly useful when moving through jungle.

e. Check the direction of flow of streams; never take it for granted a stream just encountered will be the one next shown on the map. Remember that not all the smaller streams are marked on the map.

f. Estimate the distance travelled. When moving up or down hills, distance is illusory, generally seeming farther than in fact it is.

g. If there is a possibility of having to return by the same route, look back at regular intervals to note landmarks which could act as a guide on the return journey. The route may also be marked for the return journey by snapping twigs and saplings and the blazing of trees.

NAVIGATION BY THE SUN

The Sun Method

At noon in winter in the southern hemisphere, the sun will be due north and, in consequence, shadows at this time of day will be thrown towards the south. In the summer to the north of Capricorn this method of direction finding will not always apply. For example, at noon in Cape York, Darwin and northern areas of West Australia the sun will throw (short) shadows to the north noticeably during December.

Watch Method

To find north in the southern hemisphere using the watch method, hold the watch so that the 12 of the dial points to the sun. A line bisecting the angle between 12 of the dial and the hour hand will indicate north. This method does not apply in areas north of Capricorn in mid-summer.

NAVIGATION BY THE STARS

Introduction

A knowledge of the position of stars and their movements around the heavens will assist you in finding your way and maintaining direction. This knowledge may save lives where there is no compass, when an additional check is required on a compass reading, or when it may not be practicable to use a compass, for example, in areas where there are iron ore deposits or in high latitudes.

Finding Direction in Southern Hemisphere

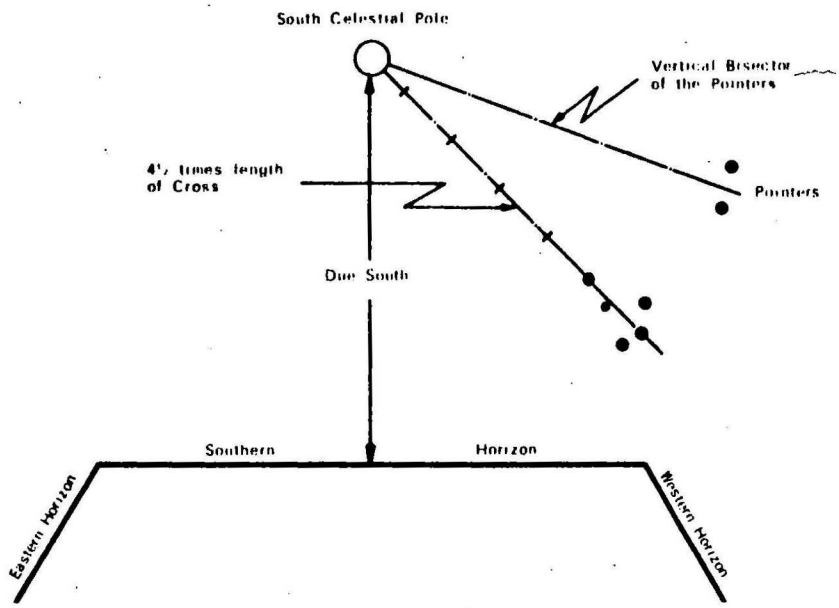
Unfortunately, there is no star near the south celestial pole bright enough to be easily recognized. Therefore, the constellation most commonly used to find south in the southern hemisphere is the Southern Cross and its pointers. The south celestial pole may be found:

a. By producing the length of the Southern Cross, four and one half times.

b. Where the prolongation of the length of the Southern Cross meets the vertical bisector of a line joining the Pointers.

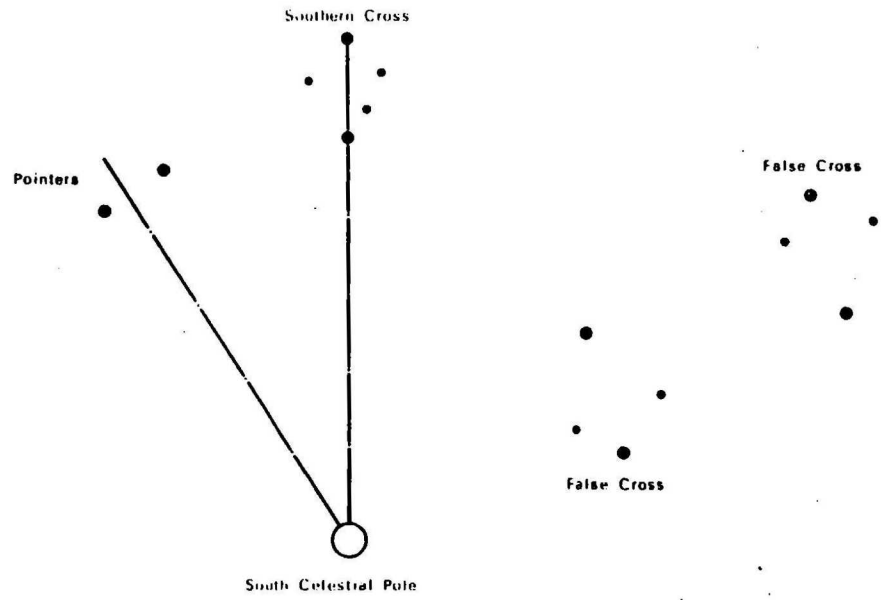
Be careful not to mistake two groups of stars, known as the False Crosses, for the Southern Cross. In May, for example, the False Crosses appear as shown in the adjacent diagram. You can recognize these False Crosses because they are larger than the Southern Cross, and they do not have Pointers.

FINDING SOUTH USING THE SOUTHERN CROSS AND POINTERS



In this figure, the observer would be a few degrees South of latitude 30 degrees south because the Cross is seen to be circumpolar. The Southern Cross would be in this position at 9pm in mid October.

FALSE CROSSES



TRAVEL CONSIDERATIONS

Don't travel unless you are absolutely certain that you can reach your destination on the water supply available.

Tropics (PNG and Similar Areas)

The most useful aids to travel in the tropics are a machete, a compass, a first aid kit, and stout shoes.

Travel only when it's light. Avoid obstacles such as thickets and swamps. Don't try to crash through thick jungle; push vegetation aside or use your machete. Part the brush to pass through, cut your way as a last resort. Don't climb over logs if you can walk around them.

Ridges. Travelling on a ridge is often easier than moving in a valley or along a stream. The vegetation is usually less dense, the ridge serves as a guide, observation points are frequent, landmarks are more easily picked up and tributary stream or swamp crossings will be few. In addition, ridges generally have a game trail along their top.

Streams and Valleys. Following a stream requires fording, detouring and penetration of thick vegetation. In mountainous country, a stream may tend to wind; the vegetation may be dense, observation points rare and swamps common. Nevertheless, it presents some advantage in strange country for it gives a comparatively definite course which may lead to habitations. Rivers and streams are a source of food, water and a possible means of travel by boat or raft.

Coast Lines. A coastal area might allow for easy travel but such travel is usually long and circuitous. Nevertheless, it affords an excellent start line and possible food area.

Mountain Travel

Mountainous or deeply eroded country presents special difficulties. What may appear from a distance to be a single ridge may prove to be numerous ridges and valley, all of which must be crossed before reaching the main ridge. If cross graining the mountains is difficult or hazardous, the only course is to follow valleys or ridges; care must be taken not to travel at right angles to them. If a hidden gorge with nearly perpendicular walls is found, you should start again and try another route. Game trails may show the best path.

Desert Travel

For desert survival:

a. Water is the most important factor. Carry as much as possible even if something else has to be left behind. To maintain your body efficiency in hot desert-like country the requirement is that you have a minimum of one gallon of water available each day. If having this amount of water available you have to do any walking, it would always be preferable to walk by night. In this way you could count on travelling 20 miles for each gallon of water available. However, should you move by day, the maximum you could count on travelling would be 10 miles for each gallon of water available to you.

b. Dress properly as protection against direct sunlight and excessive sweat evaporation. If sunglasses are unavailable make slit goggles out of a piece of material. Remember that clothing is necessary for warmth in the desert where cold nights are common.

c. Care of the feet. Army type boots are perfect for desert travel. Sand dunes can be crossed barefooted in cool weather, but during the summer the sand will burn the feet.

When travelling:

a. Travel only in the evening, night or early morning. Stay in the shade and rest during the hot part of the day.

b. Head for a coast, a known route of travel, a water source or an inhabited area. Along the coast, sweating can be reduced by wetting clothes in the sea.

c. Follow the easiest available route. In sand dune areas, follow the hard floor valleys between dunes, or travel on dune ridges.

d. Avoid following streams hoping to reach the sea, except in coastal desert areas or those areas with large rivers flowing across them. In most deserts, valleys lead to an enclosed basin or temporary lake.

e. Check maps for accuracy if possible. Maps of desert regions are usually inaccurate.

f. Multiply estimations of distances by three since the absence of features makes an under-estimate likely.

g. Avoid travel when visibility is bad. If unavoidable, mark the direction of travel with a deep scratched arrow on the ground, an arrow of stones or anything available.

Shelter from sun and heat and the occasional sandstorm is most important though shelter material will generally be hard to find:

a. Some protection from the sun will be obtained by covering the body with sand. Burrowing in the sand will also reduce water loss. Some desert survivors have reported that the pressure of the sand offers valuable physical relief to tired muscles.

b. A tent fly or other suitable cloth is useful for covering a natural or man-made depression. In rocky desert areas or where desert shrub, thorn shrub or tufted grass hummocks grow, a tent fly or cloth draped over the rocks or shrubs will provide shade.

c. Make use of natural desert features for shade or shelter: a tree, lee of a hill, a rock cairn, or caves. The wall of a dry stream bed may also provide shelter, but after a cloudburst it may suddenly become flooded. Wadi banks along dried river beds, valleys and ravines, are particularly good places to look for caves.

d. Utilize native shelter when practicable.

e. In a sandstorm, if there is no shelter, lie down with your back to the wind, cover your face with a cloth and sleep out the storm. Do not worry about being buried by the sand. Even in sand dune areas it takes years for the sand to cover a dead camel. If possible seek some shelter on the lee side of a hill.

GENERAL NOTES

First Aid

Communications

Fire Making & Fire Hazards

Shelters

Indigenes

Health Notes for Papua New Guinea

Survival Equipment Check List

FIRST AID

INTRODUCTION

The aim of first aid is to render immediate temporary assistance in cases of wounds or accidents, to prevent so far as possible further damage to the injured person through loss of blood, shock or infection of wounds and to relieve pain. It is very important to be gentle in handling the injured and to inspect the injuries before deciding on treatment.

IMPROVISED EQUIPMENT

a. Bandages and dressings can be sterilized by boiling or steaming them in a covered container or by charring (scorching) them.

b. Try to keep all improvised equipment as sterile as possible; extreme heat is the best method of doing this.

c. Stretchers can be improvised from most materials. Always test the stretcher first before laying the injured person on it.

INJURIES

Medical treatment other than the simplest first aid can be dangerous. If the proper treatment is not known, make the person comfortable rather than risk further injury by improper treatment.

Injuries most likely to be encountered include cuts and bruises, fractures, sprains, concussions and burns. In all cases of severe injury, keep the person lying down, with his head turned to one side to prevent choking.

SHOCK

This condition is characterized by paleness, trembling, sweating and thirst and can accompany any injury. The more severe the injury the more likely it is that shock will develop.

If the patient is unconscious lay him flat on his back, and raise his feet unless he has a head injury or his breathing is difficult. Keep him comfortable and warm but avoid overheating him. If the patient is conscious give him warm drinks.

If you are alone and seriously injured, you should lie down in a depression in the ground, behind a tree, or any place sheltered from the wind. If possible, you should lie with your head lower than your feet to increase the flow of blood to the head. You should keep as warm as possible and rest for at least 24 hours.

BLEEDING

Halt bleeding as soon as possible by one of the following methods:

a. Place a sterile first aid dressing directly on the wound and apply hand pressure, or bandage the wound firmly.

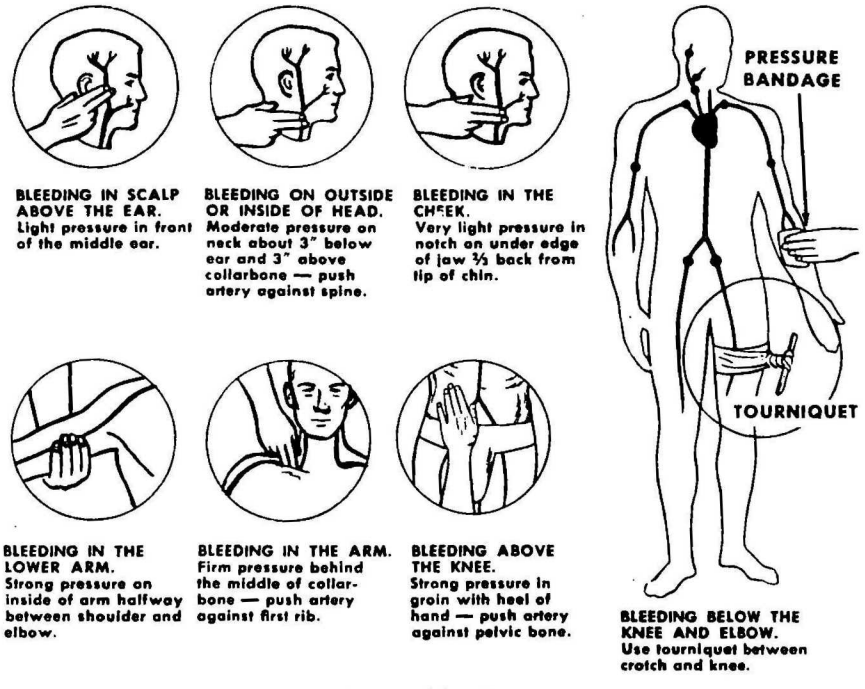
b. If the bleeding is from an arm or leg, apply finger pressure on the appropriate pressure point then elevate the limb. Uncontrolled bleeding necessitates the use of a tourniquet which should be applied between the wound and the heart. In cases where there is a traumatic amputation (loss of an arm, leg, hand, foot, etc) place the tourniquet near the end of the stump. In all other cases where a tourniquet is required to control bleeding, place it above the elbow or knee. Once a tourniquet is applied, do not loosen or release it regardless of how long it has been applied. A tourniquet, once applied, should be removed only by personnel trained and equipped to control the bleeding by other means and able to restore lost blood. Remember that the tourniquet should be regarded only as a last resort in control of bleeding; it should never be used if the bleeding can be adequately controlled by pressure and elevation.

FRACTURES

a. Handle persons with fractures carefully to avoid causing additional injury.

b. If the fracture is accompanied by a wound, gently remove the clothing by tearing or cutting and treat the wound before splinting it.

c. Splint the patient before moving him. Improvise splints from branches, a tight roll of clothing, or pieces of equipment. Pad the splint and place it so that it supports the joints above and below the fracture. Immobilize a fractured leg by tying it to the unbroken leg, if no other suitable materials are available.



BLEEDING IN SCALP ABOVE THE EAR.
Light pressure in front of the middle ear.

BLEEDING ON OUTSIDE OR INSIDE OF HEAD.
Moderate pressure on neck about 3" below ear and 3" above collarbone — push artery against spine.

BLEEDING IN THE CHEEK.
Very light pressure in notch on under edge of jaw ⅓ back from tip of chin.

BLEEDING IN THE LOWER ARM.
Strong pressure on inside of arm halfway between shoulder and elbow.

BLEEDING IN THE ARM.
Firm pressure behind the middle of collarbone — push artery against first rib.

BLEEDING ABOVE THE KNEE.
Strong pressure in groin with heel of hand — push artery against pelvic bone.

BLEEDING BELOW THE KNEE AND ELBOW.
Use tourniquet between crotch and knee.

How to stop bleeding

SPRAINS

a. Bandage and rest the sprained limb.

b. Apply cold applications for the first 24 hours after injury, then apply heat if it is available and considered necessary.

c. If it is necessary to use the sprained limb, splint the injured area as much as possible. Sprained limbs can be used to the limit that pain will allow.

CONCUSSION

a. Skull fractures or other head injuries are likely if there is unconsciousness accompanied by the escape of thin watery blood or blood tinged water from the nose or ears, convulsion, or unequal or unresponsive pupils of the eyes. These signs are frequently accompanied by headache and vomiting.

b. Keep the patient warm and dry but handle him gently.

c. Such cases should be carried on their side because in their unconscious state there is a danger of the tongue falling back in the throat, or blood and saliva running back into the throat causing suffocation.

CHEST WOUNDS

One of the greatest dangers when there is a penetrating wound of the chest wall is that air is sucked inside the chest through the wound at each breath causing collapse of the lung. These sucking chest wounds must be promptly dressed and a large firm dressing applied to prevent air entering the chest through the wound; if adhesive strapping is available it should be applied over the dressing. It is more important to dress these wounds speedily than to wait for sterile dressings should these not be readily available.

ABDOMINAL WOUNDS

These must always be regarded seriously because of the danger of damage to the internal organs and of internal haemorrhage. Even if it appears that the wound has not penetrated right through the abdominal wall, this must never be taken for granted and all abdominal wounds

should be treated as penetrating ones. Neither solid nor liquid foods may be given by mouth; if there is thirst, the most than can be done to relieve it is to moisten the lips and tongue with a damp sponge or cloth.

SUNBURN

This will probably be the commonest burn injury likely to be encountered. Protect from further exposure, and cover the sunburned area with ointment or a substitute such as coconut oil.

Do not touch sunburned areas. Apply the ointment and cover the burn with a dressing. Do not remove the bandage except as an emergency. Give the patient large amounts of fluid and keep the burned area at rest.

The prevention of sunburn in the tropics is much easier than its treatment. Many people become severely burned because they fail to realize that the effects of sunburn are not felt until it is too late, i.e., when the skin begins to turn pink or to feel hot. When hazy or overcast the danger of sunburn is increased because it is less noticeable. Keep out of the sun as much as possible and allow your skin to tan slowly; after acquiring a tan the dangers of sunburn are somewhat reduced.

ORDINARY BURNS

Burns cause severe pain which often results in shock and infection, offering an avenue for the loss of considerable body fluid and salts. The initial treatment is directed toward the relief of pain and prevention of infection. In survival the closed method of treatment has certain advantages: covering of the wound with a clean dressing of any type reduces the pain and risk of infection. Further, such protection enhances mobility and performance of vital survival functions.

Maintenance of body fluids and salts is essential to recovery from burns. The only way to administer fluids in survival is by mouth; a sufficient water intake in the early period following the burn damage and before nausea and vomiting starts is therefore useful. Do not touch the burned part with the fingers, and do not attempt to remove the adherent clothing but cover the area with any clean soft material available.

Burns of the face and hands should be kept moist with dressings soaked in a solution containing one teaspoonful of salt to a pint of water. Never use oil or grease on burns or scalds. Apply a thick gauze pack and bandage firmly; don't change the bandage. If the pain is severe, give

the patient a morphine injection if available. Keep the burned part at rest; splints may sometimes be used to advantage to immobilize the burnt area. If necessary, to open blisters use a sterilized needle to pierce through the skin at the base of blister and apply a sterile bandage after drainage.

BLISTERS

Blisters are dangerous because they may cause infections. If boots fit well and are dried after crossing wet ground, and socks are changed frequently and feet exercised, not much trouble with blisters should be experienced. Should a blister develop, however, pierce the thick skin at its base with a sterilized needle or knife blade; the point of the needle or knife may be quickly sterilized by holding it in a flame for a few seconds. Press and drain the blister, then apply a clean bandage to prevent the dead skin from being rubbed off before it heals.

PRICKLY HEAT

This unpleasant condition is characterized by an itchy and irritating skin rash which may appear anywhere on the body; it is often evident on the shoulders and in the natural folds of the skin and other areas of pressure. The exact cause, apart from heat, is in doubt but it is believed to be due partly to the removal of the natural fat of the skin by excessive sweating and the over use of soap while washing and bathing. It may be relieved by washing without soap, then thoroughly drying the body, and allowing maximum air circulation around the affected parts.

EYE INJURIES

Clean the wound and the eye by irrigating with purified water. Cover the eye with a clean dressing and, if necessary, take aspirin to relieve pain.

To remove a foreign body in the eye, first irrigate with purified water. A simple but frequently effective method is to pull the upper eyelid over the bottom eyelid, then to blow the nose firmly, simultaneously releasing the upper eyelid. If this is unsuccessful, wind some sterile cotton on a match stick to make an applicator, moisten with water and attempt to dislodge the foreign body by several gentle wipes over the affected areas.

HEAT EXHAUSTION

Heat exhaustion can occur in climates where the temperature rises above 85°F. Above this temperature the body loses heat by sweating and, if the sweating mechanism is seriously impaired, a man will become debilitated or perhaps die from the effects of heat.

The effects of heat are both general and local and for ease of description are usually divided into two types: acute and chronic. This division is not rigid and variations of the following descriptions may occur:

a. Acute effects of heat (popularly known as sunstroke or heat stroke) occurring in persons exposed to or carrying out vigorous physical activity in very high temperatures, can be a serious threat to life. It is not necessary to be exposed to the sun; for example, the condition occurs in the stoke-holds of ships. It is due to failure of sweating and a break-down of the heat regulating mechanism. The onset is sudden, the temperature rises above 105°F, the skin flushes hot and dry, and delirium progressing to unconsciousness occurs unless treatment is rendered promptly. Convulsions may occur; sweating sometimes slows or stops in advance and may serve as a warning. Other warning signs are weakness, headache, dizziness, loss of appetite, nausea and vomiting.

b. Chronic effects of heat, heat exhaustion or heat prostration, are generally of gradual onset and result from excessive loss of water and salt from the body. The earlier signs are lassitude, apathy, muscular cramps and weakness, headache, giddiness and a tendency to faint; nausea and vomiting generally develop later. As the condition becomes more marked, collapse occurs with sunken face, pallor, cold clammy skin, feeble pulse, confused mental state with later stupor and coma. The first sign, however, may be a sudden collapse with the patient in the condition just described.

If heatstroke or heat exhaustion are suspected:

a. Move to the coolest spot available.

b. Loosen equipment and clothing.

c. If skin is dry, burning or hot, sponge frequently with cool water, and fan to help the cooling process.

d. Drink cool, slightly salted water.

SNAKE BITE

Though the danger from snake bite is considerable it is not as great as commonly believed and even untreated bites are not always fatal. Death from a snake bite may be caused either by the venom or from shock and fear. Treatment should be carried out calmly and swiftly.

The aim of treatment should be to:

a. Decrease the absorption of venom by:

1. Applying a ligature.

2. Cooling the area of the bite.

b. Reduce the blood circulation rate by:

1. Reassuring the patient.

2. Keeping the patient at rest.

3. Immobilizing the bitten part.

The following action should be taken:

a. Reassure the individual. Complete recovery from snake bite is the rule.

b. Keep the individual at rest.

c. Apply a lightly constricting ligature (handkerchief, belt, piece of cloth) to the arm or leg between the bite and the heart. The ligature must be tightened until the veins stand out, but not to stop the pulse at wrist or ankle. It should be released for one minute every 30 minutes.

d. Wash the area of the bite with plain water without rubbing.

e. Immobilize the bitten part by applying a splint as for a fracture and keep it hanging down below the level of the heart if possible.

f. Give mouth-to-mouth or mouth-to-nose artifical respiration if breathing stops.

g. Treat the patient if he is suffering from shock.

h. If available, give aspirin, one or two tablets, for pain.

i. Identify the snake if possible; kill it if necessary.

j. Get the patient to a doctor as quickly as possible.

Do not:

a. Use potassium permanganate (Condy's Crystals).

b. Cauterize the bite.

c. Cut the bite to promote bleeding.

RESUSCITATION

CESSATION OF BREATHING

The best form of artifical respiration is mouth-to-mouth resuscitation. This is the only technique which guarantees enough air exchange to revive the unconscious person, because it allows the operator to ensure that the patient's airway is unobstructed. If an obstruction is present, air cannot enter the lungs regardless of the method or type of artificial respiration used. There are three main causes of obstruction:

a. Liquid, false teeth or other foreign matter in the mouth or throat.

b. Relaxation of the jaw. The tongue is attached to the jaw so that it falls backward and blocks the throat (called "swallowing the tongue").

c. Position of the neck. When the neck is bent forward so that the chin is near the chest, the throat becomes kinked and blocks the passage of air.

To correct any of the above conditions, place the patient on his back, face upwards, and hold the lower jaw forward.

PROCEDURE

a. Turn the patient on his back.

b. Clean his mouth, nose and throat, removing any false teeth. If the mouth, nose and throat appear clean, start the exhaled-air artificial respiration immediately. If foreign matter such as vomit or mucus is visible in the mouth, nose and throat, wipe it away quickly with a cloth or by passing the index and middle fingers through the throat in a sweeping motion.

c. Place the patient's head in a "Sword swallowing position"; the head must be placed as far back as possible so that the front of the neck is stretched.

d. Hold the lower jaw up, approach the patient's head preferably from his left side. The operator then inserts the thumb of his left hand between the patient's teeth at the midline. Pull the lower jaw forcefully outward so that the lower teeth are further forward than the upper teeth. Hold the jaw in this position as long as the patient is unconscious. A piece of cloth may be wrapped around the thumb to prevent injury to the patient's teeth or to the operator's thumb.

e. Close the patient's nose by compressing it between the thumb and forefinger of the right hand.

f. The operator then blows air into the patient's open mouth with airtight contact between mouths. Blow rapidly and forcefully until the chest rises.

g. When the chest rises, allow the patient to exhale by himself.

If the chest does not rise when air is blown into it, improve the support of the patient's air passage-way, and blow more forcefully.

Repeat the inflations of the lungs to a rate of 12 to 20 times a minute. The operator will need to breath slightly faster and more deeply than usual in order to get enough air himself, though this is of no great

moment. Continue rhythmically without interruption until the patient starts breathing, or is obviously dead. A smooth rhythm is desirable, but split second timing is not essential.

SPECIAL CONSIDERATIONS

If the patient begins breathing, keep his air passage-way open by maintaining the support of his lower jaw until he wakes up. If his tongue or fingernails are blue rather than pink, he is not breathing adequately and requires assistance.

Although the patient, because of movement of his chest and abdomen, may appear to be breathing, air may not be reaching his lungs due to complete obstruction of the air passage-way from improper positioning of the head and jaw. For this reason, it is most important to determine whether or not there is any movement of air in and out of the mouth and nose by listening closely.

REPTILE, ANIMAL AND INSECT HAZARDS

This section is concerned with the first aid treatment for the bites, stings and itches of reptiles, animals and insects.

REPTILES

Crocodiles. The treatment for crocodile bite will be self evident and depends on the severity of bite and degree of shock.

Snakes. See previous sections.

Lizards. Treat as for snake bite even though most lizards are not poisonous.

ANIMALS

Animals and Their Young. Some animals become very savage when guarding their young. Avoid encounters with such animals as far as possible. If bitten and the bite is not serious, treat as a simple wound. If severely bitten, treat the wound appropriately and also treat for shock.

INSECTS

Flies. The protection used against mosquitoes is generally effective for flies. Some flies can inflict bites; however, the danger of infection lies in scratching the bite.

Fleas. Protection against fleas is obtained by using repellent powder and ensuring that the boots are tied properly and the trousers tucked in.

Lice. To delouse clothes the following methods if available are generally effective:

a. Boil the clothing to remove lice.

b. Expose the clothes to direct sunlight for some hours to remove them.

c. Have a good scrub with soap and water, otherwise a good rub down with water and sand.

Spiders. A spider bite, while not generally fatal, may cause pain and swelling. The best treatment is cold compresses or mud.

Scorpions. These bites are seldom fatal, but can cause severe pain and swelling. Treat in the same way as spider bites.

Centipedes. They seldom bite; if they do, treat as for spiders.

Caterpillars. They sometimes cause severe itching and inflammation if brushed against; treat as for spiders.

Bees, Wasps and Hornets. The stings of an aroused swarm of bees, wasps or hornets may be dangerous and possibly fatal. Some possible preventative treatment methods are:

a. Run through underbrush or undergrowth, the twigs springing back will beat off the insects; however, be careful of the eyes as they could be injured in the undergrowth.

b. If stung, carefully scrape off the stings with a knife blade.

c. An ordinary mud compress may relieve the pain.

Ants. Some tropical ants sting severely; treat the sting as for spiders.

COMMUNICATIONS

Unless you do something to attract attention you present a very poor target for search parties.

Some methods to be more conspicuous are:-

a. Fires.

b. Flares.

c. Mirrors.

d. Signal panels.

e. Ground excavation in sandy country.

SEARCHES - VISUAL SIGNALLING METHODS

Three fires arranged in a triangle, with 100 yd sides if possible, is regarded as a universal distress signal. Fires should produce a conspicuous smoke during day. This can be achieved by having a well burning fire and, when search aircraft are thought to be in the area, placing quantities of wet leaves or grass on the fire. By night, however, when smoke is not a requisite, good quick-burning light materials will provide a fire which is visible over a long distance. Vehicle petrol and oil could be used to advantage if they were salvaged.

Hand-held flares, if available, are ideal for quick action. These should be used only when aircraft and/or land vehicles are in the vicinity. Remember that aircraft crews' vision is limited to about 60 degrees either side of their headings.

Mirrors reflecting sunlight are good signalling aids for use during good weather. They can be visible up to 15-20 miles in clear conditions. An improvised mirror can be made from a ration can lid.

Signal panels of light material can be folded to form symbols of the ground/air visual code. By this means, limited communication can be carried out with an aircraft.

In sandy soils where no other signalling method exists patterns can be excavated in the sand to form a means of communication. Such patterns should be dug to provide the maximum shadow effect throughout the day.

GROUND-AIR VISUAL CODE FOR USE BY SURVIVORS

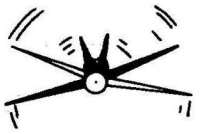
NO.	MESSAGE	CODE SYMBOL	NO	MESSAGE	CODE SYMBOL	NO	MESSAGE	CODE SYMBOL
1	Require Doctor, serious injuries	I	7	Require signal lamp with battery and radio	⁞	13	Require fuel and oil	L
2	Require medical supplies	II	8	Indicate direction to proceed	K	14	All well	LL
3	Unable to proceed	X	9	Am proceeding in this direction	↑	15	No	N
4	Require food and water	F	10	Will attempt take-off	I⟩	16	Yes	Y
5	Require firearms and ammunition	⩔	11	Aircraft seriously damaged	⌐	17	Not understood	JL
6	Require map and compass	□	12	Probably safe to land here	⏢	18	Require mechanic	W
If in doubt use International symbol		SOS						

GROUND-AIR VISUAL CODE FOR USE BY GROUND SEARCH PARTIES

NO	MESSAGE	CODE SYMBOL
1	Operation completed	L L L
2	We have found all personnel	L L
3	We have found only some personnel	++
4	We are not able to continue. Returning to base	X X
5	Have divided into two groups, each proceeding in direction indicated.	↗ ↘
6	Information received that aircraft is in this direction	→ →
7	Nothing found. Will continue search.	N N

STANDARD AIRCRAFT ACKNOWLEDGEMENTS

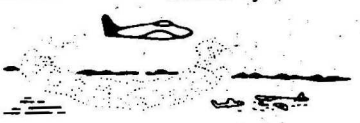
MESSAGE RECEIVED AND UNDERSTOOD:
Aircraft will indicate that ground signals have been seen and understood by



DAY OR MOONLIGHT:
Rocking from side to side

NIGHT: Making green flashes with signal lamp

MESSAGE RECEIVED AND NOT UNDERSTOOD:
Aircraft will indicate that ground signals have been seen but not understood by



DAY OR MOONLIGHT:
Making a complete right hand circle

NIGHT: Making red flashes with signal lamp

In areas such as Papua-New Guinea, set up fires and other signals in natural clearings and along edges of streams. Signals under dense jungle canopies will not be seen.

If your radio is serviceable you will obviously use it to the best advantage. If the transmitter only is serviceable (even doubtfully so) you should still send out as much information as possible regarding your position, requirements and intention.

LIGHTING A FIRE

With matches it should be possible to start a fire under most conditions of weather. It is a wise measure when operating in remote areas to carry a supply of matches in a waterproof case. Learn to shield a match flame for some time in a fairly strong wind.

FIRE WITHOUT MATCHES

Preparation. Prepare some extremely dry tinder before attempting to start a fire without matches. Once prepared, shelter this tinder from the wind and damp. Some excellent tinders are punk, lint from cloth, rope or twine, dead palm frond, finely shredded dry bark, dry powdered wood, bird nests, woolly materials from plants, and wood dust produced by insects and often found under the bark of dead trees. If some tinder is needed for future use, store it in a waterproof container, if possible.

Sun and Glass. A camera lens, a convex lens from binoculars, or the lens from a telescopic sight or flashlight may be used to concentrate the rays of the sun onto the tinder.

Flint and Steel. If available, this is the best method after matches to start tinder burning. Use the flint fastened to the bottom of a waterproof match case if one is available; a hard piece of stone will serve as a substitute. Hold the flint as near to the tinder as possible and strike it with a knife blade or other small piece of steel. Strike downward so that the sparks will hit in the centre of the tinder. When the tinder begins to smoulder, fan or blow it gently into a flame. Gradually add fuel to the tinder or transfer the burning tinder to a fuel pile. If a rock fails to produce a spark, discard it and try another.

Wood Friction. Since friction is a hard way of starting a fire, use it only as a last resort:

-90-

a. Bow and Drill. Make a strong bow strung loosely with a shoe-lace, string or thong. Use it to spin a dry, soft shaft in a small block of hard wood. This forms a black powdered dust which eventually catches a spark; when the smoke begins to rise, there should be enough spark to start a fire; then lift the block and add the tinder.

b. Fire Thong. Use a strip of dry rattan, preferably about a quarter inch in diameter and about two feet long, and a dry stick. Prop this stick off the ground by using a block. Split the end of the stick that is off the ground and hold it open with a small wedge. Place a small wad of tinder in the split, leaving enough room to insert the thong behind it. Secure the stick with one foot and work the thong back and forth.

c. Bamboo Fire Thong. With this method a spark can usually be produced in less than three minutes. Take one half of a piece of dry bamboo, that has been split down the centre from end to end, and a length of dry rattan. The bamboo half must have a conical hole drilled through it from the inside, the apex just breaking through on the outside. Around the outside, a shallow groove is cut to act as a guide in drawing the rattan over the hole. The bamboo is wedged firmly, the rattan is arranged in the groove and then pulled back and forth across the hole. It wears away the bamboo, and the dust produced is forced through to the inside of the hole, forming a pad. This becomes very hot and eventually a spark is produced.

d. Fire Saw. The fire saw consists of two pieces of wood which are sawed vigorously against each other. This method of starting fires is commonly used in the jungle. Use split bamboo or other soft wood as a rub stick and the dry sheath of the coconut flower as the wood base. A good tinder is the fluffy brown covering of the palm and the dry material found at the base of the coconut leaves.

FIRE HAZARDS

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Likely hazards, in some of our areas of operation, are bushfires. If 'cornered' in a bushfire situation your survival depends mainly on gaining protection from radiated heat waves.

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Like light, heat waves travel in straight lines and are greatly impeded by opaque materials such as clothing, wood, earth, stones and metal. Therefore, if you have no escape route, use every means to shelter yourself. Take refuge in hollows (pull earth over yourself or wrap yourself in a blanket). Running streams, ponds, and even gouged out holes in dry stream beds are obvious places of refuge. People have survived bushfires by remaining in their vehicles although possible petrol ignition was a risk to face.

Forebear to enter flames that are more than about five feet high or that are tending to "crown out" (enter the tree tops) or that are more than about 30 feet deep, or when the undergrowth is very dense (most fatilities have occurred when persons have tried to essay such severe flame fronts).

Understand what is meant by a "back-burn". Light a back-burn say 20 feet long if trapped by a high wall of deep flames; move into the burnt area.

Above all, plan ahead. Do not leave your survival activities until the fire is almost upon you.

SHELTERS

INTRODUCTION

The ability to provide shelter will greatly improve survival prospects because adequate rest and sleep are as necessary as food and water. Careful attention should be paid to the selection of camp sites and to making oneself as comfortable as possible during halts. Such care will go a long way towards reducing physical hardship.

In this regard a camp site should always be looked for at least two hours before first or last light; in selecting the site try to select one which provides:

a. Protection from natural hazards, such as floods, rock falls and cold.

b. Drinking water and food.

c. Material for making shelters and beds.

d. Some freedom from insect pests.

Full use must be made of natural shelter and wind breaks; added comfort and rest can be obtained by using bushcraft and ingenuity in making a bed from bamboo or saplings, foliage and vines. Raising the body from the ground will provide some relief from ground insects and leeches. Shelters constructed of saplings and palms are easily devised and should help to ensure adequate sleep.

DESERT SHELTERS

In the desert the principal need is to obtain shelter from the sun and heat; make use of whatever natural shade is available, such as a cave, rock ledge or the wall of a dry stream bed. A dry river bed in the desert may prove a dangerous camping ground, however, because of sudden cloud-bursts and subsequent flooding.

TROPIC SHELTERS

Site camps on knolls or high ground in areas well away from swamps. The ground will be drier, mosquitoes fewer and the benefit of any breeze will be obtained. Avoid building a shelter under very large trees or trees with dead limbs; these may fall, possibly wrecking the camp and causing injuries. Never build a shelter or sleep under a coconut tree; a falling coconut can kill you.

In mountainous areas, nights are cold. Try to keep out of the wind. If possible make a fire against a log or a rock pile, arranging the fire and shelter in such a way that the fire reflects heat but does not blow back into the shelter.

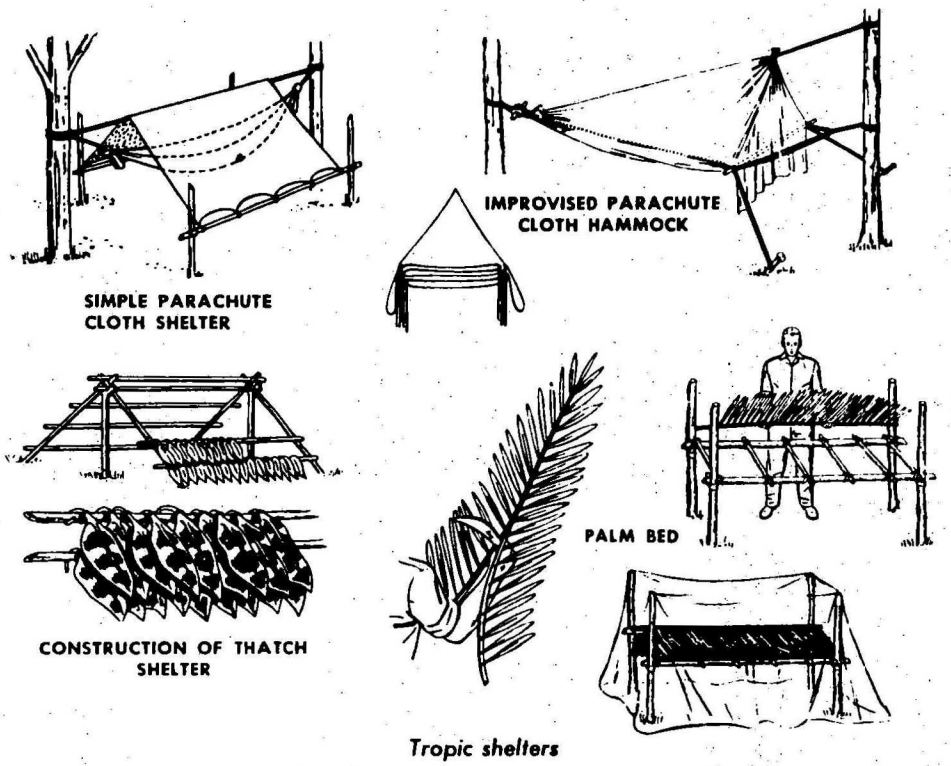
TYPES OF SHELTERS

The shelter most easily improvised is one made of a piece of plastic or similar material. This is draped over a piece of rope, vine or stick between two trees. The ends are either tied together or propped up by sticks.

Lean-to Shelter. A pole is set between two trees or between two forked sticks set in the ground, poles are then set at an angle to the ground. Bark or large leaves are placed on these poles and secured by using small twigs, young vines, etc. Be sure not to build this lean-to facing the prevailing wind and rain.

A-frame Shelter. A good rain shelter can be made by covering an A-frame with a good thickness of palm leaves or other broad leaves, pieces of bark or layers of grass. Lay the thatch shingle fashion with the tips of the leaves pointing downwards, starting from the bottom and working up so that the rain will run off.

Dig a small drainage ditch just inside the eaves of the shelter and leading down hill; this will help to keep the floor dry.



Tropic shelters

INDIGENES

CONTACT WITH INDIGENES

Indigenes, especially aborigines, may often be willing to supply food because their code of conduct nearly always includes provision for hospitality to strangers.

They are, however, very easily offended. Some for instance, dislike touching dogs and being touched by others who have had physical contact with these animals. They would be offended by someone who first pats a dog and then offers to shake hands.

Women occupy an inferior position in many indigenous societies; to show politeness European fashion to a woman before her husband would not only give offence but might even be interpreted as an attempt to win her favours.

Children are doted on; winning their affection is often the surest way of gaining the friendliness of the fathers. Care should be taken, however, because of the occasional belief in the "evil eye" which may be encountered.

GENERAL RULES

When shelter or hospitality is extended by indigenes, observe the following rules of behaviour:

a. Deal with the chief or headman; always ask politely, never demand.

b. Take plenty of time when approaching them or their village.

c. Show friendliness, courtesy and patience. Avoid displaying fear which tends to make them hostile.

d. Do not threaten or display weapons.

e. Make gifts of small personel belongings and trinkets.

f. Make use of the sign language; state your business briefly and frankly.

g. Subject to any known differences in custom, treat indigenes as equals.

h. Endeavour to pay with tobacco, salt, razor blades, matches, cloth, empty containers, etc, for whatever is received.

i. If a promise is made, be sure to keep it.

j. Respect local customs and manners. Learn their laws and abide by them.

k. Respect their privacy; do not enter their homes unless invited to do so.

l. Entertain them if possible and be a good audience.

m. Leave the women alone; have contact with them only when on business and always in the presence of the chief or their husbands.

n. Take practical jokes in good part.

o. Avoid all leading questions by answering "yes" or "no".

p. Try to pick up their language; they will appreciate efforts to make use of some of their words.

q. Learn their woodcraft and the sources from which they obtain food and drink.

r. When living among indigenes try to avoid close personal contact with them as much as possible; make your own shelter, and produce and cook your own food and drink.

s. Be friendly, firm, patient and above all, honest.

t. When departing be sure to leave a good impression.

HEALTH NOTES FOR PERSONNEL VISITING PAPUA NEW GUINEA

Personnel proceeding to Papua New Guinea will encounter new hazards which threaten health; appropriate changes in the way of life have to be made to meet these threats. If such changes are made, and there are not many of them, it is possible to live a healthy life in that country.

ACCLIMATIZATION

Some discomfort may be experienced at first as the climate in PNG is warm and humid particularly on the coastal areas. One's body quickly adapts to the change by a process of acclimatization and this can be accelerated by daily exercise to the point of sweating. Some extra salt is required during the early stages and it is best taken as table salt added to food not as salt tablets. It is interesting to note that alcohol reduces the body's ability to deal with heat stress.

MALARIA

Malaria is transmitted by a certain type of mosquito which picks up the infection usually from children in the villages.

Two sorts of malaria are of chief concern to visitors. The first is malignant malaria which is a killer if no appropriate treatment is taken, and the second is benign malaria which, whilst it does not threaten life, can be a nuisance because repeated attacks occur for a number of years unless treated.

The measures available for the prevention of malaria are, firstly, the avoidance of mosquito bites and, secondly, the taking of an effective antimalarial drug.

Thus it is advisable to sleep under a mosquito net, to wear protective clothing at night, i.e. shirt with long sleeves and long trousers, and to avoid villages during the night. There are also mosquito-repellant lotions and creams for use at night. An extension of these methods is to live in mosquito-proof accommodation and the use therein of a knock-down spray to kill any mosquitoes which have been trapped inside. Some or all of these measures could be applied wherever one is in New Guinea.

Personnel proceeding to any part of PNG should take an anti-malarial drug. The drug should be taken two weeks before departure from Australia, throughout the stay in PNG, and for one month after returning to Australia. If this advice is followed there will be no illness due to malaria whilst the drug is being taken. Further, if the drug is continued for a month after returning to Australia it will cure all infections with malignant malaria and this is important because such infections may easily be fatal.

A number of drugs are available for the prevention of malaria but it is suggested that chloroquine be used in doses of two tablets (equals 300 mgs of base) on the same day of every week.

Those who have been infected with benign malaria will probably develop a malaria attack about two months after they stop taking the drug. It is important that anyone returning from PNG who subsequently develops a fever should draw the attention of his doctor to the probability that the illness is due to malaria. In former times these relapses of malaria continued over two or three years but now there is a drug which will eradicate the infections.

Obviously, the more one avoids mosquito bites the less likelihood there is of developing benign malaria after return to Australia.

Anti Malaria Drugs (Tablets)

In Australia these are obtainable only on prescription, or from the Health Department on production of a note from your own Bureau, Division etc.

Malarial Attack

In the case of malarial attack the three-day course of treatment using chloroquine is:

1st day	-	4 tablets followed by a further 2 tablets after 6-8 hours
2nd day	-	2 tablets
3rd day	-	2 tablets

SKIN DISEASE

Health of the skin is related closely to the type of clothing worn in the warm, moise climate of PNG. In such a climate the minimum amount of clothing is the most comfortable. But clothing also serves a protective function against the bites of insects and other damage to the skin. In the towns it is a reasonable proposition to wear shorts, short-sleeved shirts and appropriate footwear. In rural areas more protection is afforded if long trousers are worn. The wearing of shoes will do much to prevent infection with hookworm; thongs should be worn in field shower and washing facilities.

One of the penalties for wearing clothing is prickly heat which especially occurs on areas subject to pressure such as under the belt. It is possible to avoid prickly heat by wearing the minimum amount of clothing appropriate to the situation.

Persons with acne do not fare well in New Guinea and those who already have tinea of the feet (athlete's foot, etc.) may find that the condition worsens.

Infected scratches, cuts, etc., leading to tropical ulcers are one of the commonest problems associated with fieldwork in PNG. Scratches and cuts must be treated promptly using:

a. Methylated spirits; dries the skin and kills germs.

b. Fungicidal or antibiotic dusting powders (e.g. Neosporin).

c. Antiseptic liquids (Dettol, Phyzohex, tincture of iodine, etc.).

d. Antibiotic ointments (e.g. Neosporin).

e. Always cover wound with band-aid.

Some bacterial immunity to antibiotics may result from their indiscriminate application. Use the other methods until the wounds become sore or infected.

Various fungal skin complaints, particularly tineas (athlete's foot, dhobi's itch, grilli) are infectious. They can be treated with ointments and powders. Socks should be of cotton and they should be boiled regularly.

Cleanliness is essential but overwashing may be detrimental. One soap wash a day is usually sufficient.

BOWEL INFECTIONS

A considerable number of diseases are contracted by eating or drinking the excreta of other people who are carriers of these diseases. Whilst this material is not a desired item of the diet it gets there by the soiling of food, by dirty fingers or flies, or by the drinking of contaminated water. These diseases include various diarrhoeas and dysentery, typhoid fever, a number of worm infections, as well as infectious hepatitis and poliomyelitis. Infectious hepatitis is a debilitating disease which can cripple the liver. In general it can be said that the more one eats food prepared by other people the more likely is one to acquire these diseases. It is wise to regard all surface water in PNG as dangerous; boiling makes it safe for drinking.

Vaccines are available against typhoid and poliomyelitis but not against most of the other diseases. Thus it is a matter of exercising as much caution as is possible about what is consumed. However, it is probable that those visitors to PNG who move around in the country for any length of time will experience one or more attacks of diarrhoea. Treatment should be sought promptly for these attacks if they are more than very mild. It would be wise for prospective visitors to be vaccinated against typhoid and poliomyelitis.

Attacks of diarrhoea should be treated immediately using Mexaform, Guanimycin (a mixture of guanidine and streptomycin), or one of a number of other proprietory brand drugs. Preferrably these should include agents to kill the parasite, as well as one to arrest bowel movement.

A number of very dangerous bowel infections are known in PNG (e.g. amoebic dysentry). These and milder disorders can be partially avoided by

a. Not drinking unsterilised surface water.

b. Observing utmost cleanliness in food preparation.

OTHER DISEASES

Scrub Typhus, Dengue Fever

These are sometimes fatal diseases, carried by mites, especially in populated areas.

Prevention is best achieved by avoidance of mite bites.

a. Wear long trousers and shirts.

b. Impregnate clothing with a miticidal agent (dibutyl thallate). This is not the same as aerogard, PB, etc. Clothing treated with dibutyl thallate will remain effective for up to six cold water washes.

Scrub typhus results in the formation of a black scab over the mite bite, followed by fever and a skin rash. It runs one to two weeks and can be fatal. Antibiotic treatment under a doctor's supervision is necessary.

Leptospirosis

This is a bacterial disease carried in the urine of animals. Infection may result from contaminated water entering through broken skin. Symptoms include fever, headache and sometimes jaundice. This is usually a minor ailment but can become debilitating.

STINGING PLANTS

In PNG contact with stinging plants is not uncommon. Severe irritation of the skin can result from injections of oxalic acid crystals. The crystals can be extracted sometimes by dry shaving.

VACCINATIONS

Vaccinations against the following are essential:

a. Typhoid

b. Smallpox

c. Cholera (for western areas)

Advisable:

a. Tetanus (a booster is useful)

b. γ globulin (provides diminishing protection against infective hepatitis for up to 3 months).

It is assumed that childhood vaccination against tuberculosis (B.C.G.) and poliomyelitis has been completed.

MEDICAL ATTENTION IN PNG

This is often expensive. You are advised therefore to take out medical insurance (not benefits). Most insurance companies will give cover against medical expenses over a limited period for quite a low premium.

ACKNOWLEDGEMENTS

The assistance of Professor Robert H. Black (School of Public Health and Tropical Medicine, Sydney) in the compilation of these health notes for personnel visiting PNG, is acknowledged.

SURVIVAL EQUIPMENT CHECK LIST

Water and Food

Compass and protractor

Maps

First-aid kit

Matches (in water-proof container)

Burning lens (Note: some of the small field lenses carried by geologists are not suitable)

Mirror for signalling

Sheet of durable Plastic (about 6 ft x 6 ft)

Plastic tube (about 6 feet)

Machete or clasp-knife

Shade cloth

Head covering

Smoke and star flares if possible

Water sterilizers (e.g. Iodine, Condy's crystals or water sterilization tablets)

Appropriate clothing especially walking boots.

WATER

You cannot hope to walk far carrying a metal jerry-can of water! Therefore, be sure to include a number of light-weight emergency carriers (plastic or polythene one gallon size would do). Your vehicle tyre tubes could also be used in an emergency.

SUPPLEMENT

PLANT LIFE OF AUSTRALIA, PAPUA NEW GUINEA AND S.E. ASIA

INTRODUCTION

This supplement gives details of some 70 of the 120,000 edible plant varieties likely to be found within Australia, Papua New Guinea, and South East Asia. Drawings and text have been reproduced by kind permission of Department of Army.

For ease of reference the plants are classified into the following groups:-

a. Roots, Tubers, Bulbs.

b. Seeds, Grains, Grasses.

c. Shoots, Stems, Leaves, Ferns.

d. Nuts.

e. Fruits.

f. Fungi.

g. Cultivated and Native Vegetables.

h. Palms.

i. Bark.

j. Water Plants.

k. Poisonous Plants.

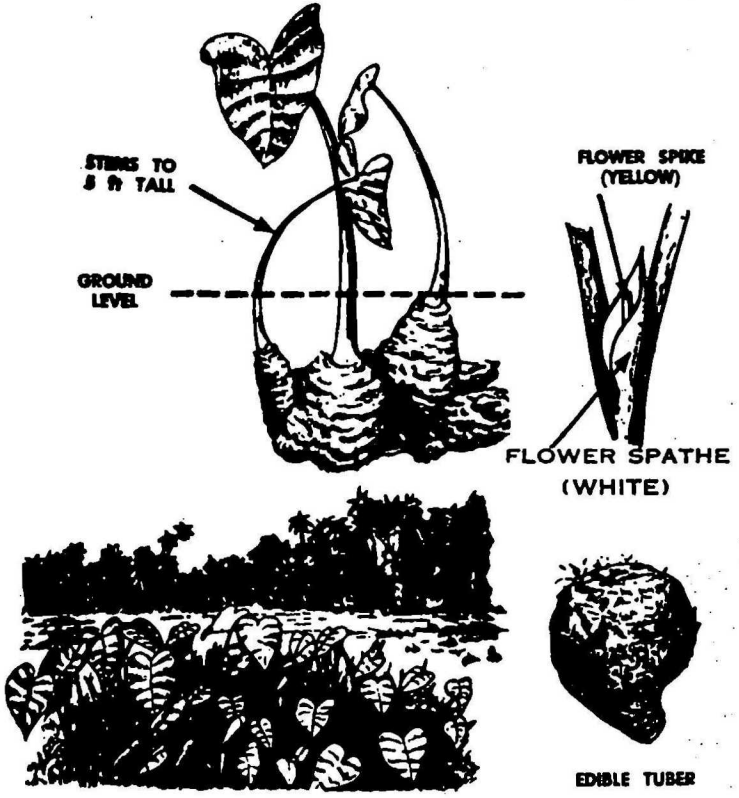
One page is allotted to each plant to allow for personal notes, colouring in, the plant's characteristics, local dialect name and any other information which may be of help in identifying the plant.

ROOTS, TUBERS AND BULBS

The following plants are illustrated: cocoa, yam or taro, sweet potato, wild potato, nut grass, bulrush, ti plant, cattail, tapioca plant, greater yam and wild onion. Many have one or more identifiable parts that have some food value.

Coco Yam or Taro (Colocasia esculenta)

The taro plant is similar to an arum lily, with dark green leaves growing from thick light green stems. The plant may grow to a height of four feet. Taro grows wild in damp places and is also to be found in native cultivations. The underground tubers are prepared like potatoes but must be well cooked and never eaten raw or half cooked. The young leaves should be boiled like spinach.



Sweet Potato (Ipomoea batatas)

Sweet potato is one of the most commonly cultivated plants. Not only can the underground sausage-shaped roots be eaten raw, roasted or boiled, but the young leaves can be boiled like spinach. The sweet potato has a creeping or scrambling stem, rather like a thick strawberry runner; the stems root where the bunches of heart shaped leaves with crinkled edges come off. Occasionally the flowers can be seen; they are pink and trumpet-like, very similar in shape to the flowers of bindweed, *"morning glory"*, or the bellvine of English hedgerows.

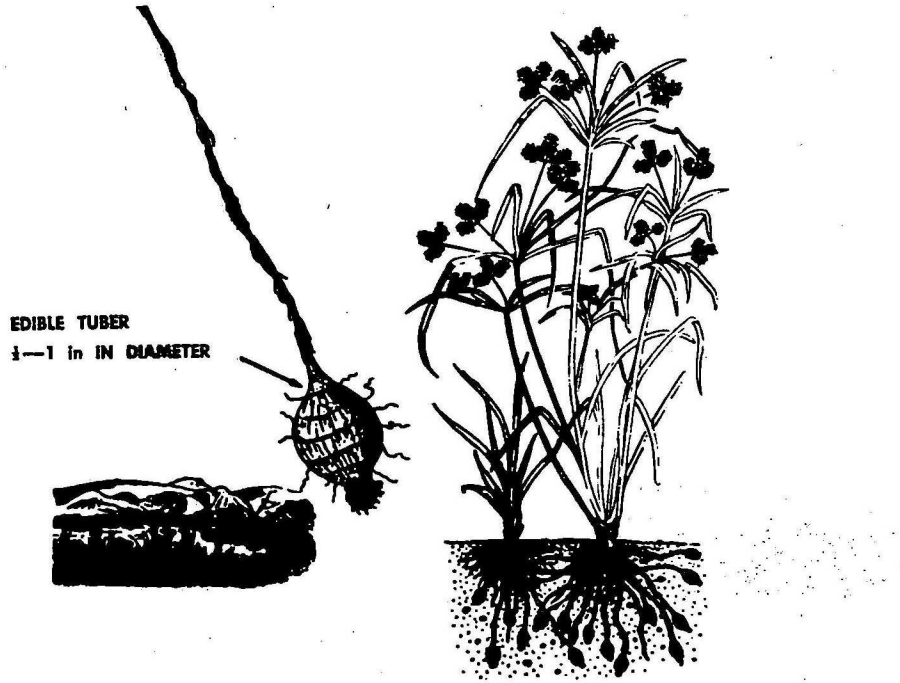
Wild Potato

The plant is small and found throughout the world, especially in the tropics.

Wild Potato

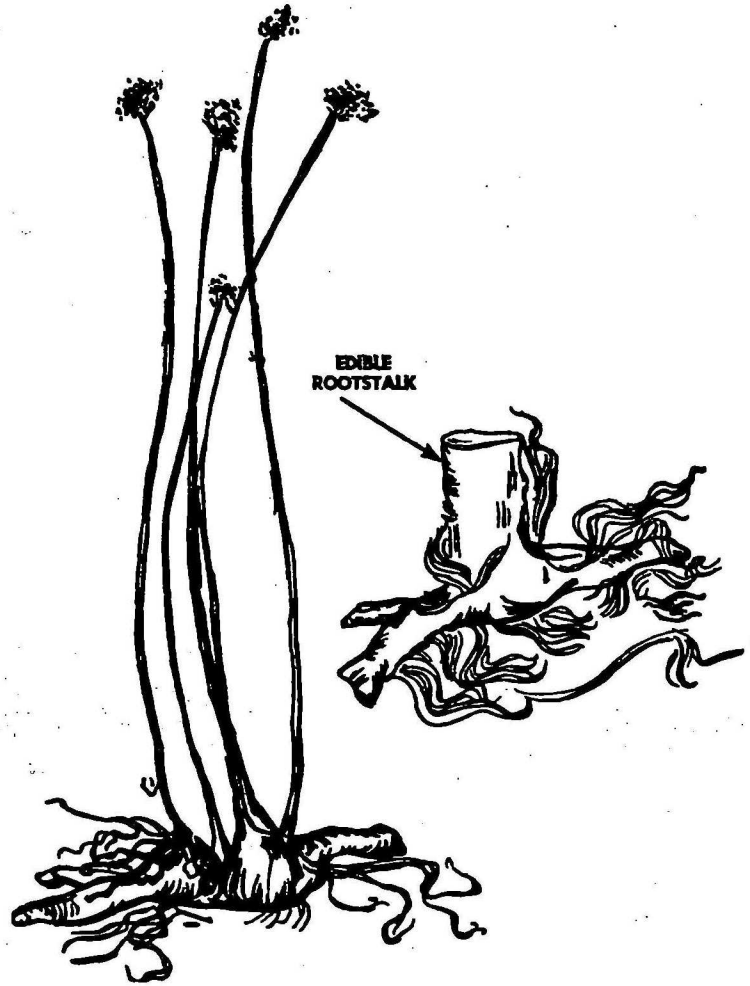
Nut Grass

Nut Grass is widespread in many parts of the world. Look for it in moist sandy places along the margins of streams, ponds, pools and ditches. It occurs in both tropical and in temperate climates. The grass differs from true grass in that it has a three angle stem and thick underground tubers that grow one-half to one inch in diameter. These tubers are sweet and nutty. Boil, peel, and grind them into flour. This flour can also be used as a coffee substitute.



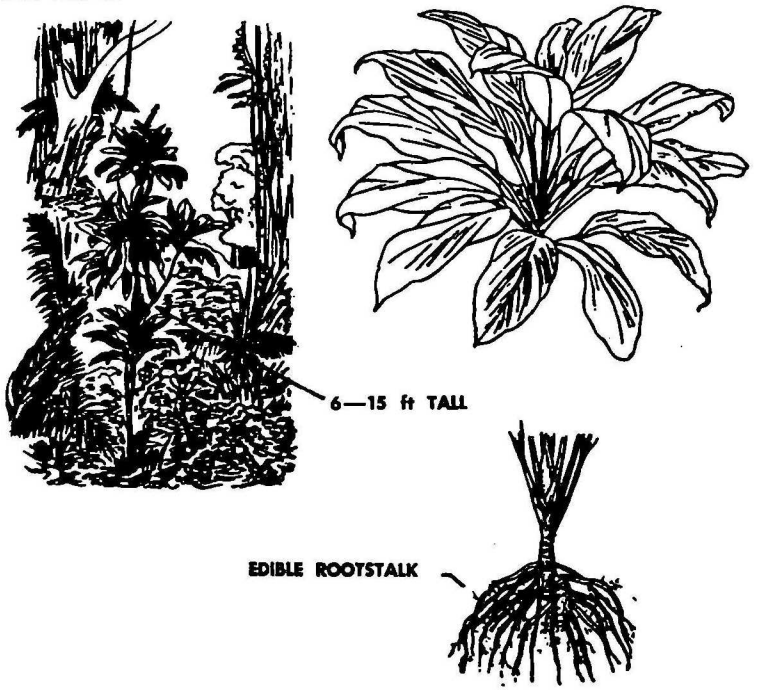
Bulrush

This familiar tall plant is found in North America, Africa, Australia, East Indies, and Malaya. It is usually present in wet swampy areas. The roots and white stem base may be eaten cooked or raw.



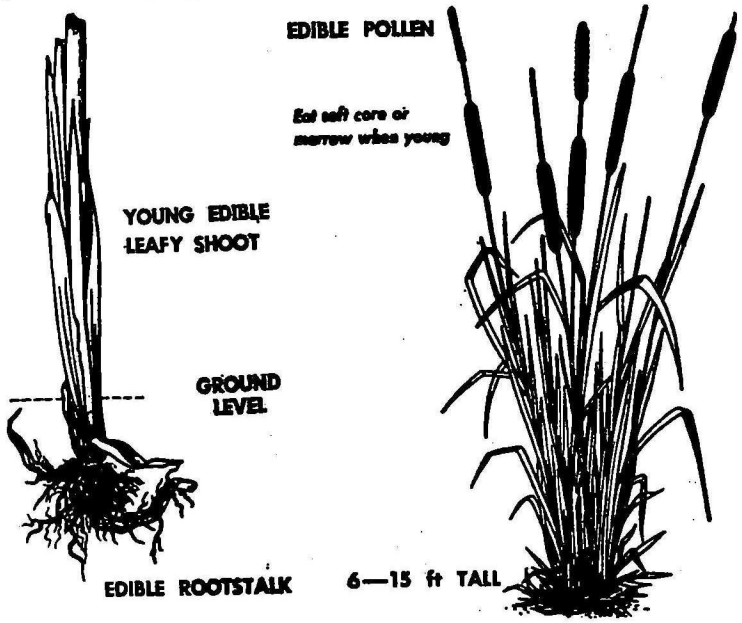
Ti Plant

This plant is found in tropical climates, especially in the islands of the South Pacific. It is cultivated over wide areas of tropical Asia. In both the wild and cultivated state it ranges from six to 15 feet in height. It has large, coarse, shiny, leathery leaves arranged in crowded fashion at the tips of thick stems. The leaves are green and sometimes reddish. This plant grows a large plume-like cluster of flowers that usually droop. It bears berries that are red when ripe. The fleshy root-stalk is edible and full of starch and should be baked for best results.



Cattail

The cattail is found along lakes, ponds, and rivers throughout the world, except in the tundra and forested regions of the far north. It grows to a height of six to 15 feet with erect, still, tape-like, pale green leaves one quarter to one inch broad. Its edible root-stalk grows up to one inch thick and contains about 45 per cent starch and 11 per cent sugar. To prepare these root-stalks, peel off the outer covering and grate the white inner portion. Eat them boiled or raw. The yellow pollen from the flowers can be mixed with water and steamed as bread. In addition, the young growing shoots are excellent when boiled like asparagus.

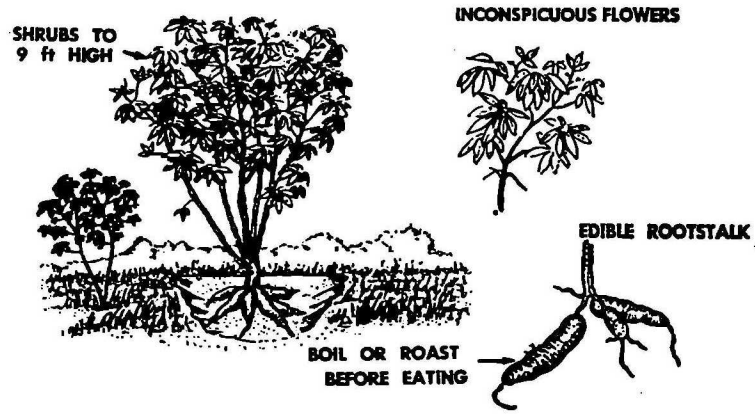


Tapioca or Cassava or Manioc (Manihot esculenta)

The tapioca or manioc plant is found in all tropical climates, especially in the wet areas. It grows to a height of from three to nine feet and has jointed stems and finger-like leaves. There are two kinds of manioc that have edible root-stalks — bitter and sweet.

The bitter manioc is the common variety in many areas and is poisonous unless cooked. Root-stalks of bitter manioc should be ground into a pulp and boiled for at least one hour. Flatten the wet pulp into cakes and bake.

Sweet manioc root-stalks are not bitter and can be roasted as a vegetable, or made into flour. The flour can be used to make dumplings or the cakes described above.

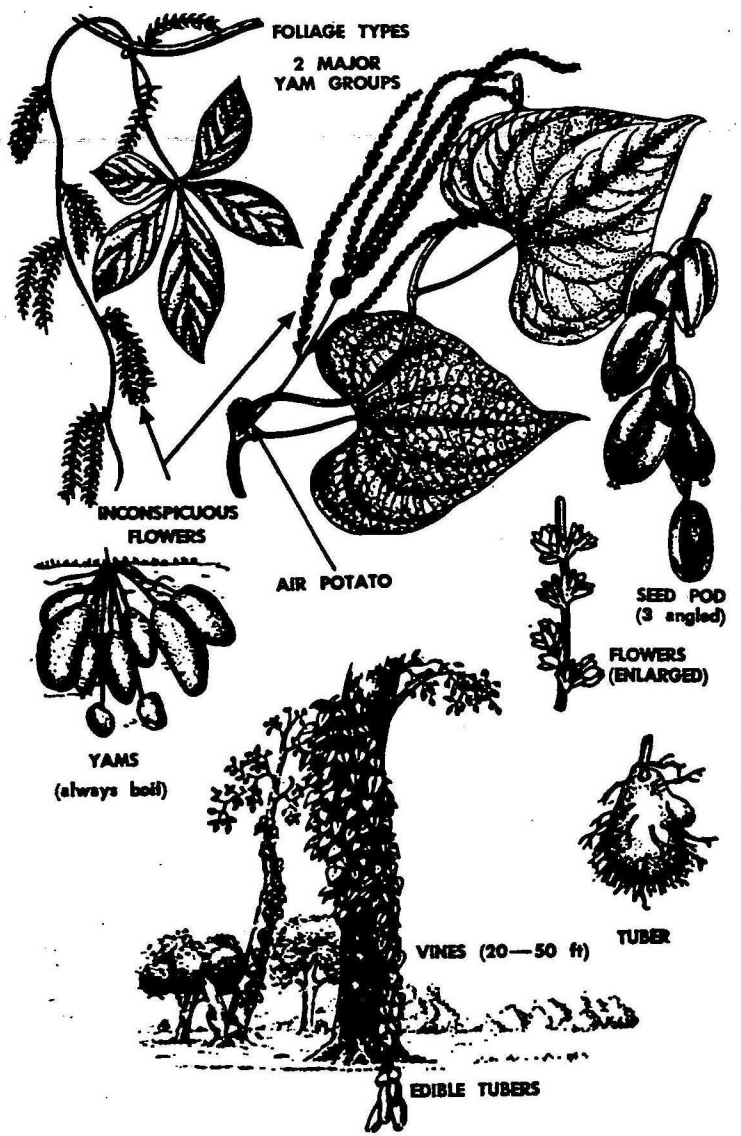


Greater Yam (Dioscorea alata)

Yams are twisting plants distinguished by long ivy-like runners. These runners have a small dark green leaf which is easily recognized as the veins of the leaf radiate from the base instead of branching off along the midrib. The leaves are oval, heart or arrow shaped.

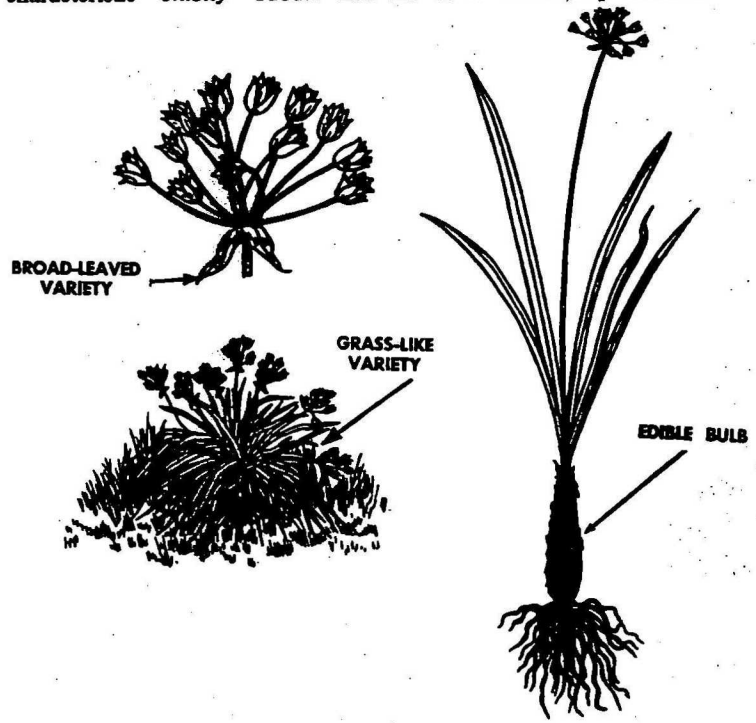
Yams are found by following the vine to the base of the stem and then digging about 12 inches underground. In shape and size they resemble a man's forearm.

Those with acid taste should not be eaten unless the acidity is removed by slicing and washing for several hours in a running stream or through several changes of water. The fibrous types can be grated, and the fibres strained by a coarse mesh. Fibreless types are common, and may be boiled, steamed, roasted or baked. A diseased plant can be distinguished by brown lines running through it when the yam is broken open. These should not be eaten.



Wild Onion

This is a common edible bulb and a close relative to the cultivated onion. It is found throughout the North Temperate zones of North America, Europe, and Asia. The plant grows from a bulb buried three to 10 inches below the ground. The leaves vary from grass-like to several inches wide. The plant grows a flower that may be white, blue, or a shade of red. Any variety of onion can be detected by its characteristic *"oniony"* odour. Eat the bulb. None is poisonous.



SEEDS, GRAINS AND GRASSES

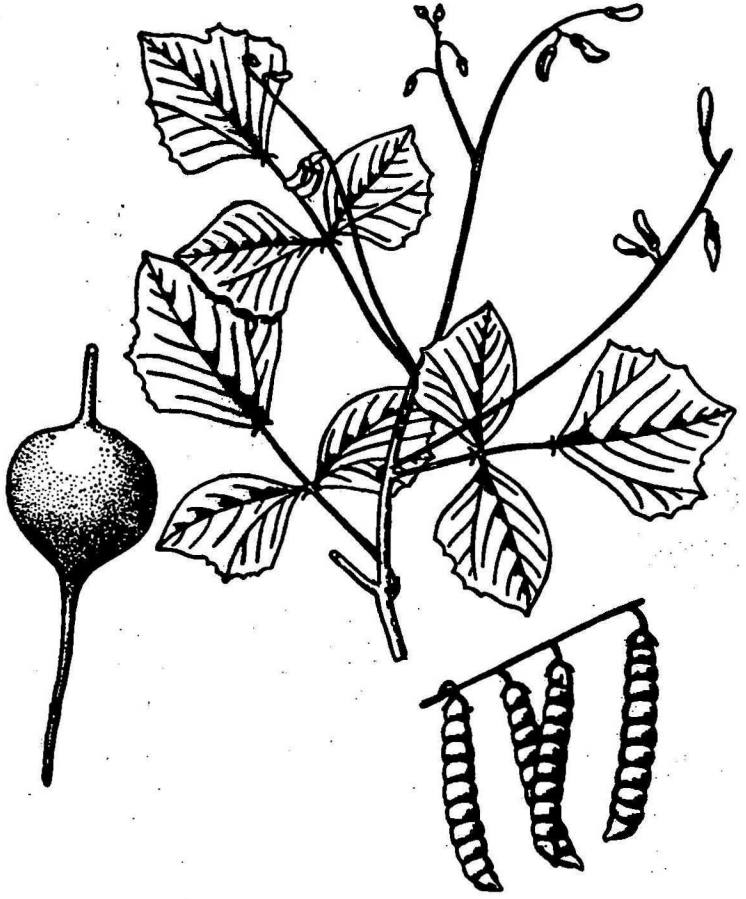
The seeds of many plants such as buckwheat (which is not a grass), and the beans and peas from beanlike plants contain oils rich in protein. The grains of all cereals and many other grasses are also rich in plant protein. The chief grain crops are rice, maize or indian corn, Job's tears, and sorghum. All these plants are grasses related to wheat, oats, etc. Rice, particularly in South East Asia, is generally cultivated in swamps or flooded fields, but sometimes on dry ground. The others are grown in ordinary fields and gardens. No known grass is poisonous, but care is needed to differentiate broad leafed grasses from some poisonous plants.

The seeds may either be ground between stones, mixed with water and cooked to make porridge, or parched. Grains like corn can also be preserved in this manner for future use. Separate any weeds from the grass and discard all grain heads having black spurs in place of normal seed grains.

The following illustrations will help in identifying them.

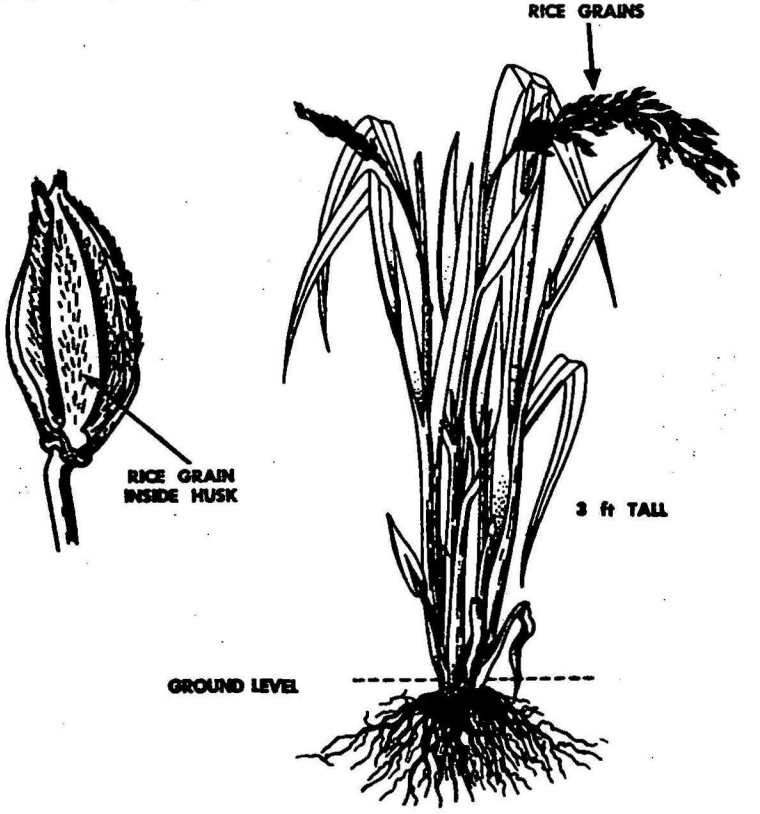
Yam Bean (Pachyrhizus erosus)

This bean is mostly found growing wild in hedgerows and thickets, but is sometimes cultivated. The turnip-shaped root is very good when young and is eaten raw. The young pods can be cooked and eaten like runner beans. The ripe seeds in the brown pods are poisonous and should not be eaten. The yam bean is a climbing plant with leaves like a runner bean and blue bean-like flowers.



Wild Rice (Oryza sativa)

Rice normally grows in wet areas as a cultivated plant. It is found in tropical and warm, temperate countries throughout the world. Wild rice, however, exists in Asia. This is a coarse grass growing to a height of three to four feet with rough, hard leaf blades up to two inches wide. The rice grains grow inside a hairy, straw coloured covering out of which the mature grains shatter when ripe. Roast these rice grains, and beat them into a fine flour, which can be carried as a powder. Combine the flour with palm oil to make cakes. Wrap these in large green leaves and carry them for future use. Rice can also be prepared by boiling.



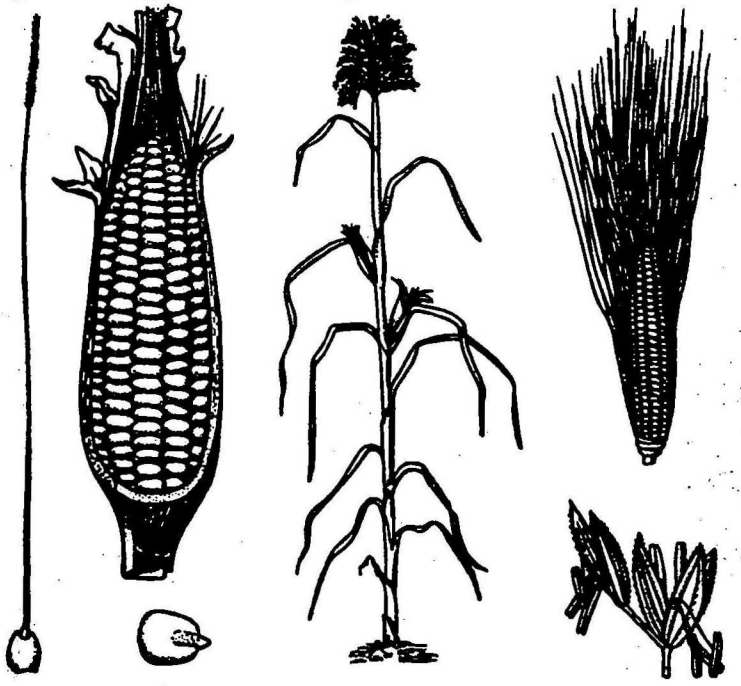
Job's Tears (Colix lachryma-jobi)

Job's tears may be found wild in open places and also in cultivated plots near villages, but never in forests. The seeds can be eaten boiled or roasted. Job's tears is a typical grass, with long tapering leaves, and reaches a height of two to three feet. The white shining *"fruits"* contain one or more seeds.

Job's Tears

Maize (Zea Mais)

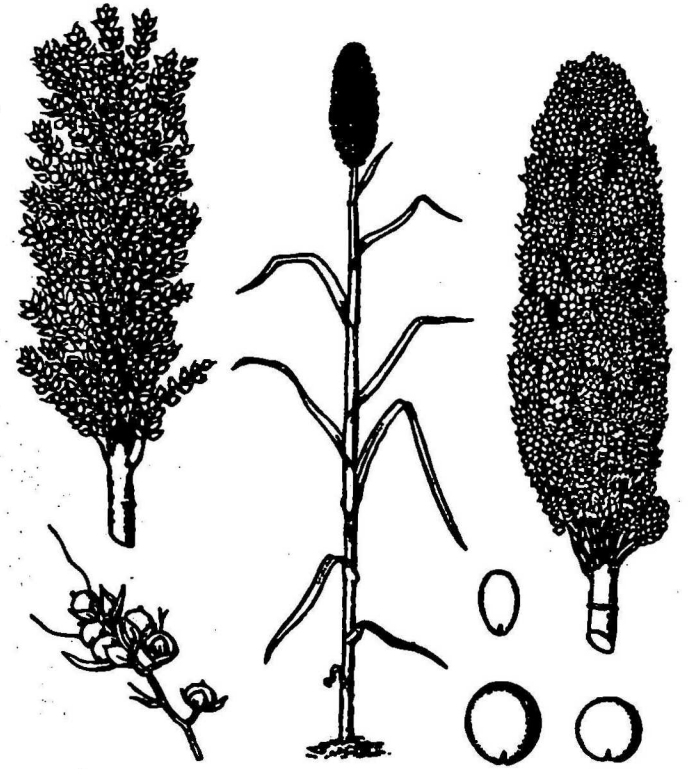
Maize is cultivated in fields and gardens, especially in the drier districts. It is a coarse grass ranging in height from three to 12 feet. The lower halves of the light green strap shaped leaves usually clasp the stout stems. At the top of the stem at flowering, there is a feathery plume while the cobs containing the grains are found halfway down the stem. Each cob is surrounded by leaf-like sheaths and from the top, projects a tassel of hairs. When the cobs are ripe, they hang downwards and the sheaths turn from green to a straw colour. The grain inside may be white, yellow, purple or striped. If the grain on the cobs can be dented with the finger nail, boil the cob in salty water for 20 minutes before eating the grain, or bake the cob without removing the enclosing leaves or husks. The mature grain found in the granaries should first be soaked then boiled. The young and soft maize may be made into powder and cooked in a bamboo stick with sugar added. When it is cooked it may be cut into pieces like cakes. Biscuits may be made with the old and hard maize. The maize must be put into water for a few hours before turning it into powder. The powdered maize can be made into biscuits or cakes by drying it in a pan or baking it in the fire. Sugar may be added as desired.



Millet or Guinea Corn (Sorghum vulgare)

Millet is solely a cultivated plant. The seeds only are edible after being roasted or boiled. Sorghum is a tall growing grass from four to 12 feet high. The long single leaves clasp the stout upright stems. The flowering spike is found at the top and contains numerous small white to brownish red seeds.

Warning: Do not confuse this plant with the sugar cane and attempt to eat it in the same way; the millet leaves and stem may be poisonous. The sugar cane has very pronounced joints on the stem and hard rind or skin coloured yellow, green or purple.



Buckwheat (Fagopyrum esculentum)

Buckwheat is only found as a crop plant. The brown seed should be made into a porridge. Buckwheat may reach a height of two to three feet. The hollow stem is often pinkish and the small whitish or pinkish flowers are borne in clusters. The leaves are triangular or heart shaped; the upper ones have no stalks, the lower ones have.

Sugar Cane (Saccharum officinarum)

The sugar cane is widely cultivated and clumps are found near all villages. There is also a wild form in open valleys. The stems can be cut into lengths and sucked for the sweet juice but do not swallow the pith. The very young flowering parts may be boiled and eaten. Remember that sugar cane may be mistaken for millet, the juice of which may be poisonous.

Sugar cane is a very large coarse grass. The leaves are often confined to the top. The stems are prominently jointed with a rib, sometimes soft but often hard, and coloured yellow, green or purple. The flower at the top is a feathery plume, quite like the millet flowering spike.

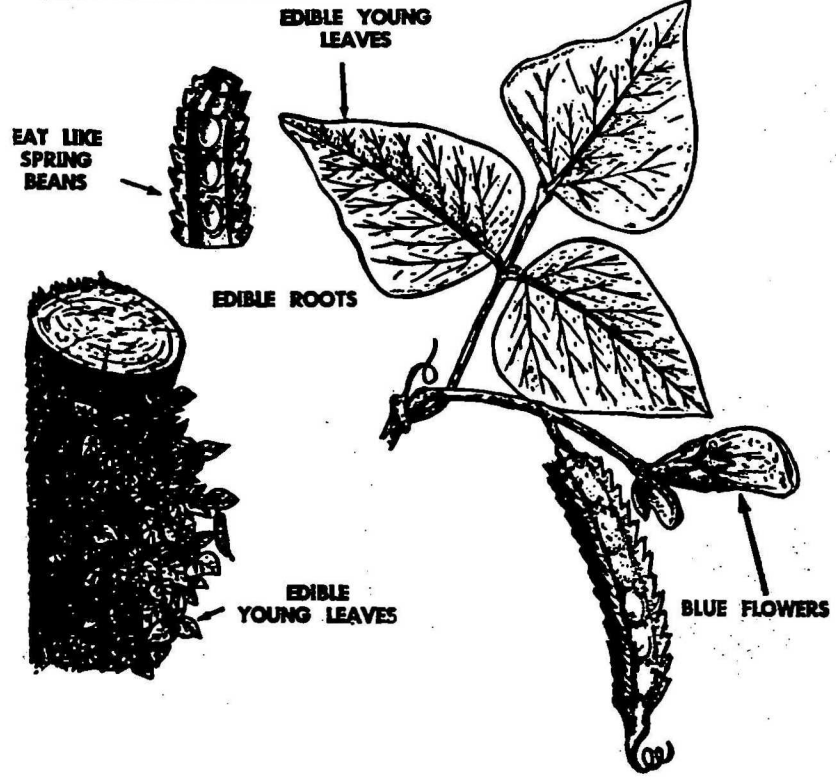
Sugar Cane

Pit

The plant resembles thin, reedy, sugar cane and is found on the banks of creeks and rivers. It has reddish green stems, growing to a height of 10 feet. The green leaves turn yellow and dry up in the older plants. These leaves are three to four feet long and about four to five inches wide. Dry yellow leaves cover the reddish green stems. Pit may be prepared by baking the tender young shoots in hot coals. After baking, the leaves are removed and the resulting food may be described as *"native asparagus"*. The leaves should be removed if the shoots are to be boiled in water until tender.

Goa Bean

This plant grows in tropical Asia, the East Indies, the Philippines, and Formosa. It represents an edible bean common to the Old World tropics and is found in clearings and around abandoned gardens. The goa bean is a climbing plant covering trees and shrubs and has a bean nine inches long, leaves six inches long and bright blue flowers. The mature pods are four-angled with jagged wings. Eat the young pods like string beans and the mature seeds by parching or roasting them over hot coals. Eat the roots raw and the young leaves raw or steamed.



Shoots and Stems. Edible shoots grow very similarly to asparagus. The young shoots of ferns and bamboo, for example, make excellent food. Although some can be eaten uncooked, most shoots are more palatable if boiled for 10 minutes, the water drained off, then reboiled until they are sufficiently tender for eating. Here are a few of the plants with edible shoots and stems likely to be encountered.

Edible Fern. Ferns are abundant in moist areas of all climates, especially in forested areas, gullies, along streams, and on the edge of woods. They might be mistaken for flowering plants, but with a little care can be distinguished from all other green plants. The leaf's undersurface is usually covered with masses of brown dots, which themselves are covered with yellow, brown, or black dust. These dots are filled with spores and their presence makes them easily distinguishable from plants with flowers. On all ferns, select young stalks (fiddleheads) not more than six to eight inches high. Break them off as low as they remain tender; then close your hand over the stalk and draw it through to remove the wool. Wash and boil in salted water or steam until tender.

Leaves. Plants which produce edible leaves are probably the most numerous of all plant foods. Many of them can be eaten raw; if cooking, avoid cooking them too long as many of the valuable vitamins will be destroyed.

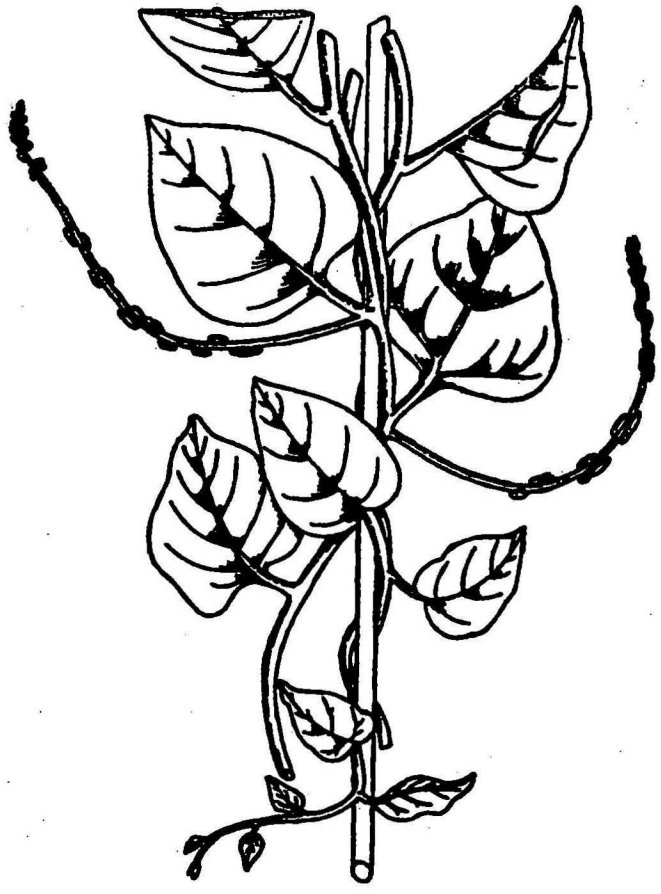
Amaranthus (Amaranthus)

Amaranthus may be cultivated, but is more often found wild in open ground and in waste places near villages. The young shoots and leaves should be cooked like greens. The common kinds of Amaranthus vary from one to three feet high and are herbs. The flowering shoots are greenish to red. In the cultivated sorts the leaves may be variegated, red or purple.

Ceylon Spinach (Basella alba) (Basella rubra)

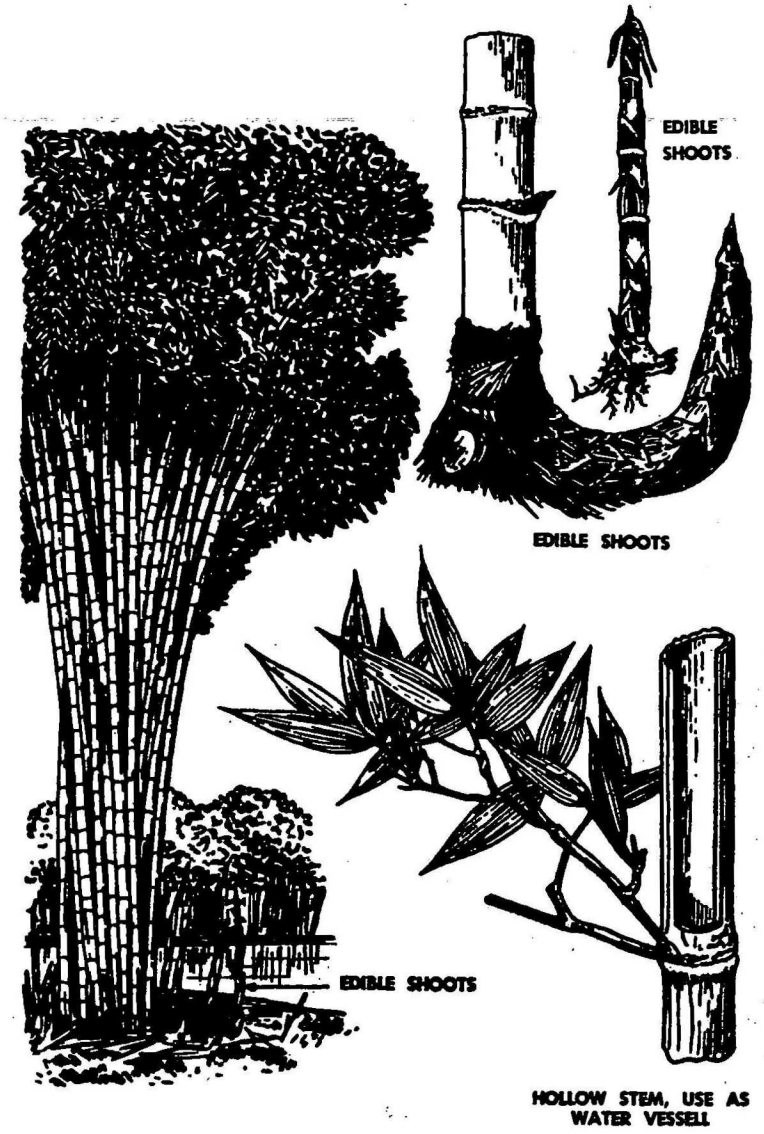
This climbing vine is not found in the jungle but principally in hedges near villages. The whole plant can be eaten raw or cooked. Ceylon spinach has fleshy stems and leaves varying in colour from green to purplish red. The flowers are small and pink, and the fruits black or purple.

Ceylon Spinach



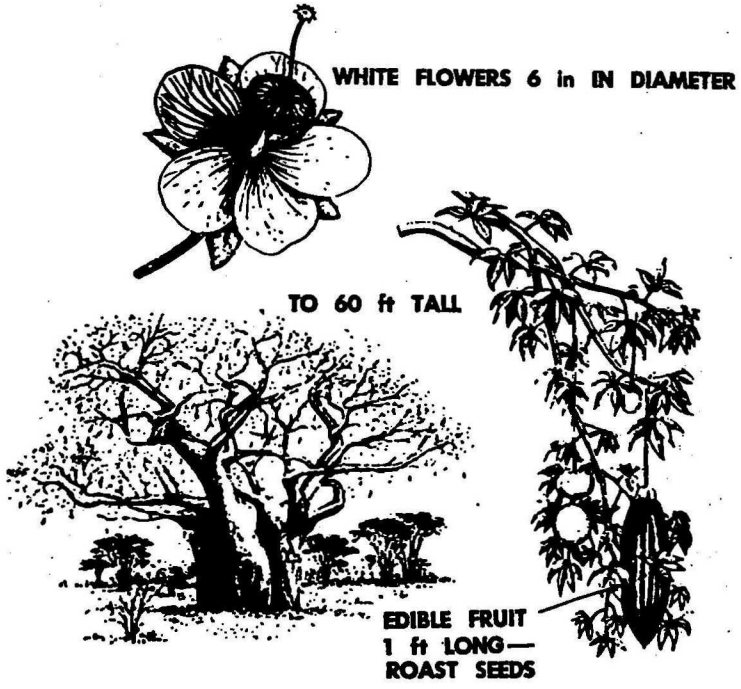
Bamboo (Dendrocalamus)

Bamboo grows in the moist areas of warm temperate and tropical zones. The mature stems are very hard and woody, while the young shoots are tender and succulent. They are stripped down to extract the vegetable. The vegetable should be thoroughly washed to ensure that no hairs have adhered to it. The young shoots should be cut in the same way as asparagus, and the soft tip ends eaten after boiling. Freshly cut shoots are bitter, but a second change of water eliminates the bitterness. Remove the tough protective sheath around the shoot before eating. Also edible is the seed grain of the flowering bamboo. Pulverize this, add water and press it into cakes or boil it in the same way as rice.



Baobab Tree

This tree is found in open bush country throughout tropical Asia and Northern Australia. It is distinguished by its enormous girth and swollen trunk and the relatively low stature of the tree. A mature tree 60 feet high may have a trunk 30 feet in diameter. It grows large white flowers about three inches across which hang loosely from the tree. The tree also bears a mealy, pulpy fruit with numerous seeds. These are edible and can be used as a soup vegetable.



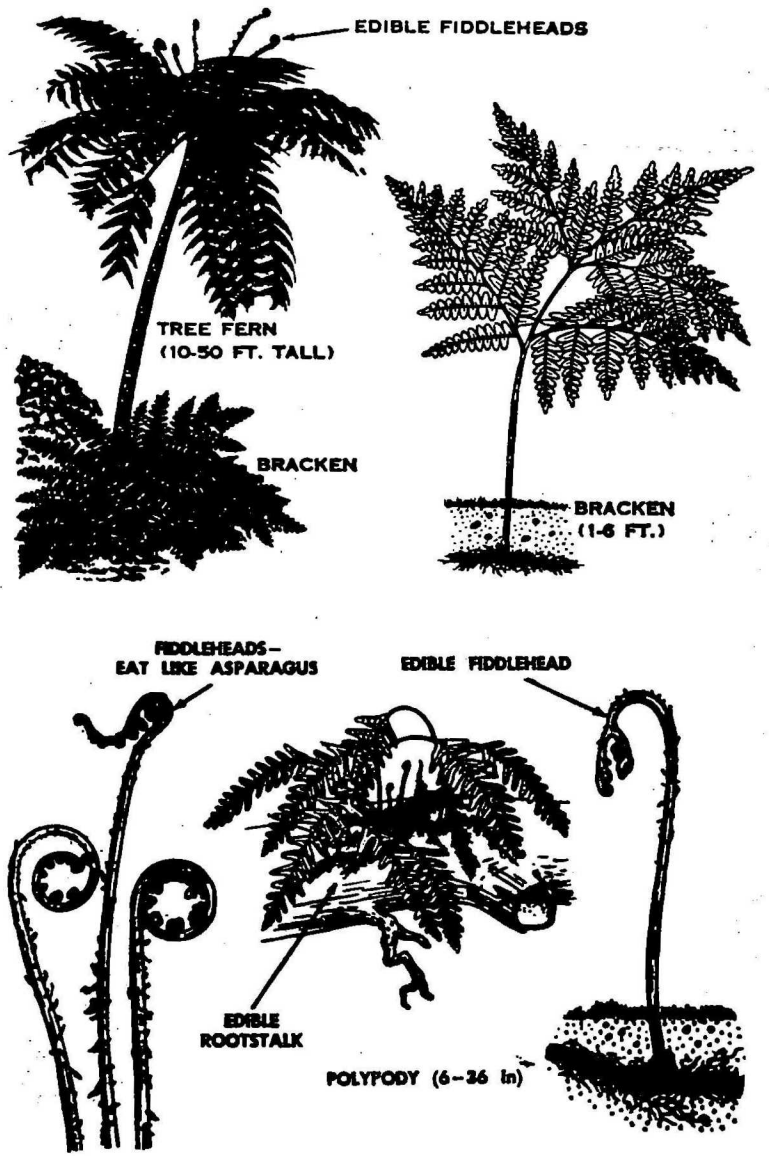
Ferns (Diplazium esculentum)

The young fronds (fiddleheads) of all ferns are edible while they are still in the soft curled stage. They can all be eaten raw, but are better cooked. The following are the main varieties, with their description and methods of preparation:

a. *Bracken Fern.* This fern is usually found growing in large patches and can reach a height of seven or eight feet. With a tree as support some plants may grow several times higher. When this occurs, a useful string can be obtained from the stalk. The young shoots are usually covered in short hairs at the base, which must be singed or rubbed off. Small quantities only should be eaten, the taste being rather bitter and unpleasant. Cook by boiling for about 15 minutes or until soft and *"mushy"*.

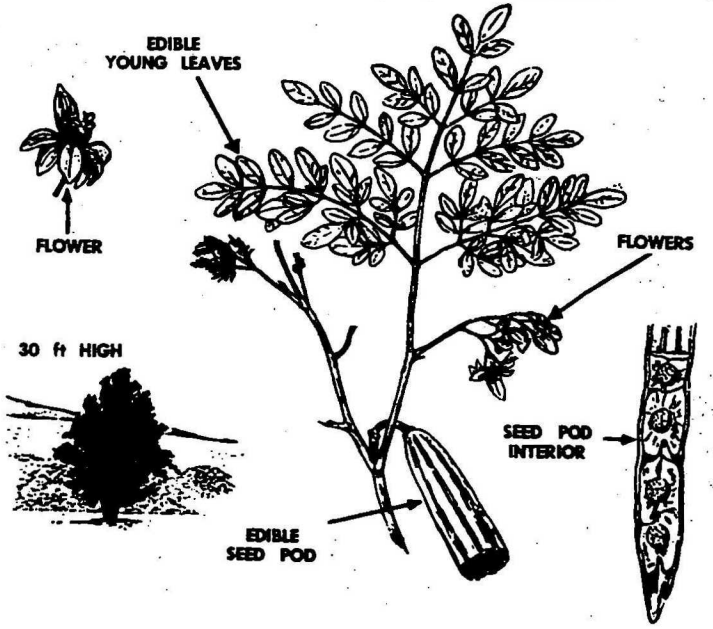
b. *Tree Fern.* When fully grown this fern has a woody stem, almost black in colour and covered with a tangled mass of short, thick follicles. It grows up to about 30 feet in height. The young shoots are thickly covered with hairs, which must be singed or rubbed off between the fingers. Where the shoot has a long stem, the lower part will be tough and indigestible; to obtain the correct part, bend the stem between the fingers, starting at the bottom, and moving up an inch or so at a time until it breaks cleanly. That portion above the break is edible.

c. *Polypody.* This fern likes moisture and is found growing on wet rocks, tree trunks and fallen logs. Its height varies between six inches and three feet. The fronds are herringbone in shape. The new shoots and the root-stalk may be eaten after boiling for 15 to 20 minutes.



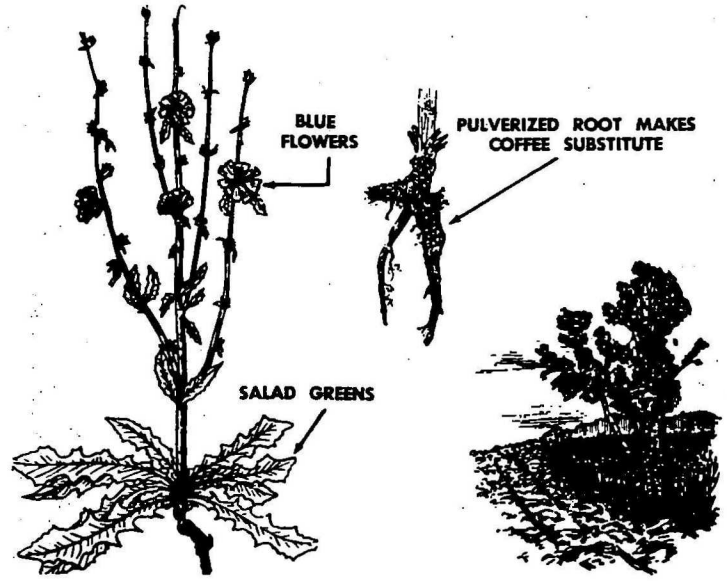
Horse-radish Tree (Moringa oleifera)

This plant is widespread in tropical countries throughout Southern Asia. Look in abandoned fields and gardens and on the edge of forest areas for a rather low tree from 14 to 45 feet high. The leaves have a fern-like appearance and can be eaten old or young, fresh or cooked, depending on their state of hardness. At the ends of the branches are flowers and a long pendulous fruit that resembles a giant bean. Cut the young seed pod into short lengths and cook it like string beans. Young seed pods when fresh can be chewed. The roots of this plant are pungent and, like the true horse-radish, can be ground as seasoning.



Wild Chicory

A native of Europe and Asia, chicory is now generally distributed throughout the world. Its leaves are clustered at ground level at the top of a strong underground carrot-like root. The leaves look much like dandelion but are thicker and rougher. The stems rise two to four feet and are covered in summer with numerous bright blue heads of flowers, which, except for their colour, resemble the dandelion. The tender young leaves can be eaten as a salad without cooking and the roots ground as a substitute for coffee.



Wild Ginger

This plant has a fleshy stem from which the leaves sprout opposite each other on either side. The leaves are similar to those of bamboo, only much broader. The young leaves are often reddish in colour. The plant grows to a height of about 10 feet and is found in damp places. The young shoots, which sprout out of the ground at the base of the plant are red in colour, and are an exception to the *"Red for Danger"* rule. They may be eaten either raw or after being boiled for about 25 minutes. The roots are a cure for diarrhoea and may possibly be useful in cases of dysentery. They are cut into small pieces and boiled for about half an hour, the resulting liquor then being discarded. The process is repeated and the second *"brew"* is drunk. It should be tested first by taking a mouthful and holding it in the mouth for a few minutes. This is because the strength of the plant varies considerably; the first boiling produces a liquor which will burn the mouth; the second may also be too strong, in which case the roots are boiled for a third time.

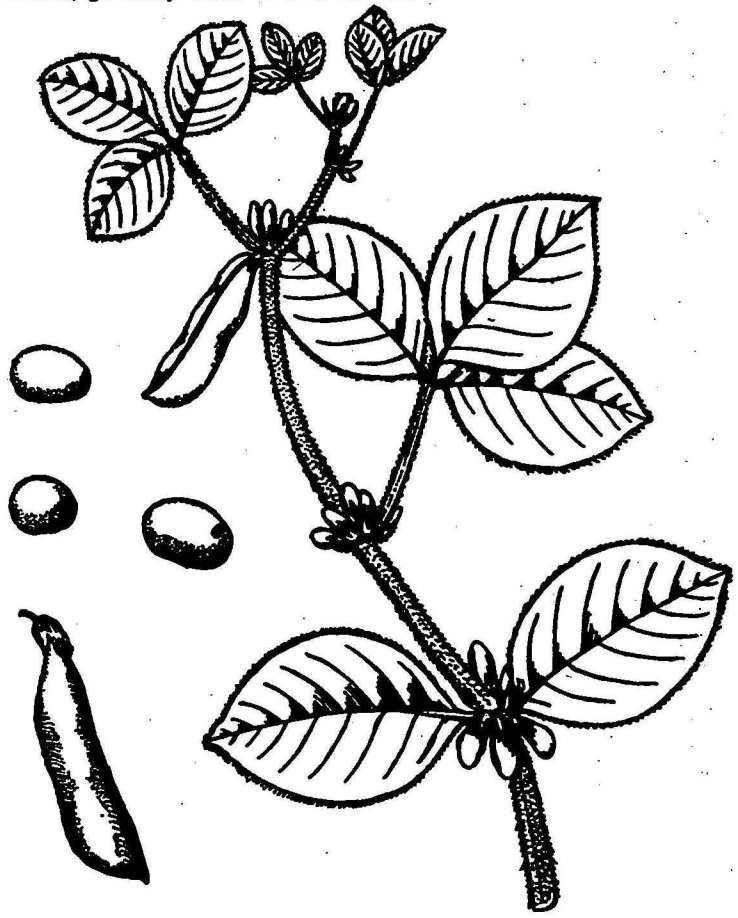
Beans and Peas. These foods are reasonably well known, and need no further introduction.

Nuts. These are among the most nutritious of all plant foods and contain valuable protein. Plants bearing edible nuts grow in all climatic zones and continents of the world except the Arctic and Antarctic. Nuts of the temperate zones such as walnuts, almonds, hickory nuts, acorns, hazelnuts, beechnuts, and pine nuts are probably well known. Tropical zone nuts include coconuts, brazil nuts, cashew nuts and macademia nuts.

Some of the edible beans, peas and nuts are shown in the following illustrations.

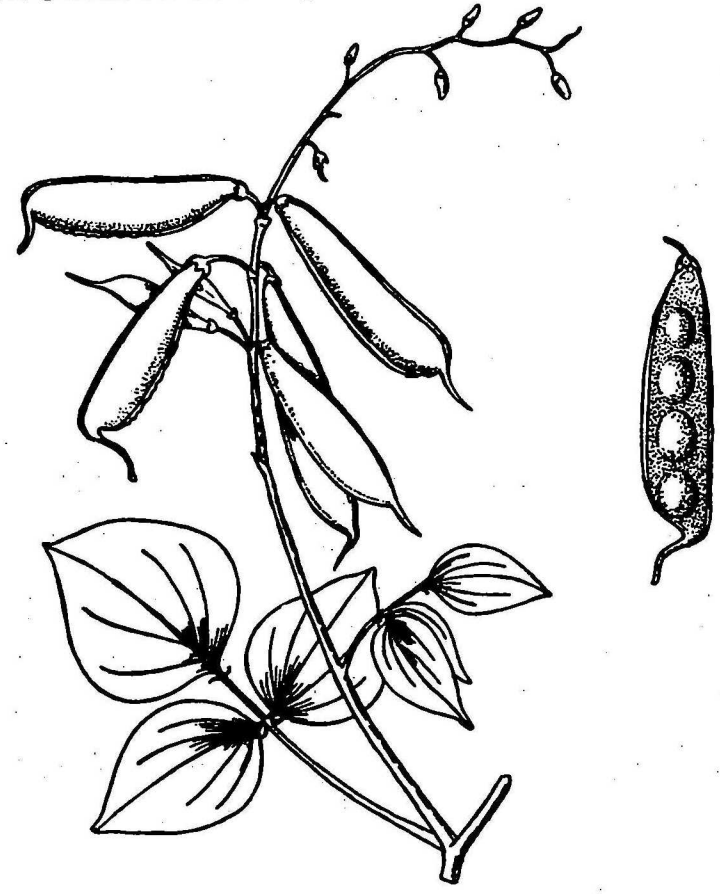
Soya Bean (Glycine max)

This bean is extensively cultivated, especially in Java. Half ripe seeds are kidney shaped, the dry ripe beans are round. The seed colour may be green, yellow, brown, mottled or black. The half ripe beans, yellow and green are best, can be boiled. The dry beans can be pounded into flour, roasted whole or soaked and boiled. The various kinds of soya beans range from one foot to four feet high. The large clover-like leaves and the stems are dotted with hairs, generally brown or white in colour. The main stems have a zigzag appearance; the flowers are minute, generally white or lilac in colour.



Hyacinth Bean (Dolichos lablab)

The hyacinth bean is a climber and is usually cultivated. The young pods can be cooked like runner beans. This plant has a violet or white flower; the young pods may have a pink or red tint; the seeds are white or yellow with black spots or black with white spots. The young shoots and the half ripe seeds are also edible.



Four Corner Bean (Psophocarpus tetragonolbus)

This twining bean is mostly planted. The young pods can be boiled and eaten like runner beans, while the mature seeds are also edible after roasting. The four corner bean of the climbing type has largish light blue pea-like flowers. The pods may be up to 10 inches long, with four thin wings running the length of the pod.

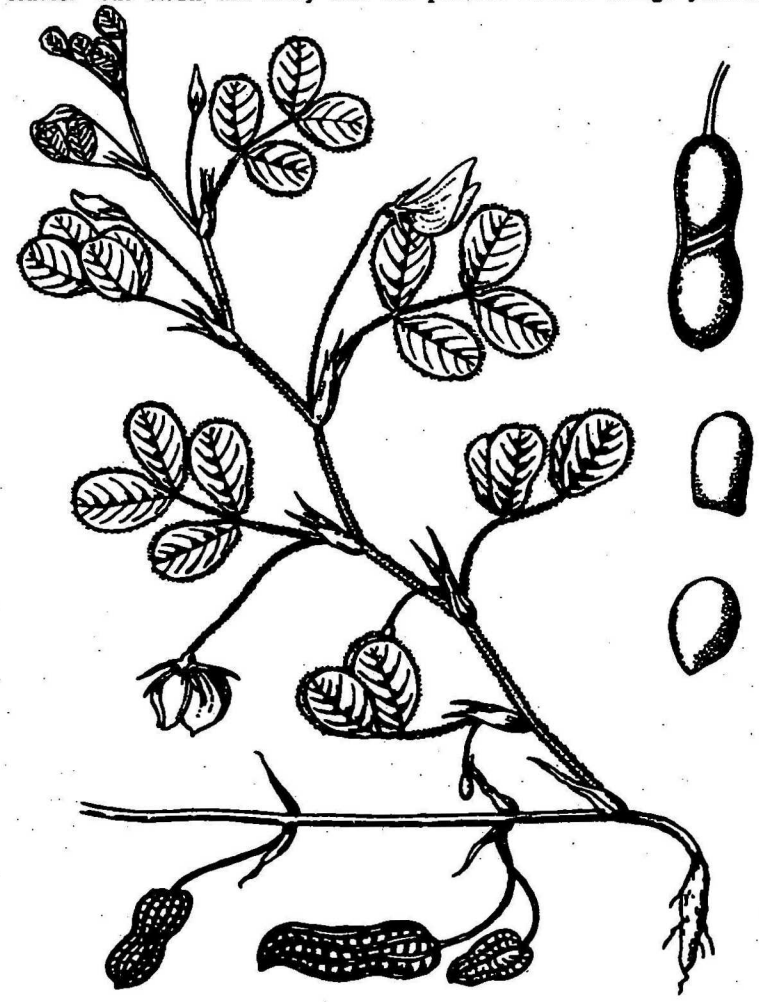
Four Corner Bean

Pigeon Pea (Cajanus cajan)

This small shrub occurs in open ground and is more often found wild than cultivated. The ripe beans are edible only after thorough cooking, but the green pods can be just boiled and eaten as a vegetable. The pigeon pea reaches five to six feet in height and has yellow flowers.

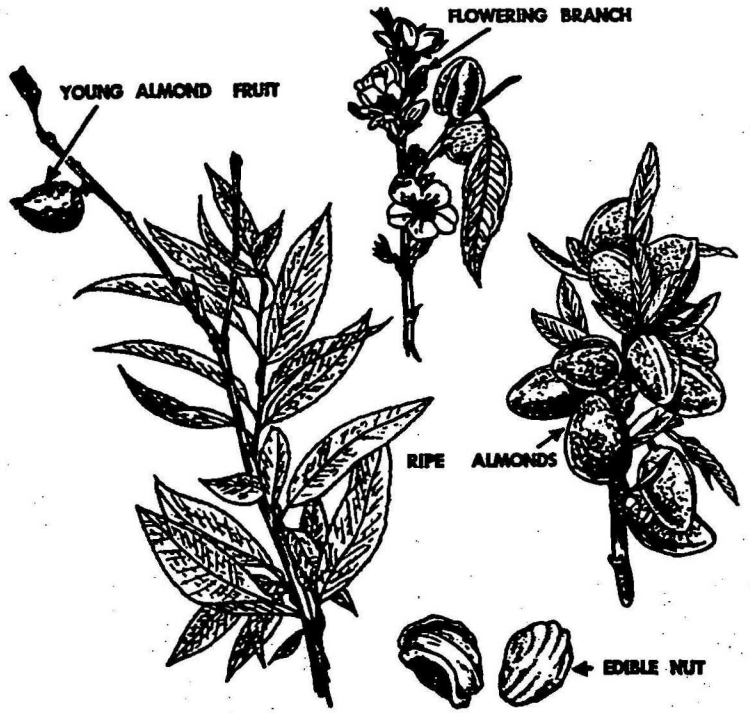
Monkey Nuts, Peanuts, Ground Nuts (Arachis hypogaea)

Monkey nut is a cultivated crop. The small hazel-like nuts are enclosed two to three together in a brownish papery pod, which is pitted all over. The pods are below ground. The nuts can be eaten raw or roasted. The monkey nut looks like a large creeping clover with four leaves. The stems are hairy and the pea-like flowers orange yellow.



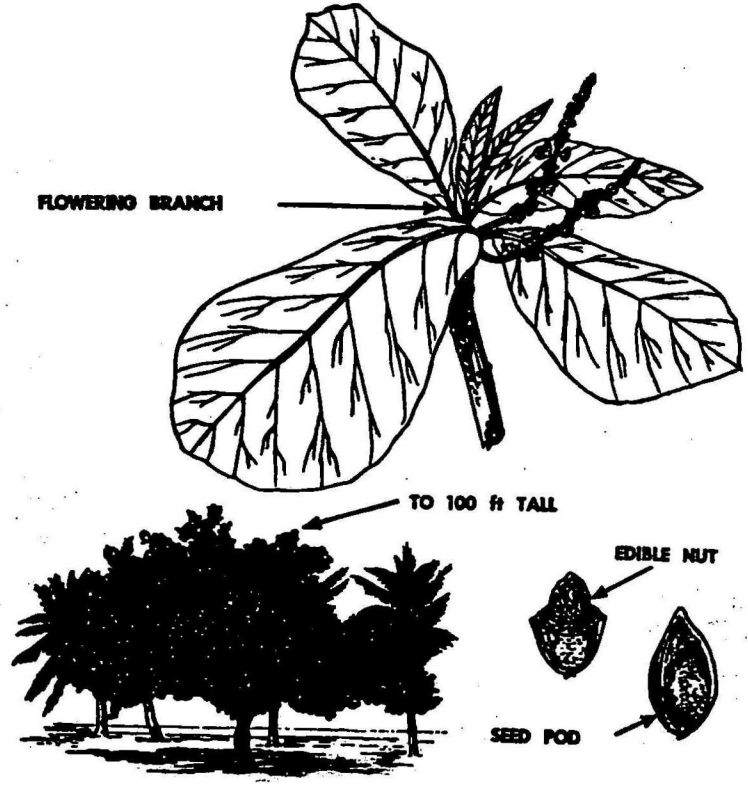
Almonds (Terminalia catappa)

The almond tree resembles a peach tree and sometimes grows 40 feet tall. The fruit, found in clusters all over the tree, looks somewhat like a gnarled, unripened peach with its stone (the almond itself) covered with a thick, dry woolly skin. To get at the almond nut, split the fruit down the side, then crush open the hard stone. A good plan is to gather and shell them in large quantities for further use as a survival food because a man can live on almonds alone for a long period provided plenty of water is available.



Tropical Almond (Terminala catoppa)

The Indian or tropical almond tree is widely dispersed in all tropical countries and is found in abandoned fields, gardens, along roadsides, and upon sandy sea coasts. It sometimes grows 100 feet tall. The edible seeds or kernels growing at the tips of the branches have a spongy, husk-like covering from one to three inches long. These kernels have an almond-like consistency and flavour.



Coconut (Cocos nucifera)

The coconut is widely cultivated and grows wild throughout much of the moist tropics, especially in Asia and the South Pacific Islands. It grows mostly near the sea-shore, but sometimes occurs some distance inland.

The cabbage or growing heart is an excellent vegetable cooked or raw. This delicacy has been called *"Millionaire's Salad"*, because its removal is said to kill the tree.

Nuts. All or part of the husk of the young nut may be sweet; if so, chew it like cane. Drink the milk from the nut. Over two pints of cold fluid may be obtained from one young nut, especially at the jelly stage, when the flesh is soft. A ripe nut will gurgle when shaken and held close to the ear. Do not drink from very young or very old nuts.

Grate or chop up the meat or flesh as it firms up; this makes it easier to digest.

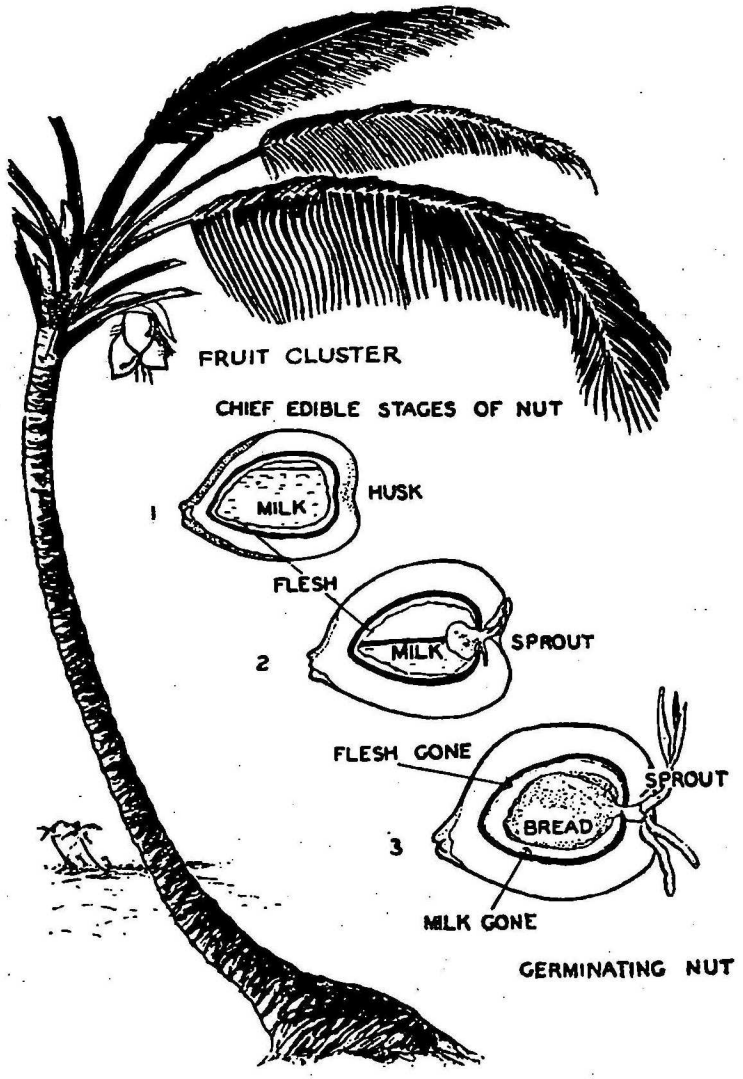
Fallen nuts germinate where they lie. In these, both milk and meat are used up, but the cavity is filled with a spongy mass, called the bread. Eat this raw or toasted in a shell over the fire. It tastes good and is very sustaining. Eat the sprouts like celery.

Climbing the Coconut Palm. Coconuts grow in clusters near the top of the palm. The slim and slippery trunks are very difficult to climb. A climbing bandage — a belt or rope a little longer than the circumference of the tree may be necessary. This is placed round the trunk and then stepped on with both feet. The loop on the other side of the trunk will support the weight of the body. The trunk is grasped with both hands, and the body pulled upwards, with knees doubled and the bandage slid up to a higher position with the feet. The body is then straightened with its weight resting on the bandage in order to get a new position. By repeating the process a man can quickly climb to the top of a palm.

Husking Coconuts. The nut is encased in a husk consisting of a smooth exterior and a matting of tough fibres. If a heavy knife or an axe is available there is no need to remove the husk of the green coconut to obtain the liquid. Whittle off the husk at the free, not stem end, to a crude point, and then the end and the top of the nut inside.

If a knife or a machete is unavailable, drive a stake three or four feet long into the ground so that it slants away at a right angle. The top of the stake should be given a crude wedge shaped edge so that it will pierce the longitudinal fibres of the husk. Stand about a foot clear of the stake, judging the point of entry so that the stake will clear the nut within the husk. Then push the coconut downward firmly against the sharpened stake, giving the coconut a twisting motion to pry off a small portion of the husk. By repeating this process, the entire husk of either green or mature nuts can be removed.

Once the nut is out of the husk, the problem is to break through the hard shell. To open a nut, hold it in one hand so that the eyes (at the stem end) are uppermost. Strike it sharply with a stone or with the point of a mature nut, just below each eye. The shell will crack and the top of the nut can be picked off without spilling the liquid.

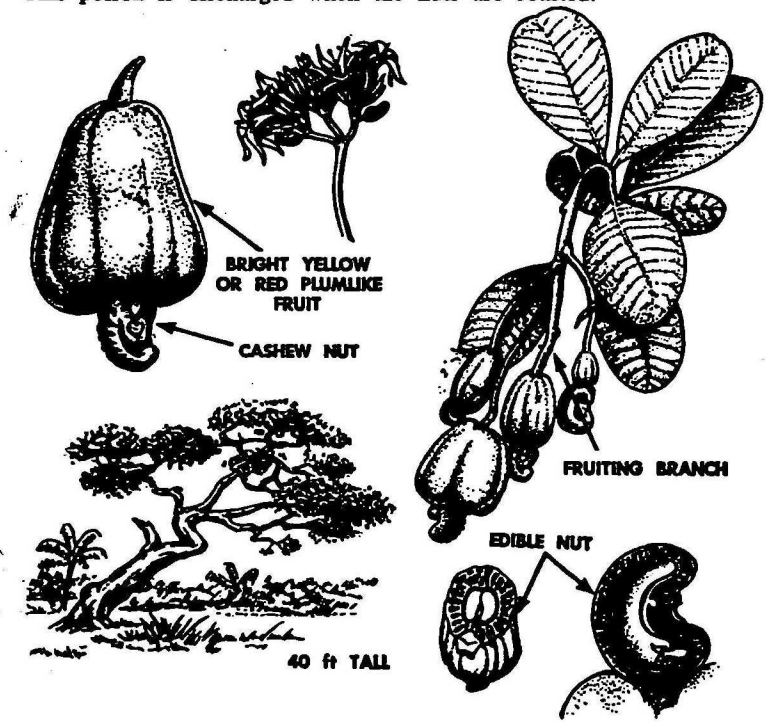


Poke out the eyes of a mature nut and drink the liquid. To break it open, place it on its side in the palm of your hand. With the other hand, grasp a stone and strike the middle of the nut, revolving it a quarter turn and striking it again. Continue to turn it, striking it each time, until it cracks in half.

Coconut Oil. Coconut oil is a good preventive for sunburn as well as an aid in keeping off chiggers and other insects. It can also be used for cooking. Coconut oil can easily be obtained by exposing the meat of the coconut to the sun. The oil will run more quickly if the meat is grated or pounded before placing it in the sun. Oil can also be obtained by heating the coconut meat over a slow fire.

Cashew Nut (Anacardium occidentale)

This nut grows in all tropical climates, on a spreading evergreen tree that reaches a height of 40 feet. The leaves are eight inches long and four inches wide; the flowers are yellowish pink. The fruit is thick, pear shaped, pulpy and red and yellow when ripe, with a kidney shaped nut growing at the tip. This nut encloses one seed and is edible when roasted. Be careful of the green hull surrounding the nut. It contains an irritant poison that will blister eyes and tongue like poison ivy. This poison is discharged when the nuts are roasted.

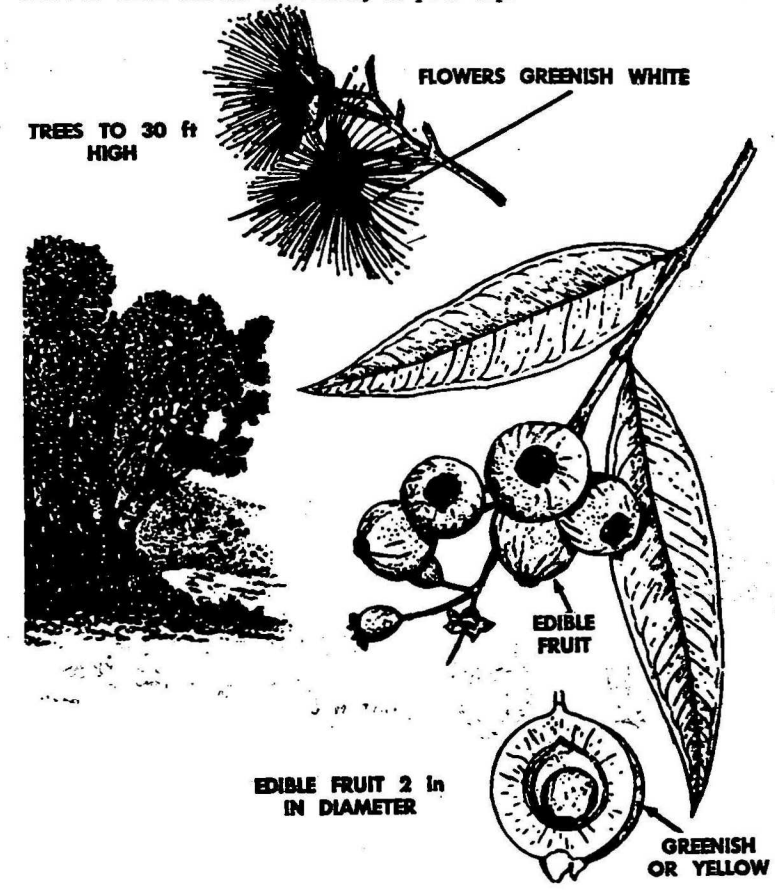


. Edible fruits are plentiful and can be classified as dessert or vegetable. Dessert fruits include the familiar blueberry and blackberry and the cherry, raspberry, plum and apple of the temperate zone. Vegetable fruits are the common cultivated tomato, cucumber, pepper, egg plant, etc. In the jungle there are few edible fruits and many poisonous ones. Eat only fruit from trees near houses or in fields or gardens. The orange, lime (like a small lemon), pomelo (like a large grape fruit) and the pineapple are well known. In the tropics, fruits stay green on the tree even when they are sweet and fully ripe. Pineapples unless yellow and ripe should not be eaten.

. Many of the wild berries and fruits of Australia are probably familiar to all. However, to refresh memories about familiar ones and perhaps increase knowledge of those growing in other areas, here are some that may be encountered.

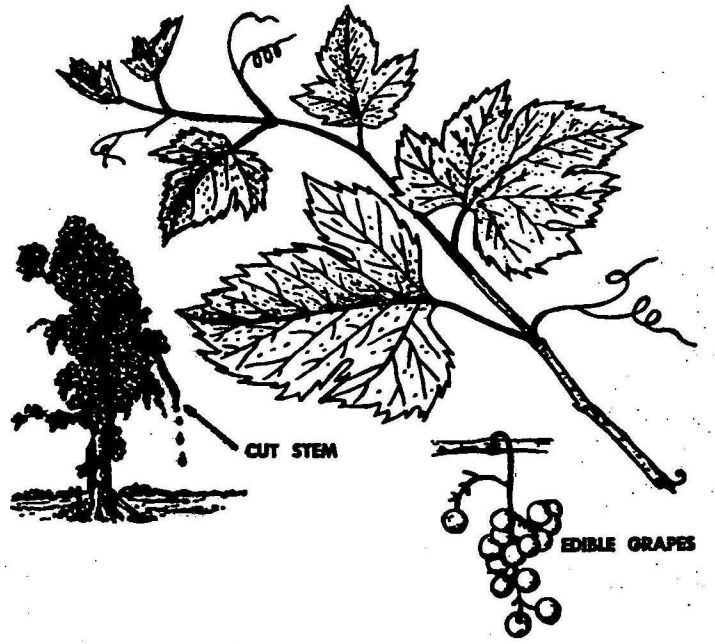
Rose-apple (Syzygium jambos)

This small tree (10 to 30 feet high) is native to the Indo-Malayan region but has been planted widely in most other tropical countries. It also appears in a semi-wild state in thickets, waste places, and secondary forests, and has tapered leaves about eight inches long and greenish white flowers up to three inches across. The fruit is two inches in diameter, greenish or yellow, and has a rose-like odour. It is excellent fresh or when cooked with honey or palm sap.



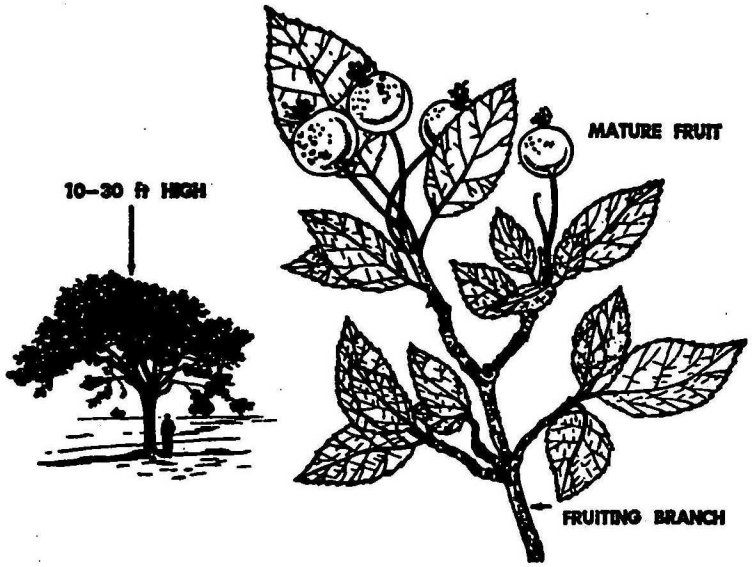
Wild Grape Vine

This climbing plant is found in Asia, the East Indies and Australia. It overruns other vegetation where it occurs. Its leaves are deeply lobed and similar to cultivated grapes. The fruit hangs in bunches and is rich in natural, energy giving sugar. Some water can also be extracted from the grape vine.



Wild Crabapple

This fruit is common in temperate Asia. Look for it in open woodlands, on the edge of woods, or in fields. The apple looks sufficiently like its tame relative to be easily recognized. If it is necessary to store some food for future use, this fruit can be cut into thin slices and dried.

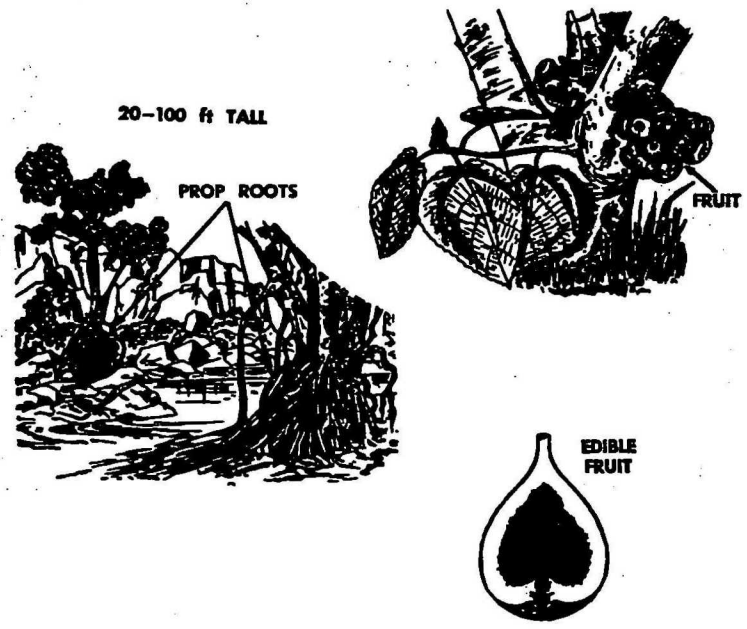


Bael Fruit

This fruit grows on a small, citrus-type tree and is related to oranges, lemons, and grape fruit. It is found wild in Burma. The tree is eight to 15 feet tall with a dense and spiny growth while the fruit is two to four inches in diameter, grey or yellowish, and full of seeds. Eat the fruit when it is just turning ripe, or mix the juice with water for a tart but refreshing drink. Like other citrus fruits, it is rich in Vitamin C.

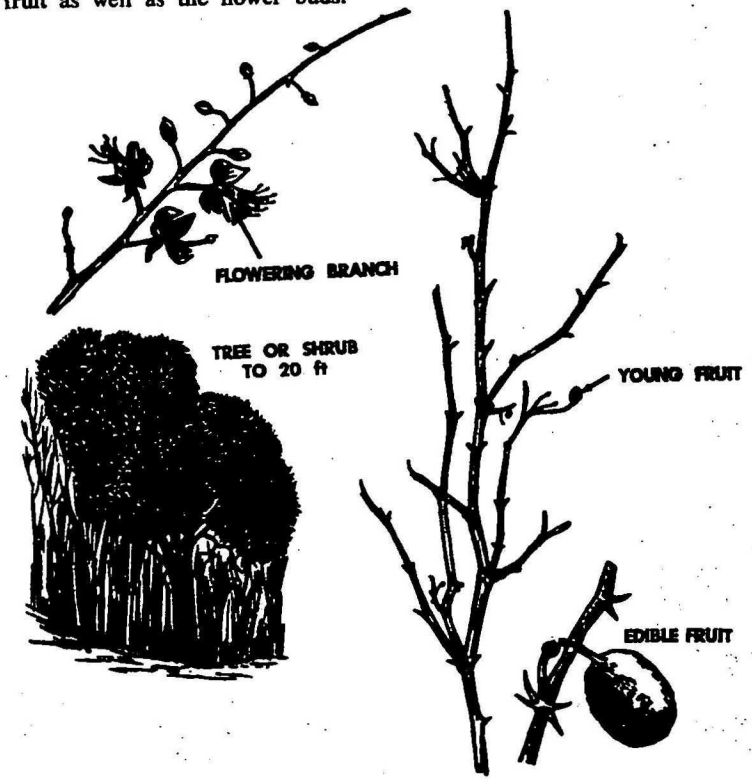
Wild Fig

Most of the 800 varieties of wild figs grow in tropical and sub-tropical areas having abundant rainfall. A few dessert kinds do however exist. The trees are evergreen with large, leathery leaves. Look in abandoned gardens, along roadways and trails, and in fields for a tree with long aerial roots growing from its trunk and branches. After identifying the tree, look for the fig fruit which grows out directly from the branches. The fruit resembles a child's top or a pear. Many varieties are hard and woody, covered with irritating hairs, and worthless as a survival food. The edible type is soft when ripe, almost hairless, green, red or black in colour.



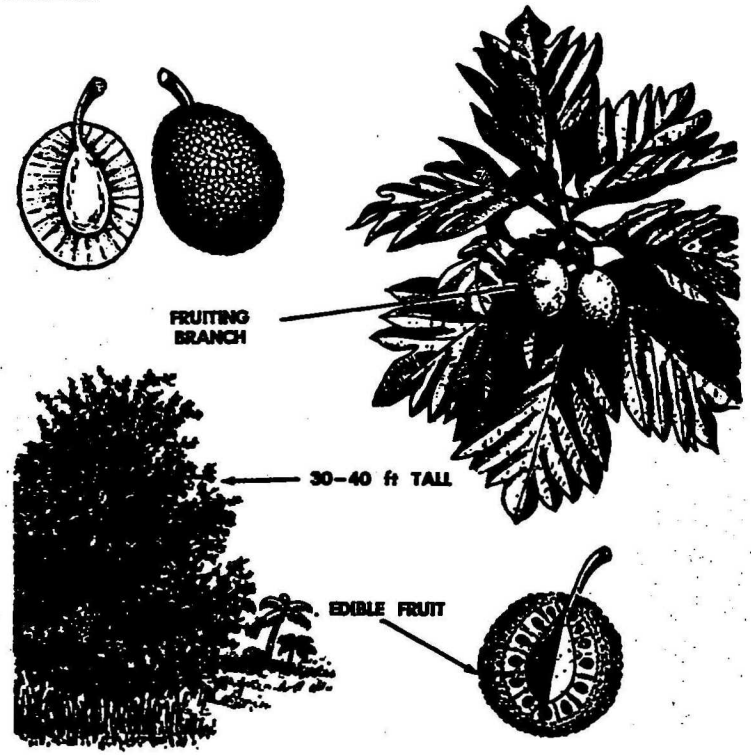
Wild Caper

This plant grows either as a spring shrub or small tree about 20 feet tall in India, and Indonesia. It is leafless with spine covered branches, flowers and fruit that grow near the tips of the branches. Eat the fruit as well as the flower buds.



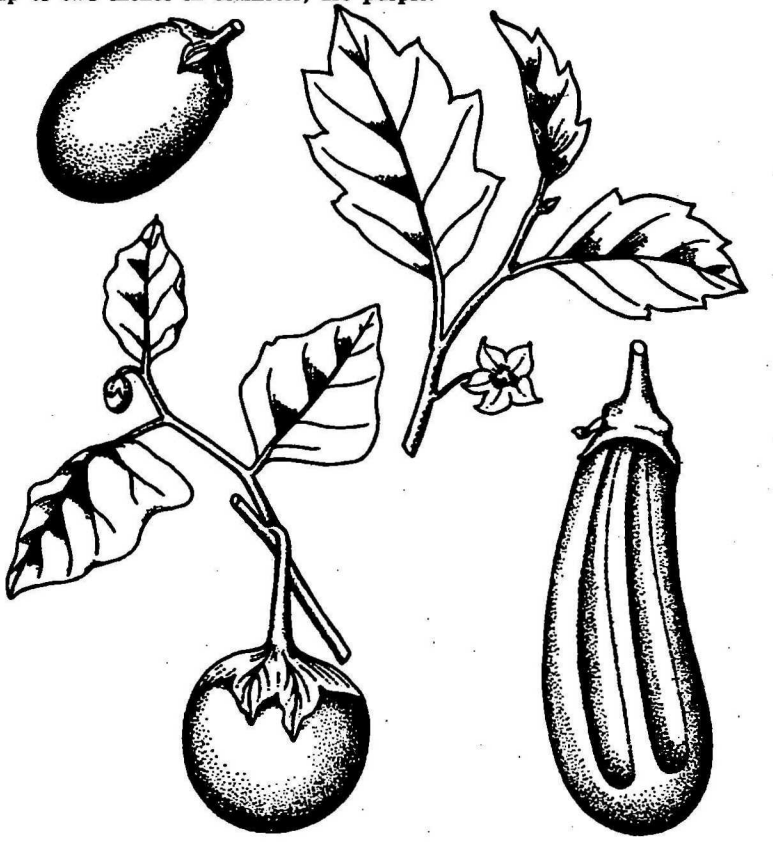
Breadfruit (Antocarpus altilis)

The breadfruit tree grows to a height of between 40 and 60 feet. It has large, glossy, deeply cut leaves and bears a round, dark green starchy fruit, about the size of a melon. The breadfruit is five to seven inches long and about four inches in diameter. It is rough on the surface, which is dark green in colour, and has a solid white pulp containing seeds. The better varieties are seedless but the wild variety found in the forests contains numerous seeds. The common method of cooking is to bake the whole fruit in the coals of a fire. The interior is then scooped out and tastes like boiled potatoes and sweet milk. To preserve the fruit, cut into pieces and allow these to dry in the sun. Flour can be obtained by grinding the dried pieces. The seeds or kernels are edible; when roasted they have the flavour of chestnuts.



Brinjal or Egg Plant (Solanum melongera)

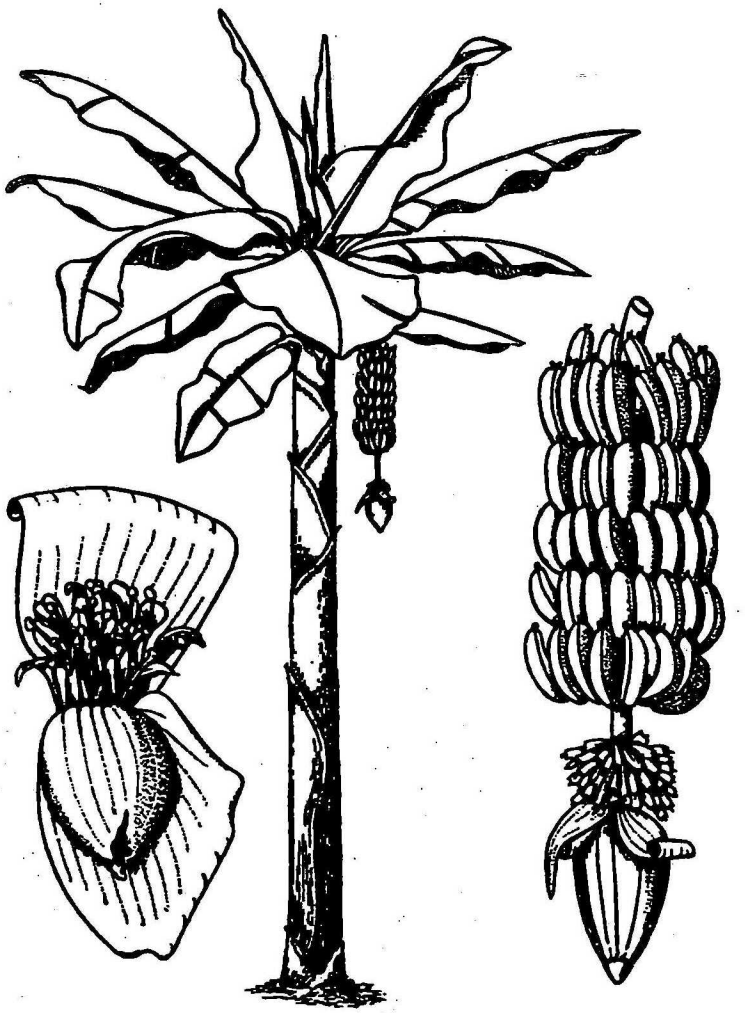
The brinjal is mostly found cultivated. The fruits are irregular in shape and size but can be recognized by their greenish bronze or purple skins which when rubbed are very shiny. The fruits, at their best before they are fully ripe, can be eaten roasted or boiled. The brinjal is a much branched bushy plant varying in height from three to five feet. The stems are woody, the leaves hairy on the underside and there may be prickles on the stems and at the base of the fruit. The flowers, up to two inches in diameter, are purple.



Banana (Muss sapientum) (Musa trodlodytarum)

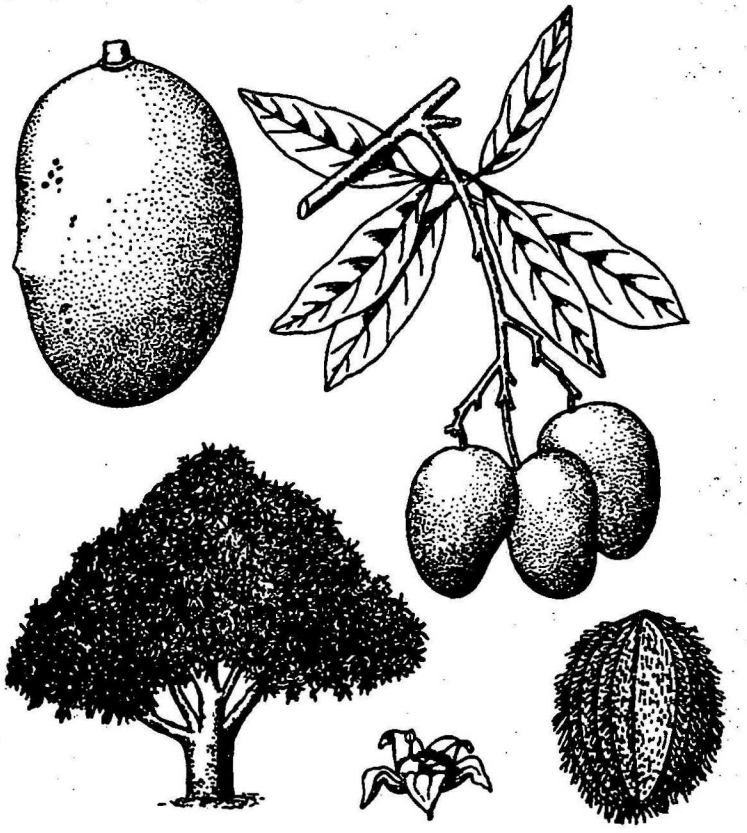
The banana is so well known as to need hardly any description. It grows in large bunches which hang from the top of the plant. When the fresh fruit is ripe the skin of the banana is usually light yellow. The flesh under the skin is soft but firm. The most palatable is the small variety with a light yellow skin. If the flesh is hard the banana should be cooked before eating. Many varieties are indigestible unless cooked. Bananas may be baked in their skins in hot coals or boiled in water until tender. The purple onion-shaped portion found growing on the end of a bunch consists of small, undeveloped bananas. This portion may be boiled until soft, when the outer layers are peeled off and the inside is eaten. The trunk of the plant may also be prepared in the same manner as a palm, and the resulting vegetable eaten. Unripe bananas may be sliced, baked and kept for consumption as required. Unripe bananas are good to eat only when fried or boiled. Cakes may be made by mixing ripe bananas with unripe bananas and baking the mixture. Wild bananas have a peppery taste, and before being boiled they should be thoroughly washed, and preferably kept in water for a night.

Banana



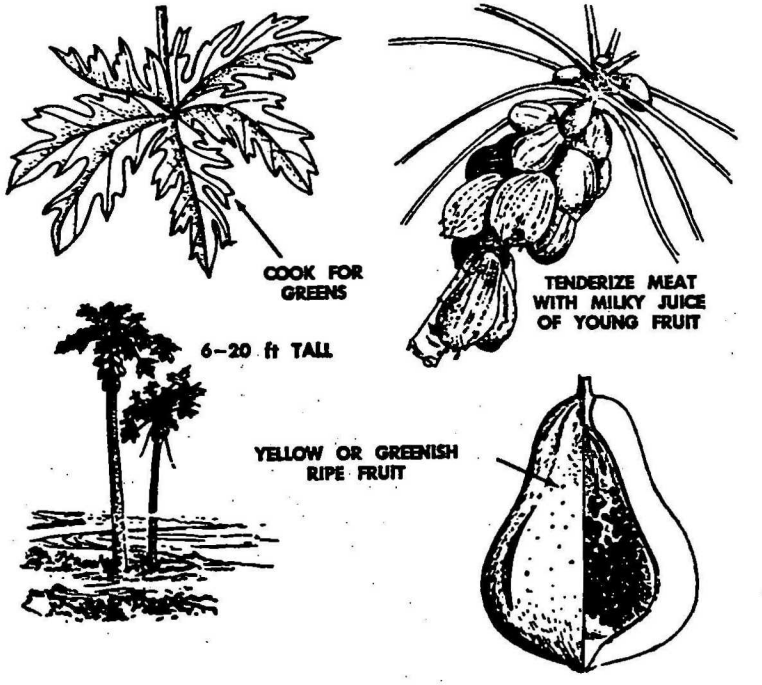
Mango (Mangifera indica)

The mango is a large spreading tree, 30 to 40 feet in height, which is planted and not found in forests. The fruit, about five inches long and two or three inches across when ripe, is yellow. To a few people, mangoes cause a rash. The sap in the stems, etc, is irritating. Do not carry mangoes inside a shirt. Wild mango fruits are very inferior and taste strongly of turpentine. The foliage is dense with very dark green glossy leaves with pointed tips.



Pawpaw or Papaya (Carica papaya)

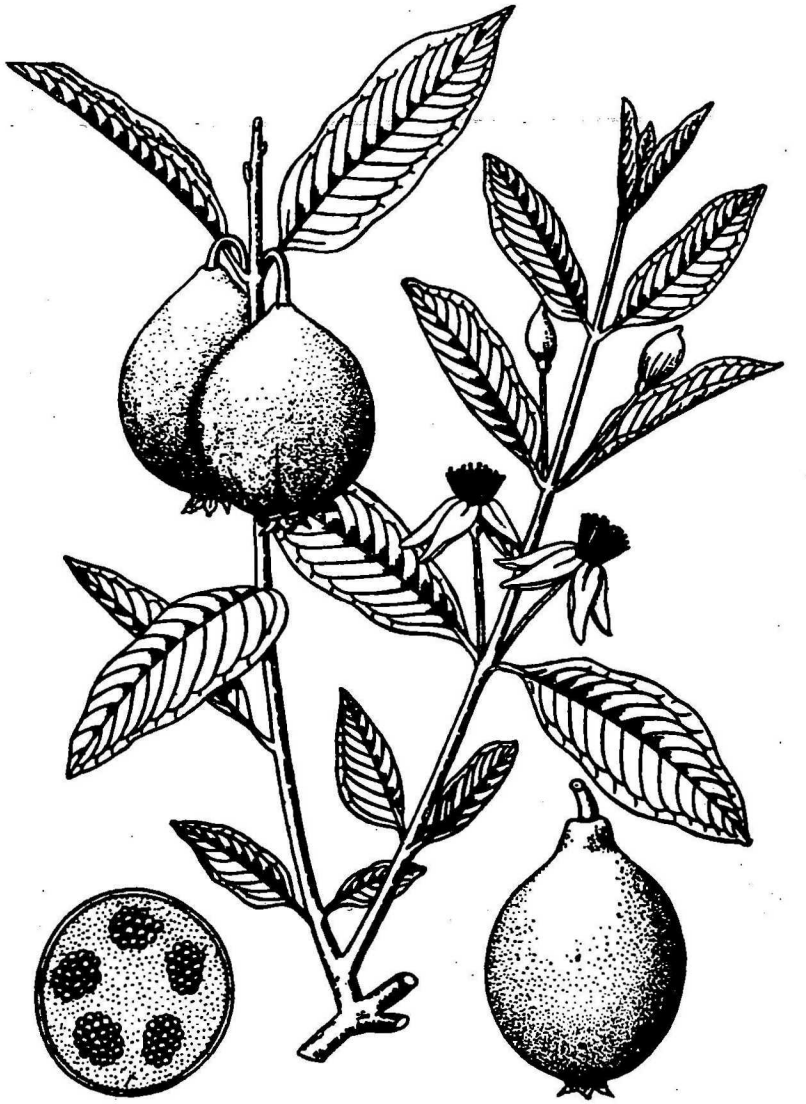
This tree grows in all tropical countries, especially in moist areas. It will be found around clearings and former habitations, and also in open sunny places in uninhabited jungle areas. The papaya tree is small (six to 20 feet tall) with a soft hollow trunk that will break under a man's weight if he tries to climb it. This trunk is rough and the leaves are crowded at the top. The yellow or greenish fruit grows among and below the leaves directly from the trunk and is squash shaped. It is high in Vitamin C and can be eaten raw or cooked. The milky sap of unripe fruit is a good tenderizer when rubbed into meat. Avoid allowing this juice to enter the eyes; it will cause intense pain and temporary, or possibly permanent, blindness. Also edible are the young papaya leaves, flowers and stems. Cook them carefully and change the water at least twice. The green fruit can be cut into slices and boiled until tender and has a taste similar to marrow. Papaya seeds contain pepsin, which acts as a purgative.



Guava (Psidium guava)

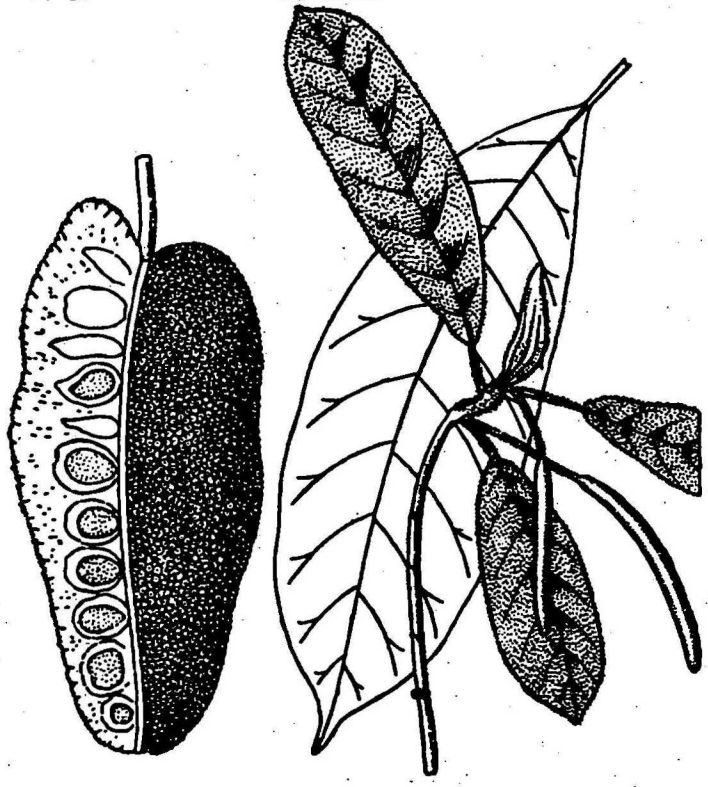
This shrub or tree is rare in thick forest but elsewhere is often common. The fruits are greeny yellow with a smooth skin and many seeds. It can be eaten raw or cooked. The guava bush has white flowers and ranges in height from five to 15 feet.

Guava



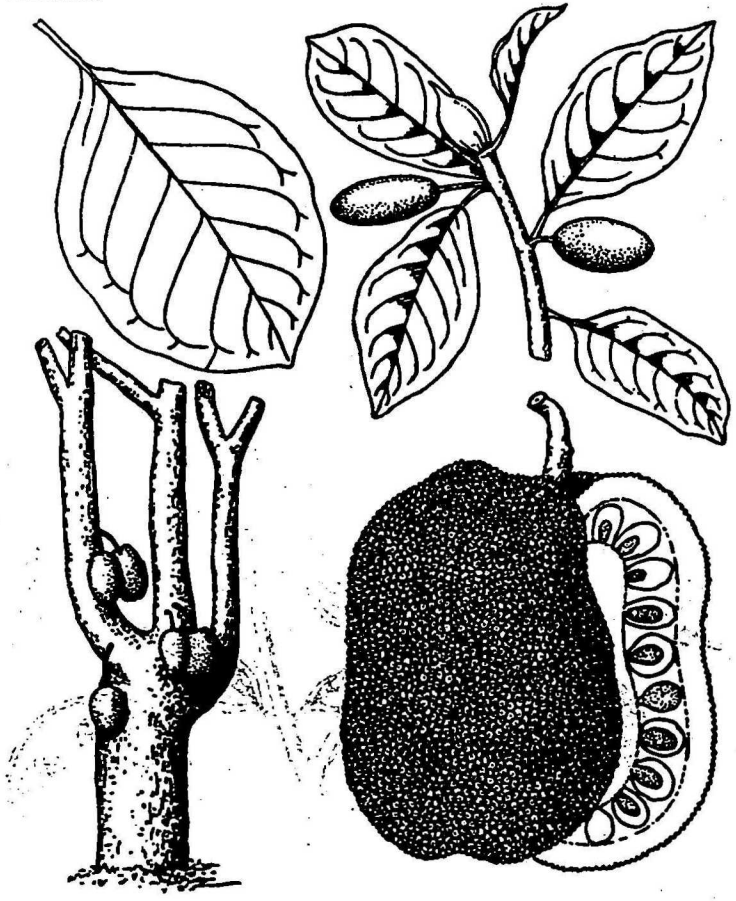
Chempedak (Artocarpus champeden)

The chempedak is a large tree, with cylindrical fruits borne on the main branches. The greenish fruits somewhat resemble the jak fruit but are smaller and have a very characteristic smell. The pulp should be eaten and also the seeds, after boiling or roasting. The tree has a milky sap, with somewhat hairy leaves.



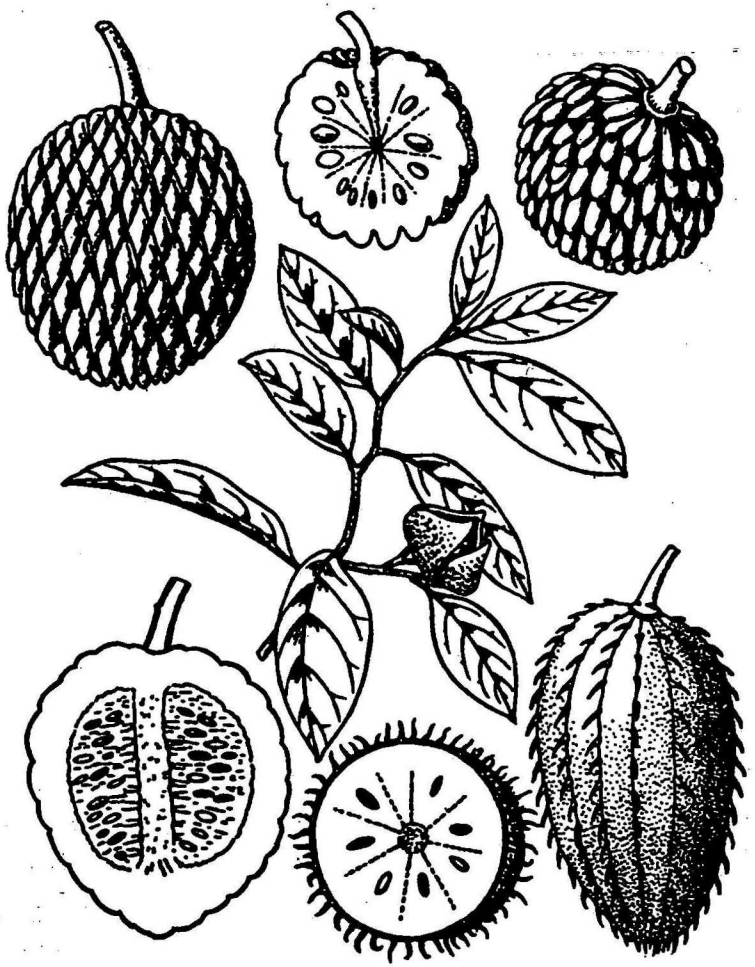
Jak Fruit (Artocarpus heterophylea)

The fruits of this large cultivated tree are green or greenish yellow when ripe, and may be as long as three feet and weigh up to 40 pounds. The pulp is eaten raw and the large seeds can be eaten boiled or roasted. The leaves of the jak fruit are very large and the sap of the tree is milky. The fruits arise direct from the trunk or larger branches.



Sweet and Sour Sops, Custard Apple (Annona sop)

These three small trees are somewhat alike. Sour sop and custard apple are cultivated but the sweet sop may be found wild, but not in the forest. The greenish fruits are eaten raw. The trees of the three kinds are up to 15 feet high. The fruits of the sweet sop and custard apple have a scaly appearance while the sour sop is covered with hooked short spines.



Indian Jujuba (Zizyphus jujuba)

This small tree is common in the drier parts of Burma and Java, and has leaves which are greyish on the underside. The fruits, eaten raw or cooked, are yellow and look like small plums.

Durian

Ripe durians are good for eating. Unripe durian may be eaten after being boiled with sugar or salt.

Wild Durian

The wild durian tree is somewhat like an elm in appearance and grows to a considerable size. The fruit is large, round or egg shaped, with a hard husk, covered with thorny spikes. It can be split into five segments, each of which has an oval compartment containing a gluey pulp carrying some seeds. The odour is distinctive and slightly unpleasant, but the fruit has a pleasant flavour and is nourishing. The durian fruits in Malaysia between August and November.

Wild Passionfruit

Wild passionfruit is common in clearings. The species with the fruit surrounded by a spidery calyx can be eaten raw. The calyx is a whorl of leaves forming the outer case of the fruit. The leaves of the plant may be eaten after boiling for about 15 minutes.

Mangosteen

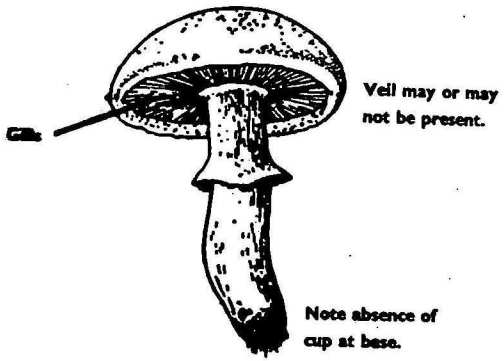
There are many inferior varieties of mangosteen in the jungle. All are extremely acid with a soft or watery pulp. They are similar to a large plum in appearance, vary from green to purple in colour, and are crowned at the top with a dark lobed disc.

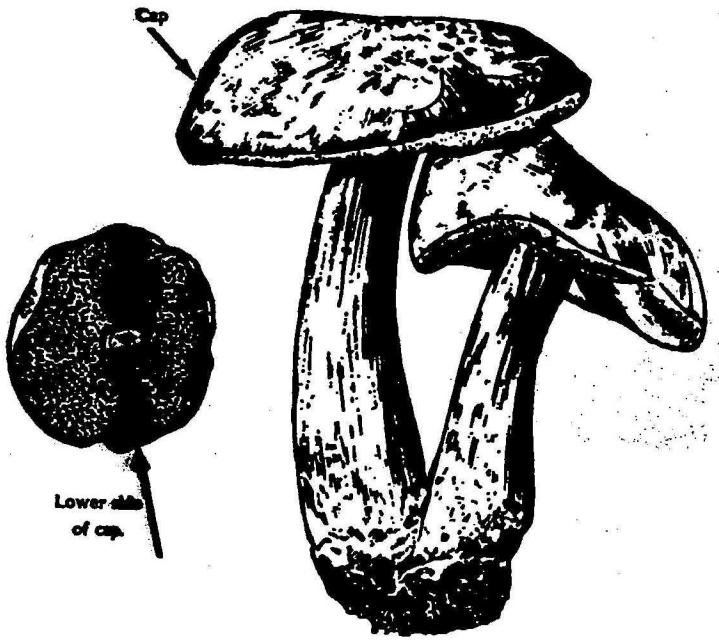
Wild Raspberries

These are similar in appearance to the European plant, but the stems are less rigid and more closely resemble blackberry stems. The fruit is small and not very sweet, but quite tasty. The plant is not found below about 2,000 feet.

FUNGI

Although many varieties of edible fungi are found in different parts of the world such as the mushrooms eaten on steaks and the mould in blue cheese, a large number cannot be eaten without ill effects and some are poisonous. Edible fungi are comparable to an extent with common leafy vegetables and may be available in areas where other edible plants are scarce.





The most common edible fungus is the mushroom which is generally safe to eat. However, as it is similar in appearance to other non edible fungi the following hints about selecting edible mushrooms should be studied:

a. Avoid all mushrooms having any signs of red colouring on the cap or with reddish pores or gills on the underside of the cap or any red colouring on the stalk.

b. Do not eat any mushroom which changes colour on being broken.

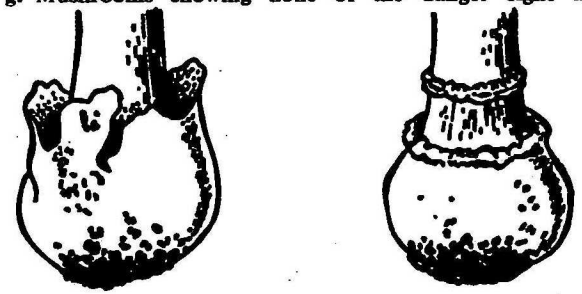
c. Avoid all gilled mushrooms with white or pale milky juice. White gilled mushrooms generally should be regarded as dangerous.

d. Avoid yellow or yellowish orange mushrooms growing on old stumps or trees. If they have crowded or solid stems, convex overlapping caps, broad gills extending irregularly down the stem, or surfaces that glow phosphorescently in the dark, they are probably poisonous.

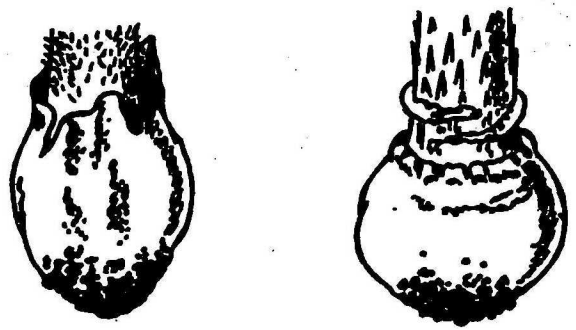
e. Avoid any mushroom which seems to be too ripe, water soaked, spoiled, maggoty, or with worm holes.

f. All fungi growing on dung must be avoided.

g. Mushrooms showing none of the danger signs mentioned



Note cups at base.



above should be dug completely out of the ground. Those without a cup at the base should be safe to eat. Those with a cup, must be discarded.

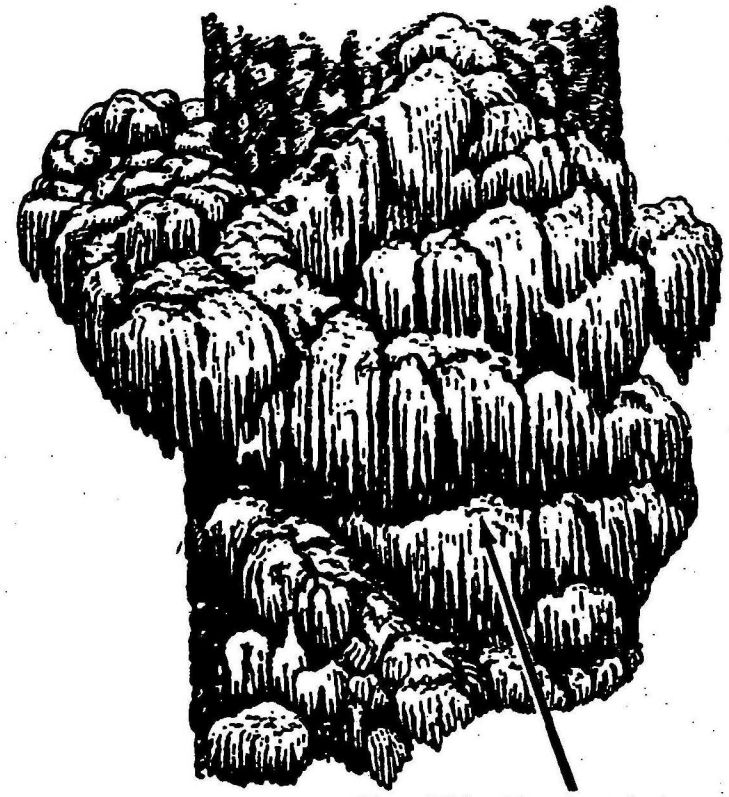
Many non-gilled fungi are poisonous. This group includes coral fungus, coral hydnums, cup fungus, and stink-horns, Included in this general group of non-gilled fungi is the Puffball. The young Puffball, however, may be eaten provided the inside is not coloured.

For the person in a survival situation it is generally better to avoid eating mushroom type fungi even if the tests mentioned above indicate that it would be safe to do so. The personal sensitivity of the individual is a further factor to be considered and in all cases, initially, a small quantity only should be eaten on trial. If no ill effects are experienced in 24 hours the fungi should be safe to eat.

White, Orange, Yellow, Pale Violet
(2-6 in. High)

Coral Fungus

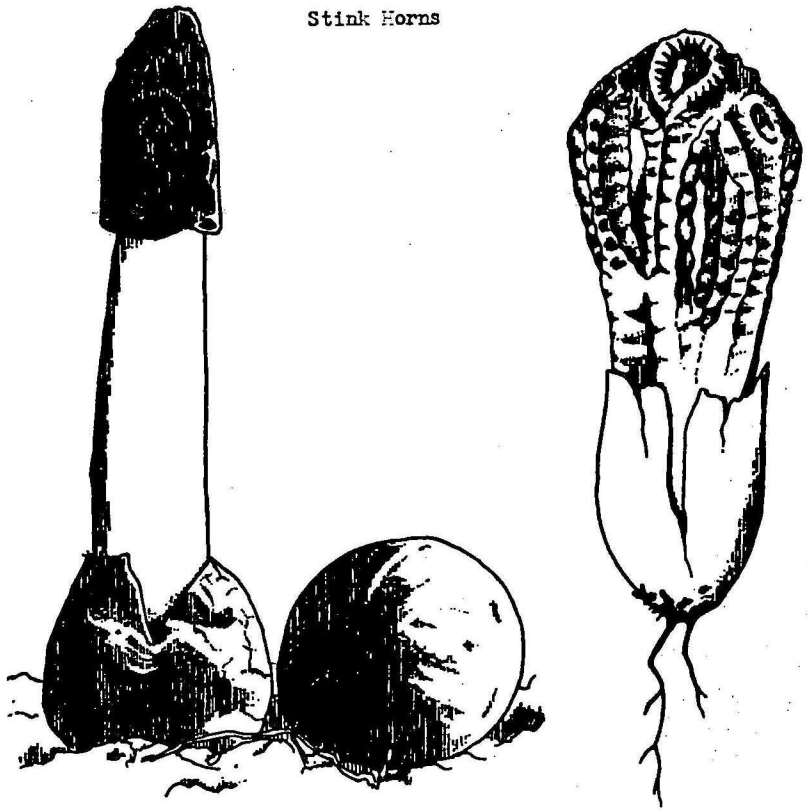
Coral Hydnums



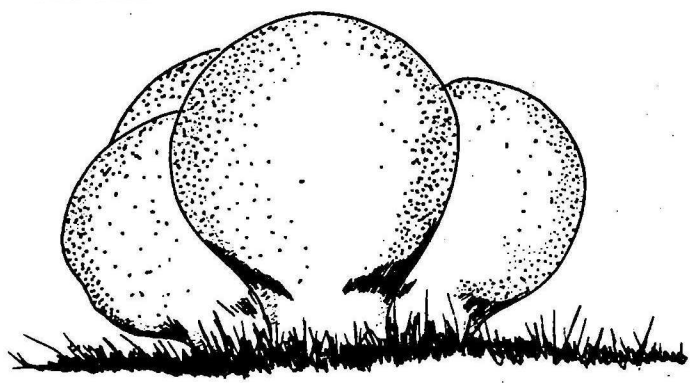
Waxy White Found on dead wood

Cup Fungus

Stink Horns



Puff Balls



CULTIVATED VEGETABLES AND NATIVE VEGETABLES.

Harvested vegetable or grain fields are rich sources of food. Be on the lookout for old potato, rice, corn, and turnip fields and harvested pea patches, etc, in the countries of South East Asia.

If a potato field is found, dig into the hills for potatoes that were overlooked when the field was harvested. Eat the potatoes raw or cooked. Look for fields with vegetable stalks that remain in the ground after harvest. These include turnips, rutabagas, carrots, beets, radishes, etc. Any of these can be eaten cooked or raw. However, peel or otherwise clean these foods before eating to eliminate the dangers caused by contamination from fertilizers, human or otherwise.

In abandoned corn fields, search the ground for discarded ears. Eat kernels raw, cooked, or parched as pinole, a highly nutritious food made by parching corn in hot ashes or over a fire and grinding it into flour. A handful in water makes a nutritious and tasty combination.

Vegetables are produced mostly from succulent leaves, pods, seeds, stems, and non-woody roots. Select young, tender kinds, but cook all vegetables, particularly those in the tropics or those obtained from cultivated fields. In heavily populated regions, especially in Asia, human excrement is commonly used as fertilizer for food crops. Cooking will normally destroy all injurious intestinal parasites or bacteria.

Fruit which is bland or unsweet in flavour may be eaten as a vegetable. The tomato, sweet pepper, and egg plant are in this category.

Some types of vegetables which may be encountered are:

a. *Green Vegetables.* A large variety of leafy shoots can be cooked like cabbage or spinach. These are cooked in boiling water until tender. In the absence of salt, sea water, if available, may be used to add to the flavour. A tasty, balanced meal may be prepared by mixing green vegetables with rice or tomatoes. The best of these leafy vegetables are the young taro leaves, sweet potato shoots, pumpkin leaves, pigweed, wandering jew, aibeka (the edible hibiscus with reddish green young leaves, considered the best leaf vegetable in New Guinea), fig leaf tips, amaranthus viridis and other amaranthus (common weeds of cultivation).

b. *Native Spinach.* A shrub with slender stems which vary in colour from green to reddish green. The shrub grows to a height of about eight feet. It has small, dark reddish green leaves, similar to mint in shape. Boil the young leaves in salty water for 20 minutes or until tender.

c. *Beans.* The native bean vine is a thin stemmed creeper. The stem is green and has a small dark green leaf. The green bean which grows from the stem is long and narrow. The plant sometimes grows to a height of five to eight feet. The bean is sliced into small pieces, then boiled in salty water for 20 minutes or until tender. The taste of the beans is improved if they are cooked with a piece of fat meat.

d. *Cucumber.* The cucumber is the same as the apple cucumber of Australia, except that it is yellowish brown. The cucumber grows from a vine with long greenish white runners which bear green leaves divided into segments. This may be eaten raw or fried in a maize meal batter.

e. *Elatostemma.* Elatostemma is often plentiful in mountain streams and will be found growing in water among the rocks. It can be identified by its heavy fleshy stems and lopsided leaves. However, it should not be confused with the jungle begonias, which do not grow in water but have a similar leaf. Jungle begonias are not edible.

f. *Watercress.* Watercress grows in many New Guinea watercourses. Eaten raw it is an excellent green vegetable. However, care should be exercised before eating raw watercress, because of the possible contamination of the water from disease organisms. The same danger also exists when eating succulent grass shoots growing in swamps and along streams.

g. *New Guinea Cabbage.* New Guinea cabbage is the name given throughout the territory to a tree with small branches coming out in groups of young shoots of leaves at regular intervals around the trunk. On these shoots of leaves are edible nuts about the size and shape of a pigeon's egg. In the common variety, the nuts are purple or plum coloured and smooth on the outside. In another variety, these are pink and ribbed. All contain an edible kernel. The young leaves are considered one of the best greens. The young tips are better than the older leaves which have a strong flavour and are very fibrous. These trees are usually of a hole-like growth. It is unknown whether this is a natural growth or due to the lower branches having been stripped by natives to obtain the leaves.

h. *Jungle Cabbage or Cassenda.* This is the name given to a jungle tree which produces an onion flavoured edible leaf. The young tender leaves are best and may be eaten raw or cooked. The tree is common to all countries in the tropical zone and is found only in the jungle. Pieces of bark may be boiled with other vegetables to give them a flavour. The tree has no distinctive feature except for its strong garlic smell.

PALMS

At least 1,500 different kinds of palm are distributed throughout the tropical world. They grow in almost every conceivable habitat — sea-shore, swamp, desert, grass land, and jungle. Palms vary in size from a few feet to 100 feet tall. Some are climbers, such as the rattan palms. The palms assume many different forms, but generally they are easy to recognize. The leaves are of two main types:

a. Pinnate (like a feather), such as the date palm.

b. Palmate (like a hand with webbed fingers), such as the fan or cabbage palm.

Cabbage. The cabbage (terminal or apical bud) or growing point of most palms is edible either cooked or raw. It is located on the tip of the trunk, often rather deeply buried, but enclosed by the crown of leaves of sheathing bases of the leaf stem. Some, but not all, cabbages are bitter.

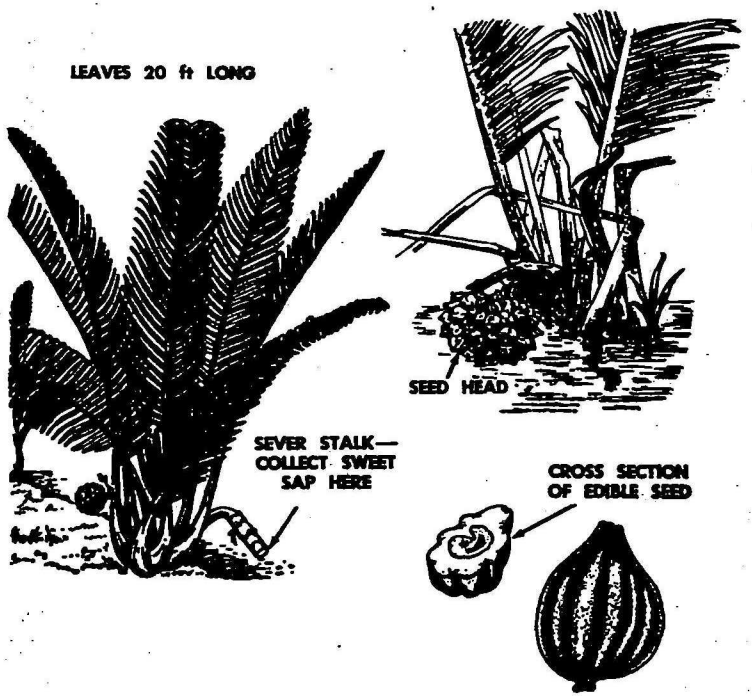
Sap. The sap of many palms is drinkable and nourishing.

Fruits. The nuts of palms are generally produced in clusters below the leafy crown. Nearly all are edible, although many are woody and, therefore, unpalatable.

Starch. Enormous quantities of edible starch are stored in the trunk of the sago palm. This palm occurs principally in South East Asia and the neighbouring islands of Indonesia. Another plant, the cycad, found throughout the same area, produces quantities of starch from its thick trunk. The palm-like cycad looks like a cross betwen a tree fern and a palm.

Nipa Palm (Nipa fruticans)

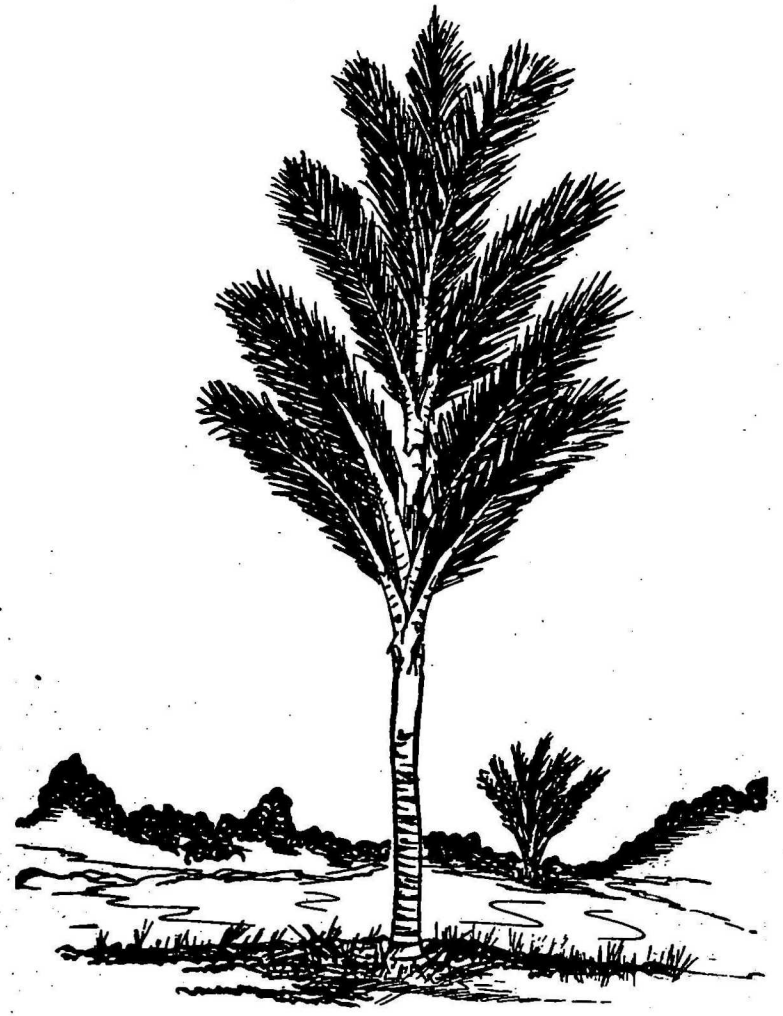
The trunkless nipa palm, which grows in salt water as a mangrove, has clusters of small edible nuts and contains a small amount of palatable liquid. This is the only palm that grows in tidal water.



Sago Palm (Metroxylon)

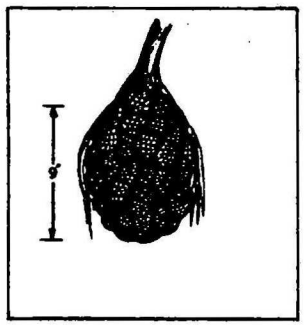
This thorny palm has an erect trunk 12 to 15 feet high and is found generally in valleys, along rivers, and in fresh water swamps. The palm does not grow at altitudes above 3,000 feet. The leaves are large and sometimes 30 feet long. The tree attains a height of 40 feet and has a trunk at least 18 inches in diameter. The sago palm is easy to identify by the size of its trunk and the fact that it grows only in swamp places or on the edge of country where there is a great deal of moisture. The plant produces numerous sprouts around its base. The terminal buds, which are the undeveloped leaves at the top of the trunk, are edible. The sago, which is a starchy food, comes from the pithy trunk of the palm. This pith contains large quantities of starch and is a most important commercial source. The palm is useless when mature, which is when it produces a flowering spike at its top. To test whether a palm is suitable for the production of sago it is advisable to remove a small portion of the pithy trunk with an axe or machete. Chew a small portion of the pith and spit out the resulting juice into the palm of the hand. Allow the juice to remain for a minute then slowly pour off. If a starchy sediment remains on the hand the palm is ready to be used, but not if the sediment flows away with the saliva. A method of obtaining this sago starch is to fell the palm near its base. The trunk is then divided into convenient sections. The rind, which is about one quarter of an inch thick, is removed, leaving the pithy brownish yellow inner portion exposed. This pith is crushed under water. It disintegrates into a pulpy mass which is kneaded with water through a strainer coarse enough to allow the sediment to pass through with the water into a container. If no strainer is available, the pith may be crushed under water which will separate the fibre and allow the starch to settle to the bottom of the container as a dirty white powder. After several washings, the starch can be dried. When a sufficient quantity of sago is obtained, the sago is placed in a porous container by wrapping the sago in large leaves or bark, then hanging up the bundle which drains off the water. If brackish water is used the sago will have a grey colour. Crudely prepared sago does not keep well. Prepared sago is a floury starchy mass that is light brown in colour. Sago is cooked by pouring boiling water on to it and stirring it briskly over a fire. The scum which appears on the surface is removed as soon as it collects. The remainder is boiled until the sago has the consistency of glue. In this form it is not very palatable unless sugar is added. Sago may be wrapped in leaves and the bundles baked in the coals of a fire. Fresh pith can be toasted and eaten, but has rather a bitter taste. Another method is to make a dough by adding water to the sago. Salt to taste and fry the dough. The extraction of the bud is as already described. It may either be eaten raw or boiled for about 15 minutes.

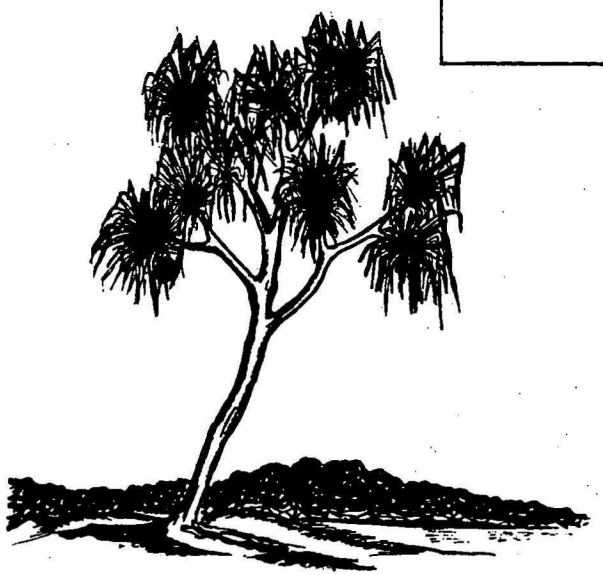
Sago Palm



Pandanus Palm (Pandanus tectorious)

The pandanus is one of the trees most frequently found on the coastlines throughout the tropical zone. It usually grows in very moist soil and can be found at altitudes up to 10,000 feet near mountain streams and creeks. The pandanus has long narrow leaves, saw-like on the edge and mid-rib. The leaves are plaited by the natives into baskets and other domestic articles. The trunk is covered with small spikes very painful to the touch. The fruit grows in large red oval-shaped heads which break up into small pieces when ripe. The surface is rough and covered by small round projections. Upon breaking open the pieces they will be found to contain a series of small grey, narrow, oval containers closely packed together. The small containers surround the seed which contains an oily juice. The juice, which may be sucked from the seed when ripe, has a rich *"fruity"* or *"winey"* smell. The seeds are nutritious and vary in quality, but are rather difficult to extract. Sometimes a machete or stone is necessary to extract them. It is best to dry the small grey containers in the sun before cracking open to obtain the seed.





BARK

The inner bark of numerous trees can be eaten raw or cooked. In famine areas people make flour from the inner bark of trees. The thin, green, outer bark and white, innermost bark are normally used for food because brown bark ordinarily contains bitter tannin.

Among trees whose bark is used as sources of food are the poplars (including cottonwoods and aspens), birches, and willows. The inner bark and growing tips of a few species of pine, including the Scotch bark pine of Northern Europe and Asia, can also be used. Pine bark is especially valuable for Vitamin C. The outer bark of these pines is scraped away and the inner bark stripped from the trunk and eaten fresh, dried or cooked. It may also be pulverized into flour.

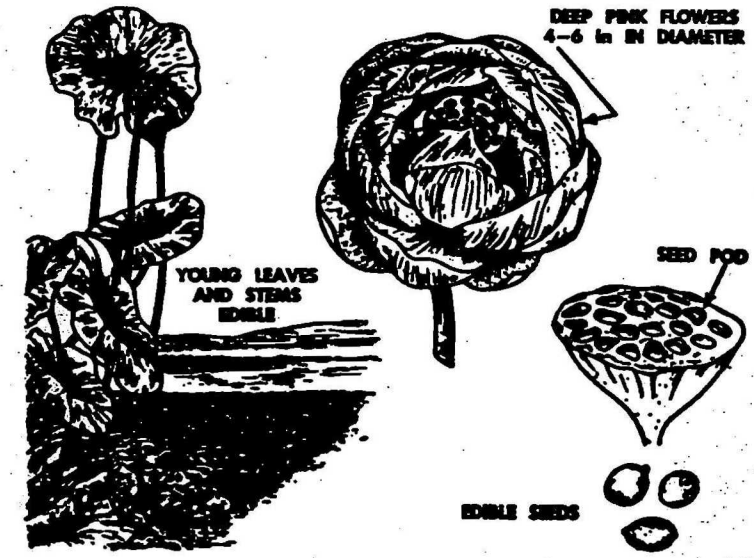
Bark is most palatable when newly formed in the spring.

WATER PLANTS

Plants that grow in very wet places along margins or rivers, lakes, and ponds, and those growing directly in water are of potential value as survival food. The succulent underground parts and stems are most frequently eaten. Poisonous water plants are rare. In temperate climates, the water hemlock is the most poisonous plant around marshes and ponds. In the tropics, the various members of the calla lily family often grow in very wet places with leaves that look like an arrowhead. Taro, jack-in-the-pulpit, calla lily, and sweet flag are members of the arum family. To be eaten, the members of this family must be cooked in several changes of water to destroy the irritant crystals in the stem.

Lotus Lily (Nelumbium nelumbo)

This plant grows in fresh water lakes, ponds, and slow streams through Asia to China and Japan. It also grows in the Philippines, Indonesia and North Australia. The leaves of the lotus lily are shield shaped, one to three feet across. They stand five to six feet above the surface of the water and grow either pink, white, or yellow flowers four to 10 inches in diameter. Eat the young stems and leaves after cooking but the rough, outer layer of the young stems should first be removed. The seeds also are edible when ripe. Remove the bitter embryo, then boil or roast them. Also edible are the root-stalks, which grow 50 feet long with tuberous enlargements. These are boiled and eaten like potatoes.

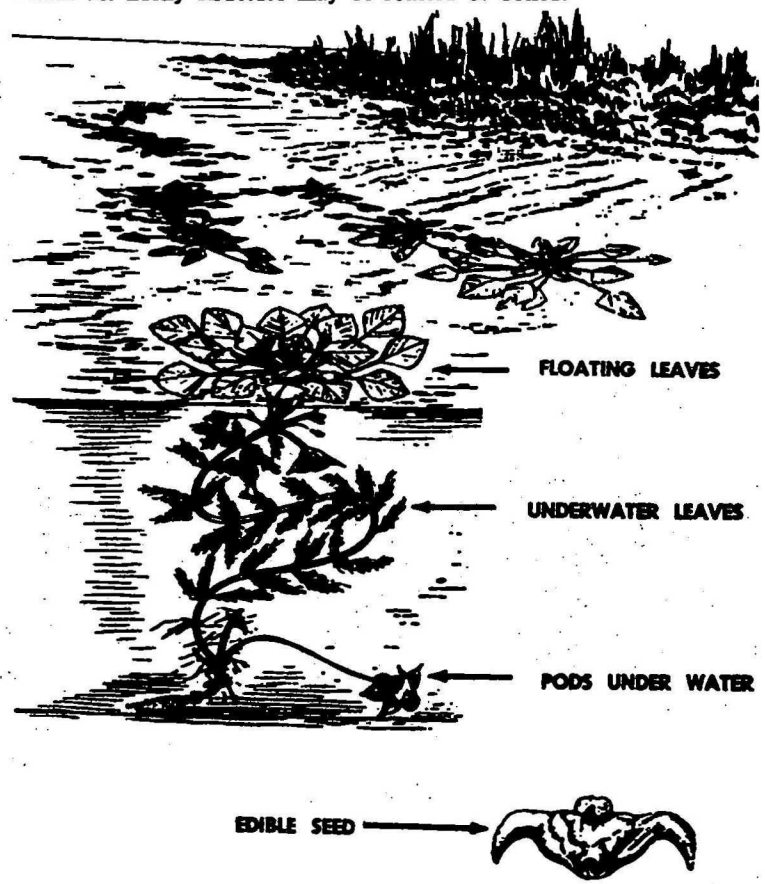


Water Lettuce

This plant grows throughout the tropics in both Africa and Asia. It is found only in very wet places, usually as a floating water plant. Look for it in still lakes, ponds and backwaters. Look for little plantlets growing from the margins of the leaves. These grow in the shape of a rosette, and often cover large areas in the regions where found. The plant's leaves look much like lettuce and are very tender. Eat the fresh leaves like lettuce, but only those that are well out of the water.

Water Chestnut (Eleocharis duhcis)

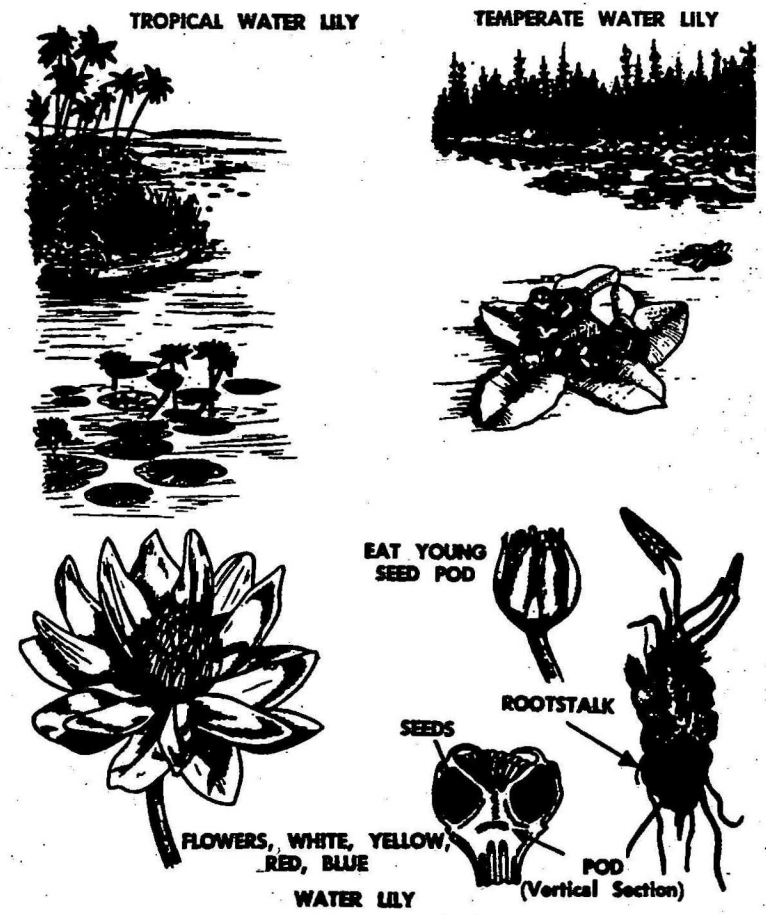
The water chestnut is a native of Asia, but has spread to both tropical and temperate areas of the world, including Australia. It is found as a free floating plant on rivers, lakes, and ponds in quiet water. The plant covers large areas wherever it occurs and has two kinds of leaves — the submerged leaf, which is long, root-like, and feathery; and the floating leaves, which form a rosette on the surface of the water. The nuts borne beneath the water are an inch or two broad with strong spines that give them the appearance of a horned steer. The seed living within the horny structure may be roasted or boiled.



Water Plantain

Water Plantain

This white flowered plant is found most frequently around fresh water lakes, ponds and streams, where it is often partly submerged in a few inches of water. It is usually abundant in marshy areas throughout the Temperate Zone and has long stalked, smooth, heart-shaped leaves with three to nine parallel ribs. Thick, bulb-like root-stocks which grow below the ground, lose their acrid taste after being dried. Cook them like potatoes.



Water Lilies (Nymphaea and Nuphar)

Water lilies occur in all the continents. Two main types occur, temperate water lilies that produce enormous root-stalks and yellow or white flowers that float on the water surface; and tropical water lilies that produce large edible tubers and flowers that are elevated above the water surface.

Root-stalks or tubers may be difficult to obtain because of deep water. The fleshy roots of water lilies (as opposed to the water hyacinth, which is a floating plant) are obtainable in most places where there is still or extremely slow moving water. Although edible raw they should be boiled or roasted. The seeds of the large water lily may be obtained after the flower has gone to seed, and may be eaten raw or roasted. If roasted, the seeds are pounded into a dough and then roasted on coals for half an hour. The leaf stems may be skinned and eaten raw like celery. The leaves may be burned and the ashes used to season food. The roots are starchy and therefore full of food if they can be reached. Eat either raw or boiled. Only one kind in South Africa is suspected of having poisonous properties; all others are perfectly safe.

Stems may be cooked in a stew. The young seed pod may be sliced and eaten as a vegetable. The seeds, though they may be bitter, are very nourishing. They may be dried and rubbed between stones as flour. The water lily is considered an important food item by native peoples in many parts of the world.

Ant Plants. Ant plants are often found on the branches of mangroves and other coastal plants, and even in some trees in the mountain jungles. They consist of a tuber about the size of a football with a small tuft of leaves on top. The tuber is riddled with cavities inhabited by ants, which will attack vigorously when the plant is disturbed.

Thorny and Prickly Plants. Thorny and prickly plants should be avoided. The lawyer vine, *"wait-a-while"* or rattan is one of the most troublesome.

Irritating Hairs. Certain vines in the jungle have velvety pods covered with the minute hairs which cause intense itching when brushed or touched. If these hairs cannot be picked out, shaving is the next best treatment. On certain types of young bamboo there is a prickly form of down, which causes intense irritation and sores. When working this type of bamboo, be certain to wear jungle gloves, or at least cover the hands.

Stinging Trees. The gympie tree is the most common. There are several types of these stinging trees and nettles. All types have large velvety heart-shaped leaves covered with stinging hairs. When these come in contact with the skin, a violent stinging sensation develops, and if a large area is affected the pain is intolerable and in extreme cases even death may result. The pain lasts for a long time and recurs when the affected part is washed, even weeks afterwards. The irritation is due to the penetration of flinty hairs and the injection of formic acid. The best antidote is the application of an alkaline agent such as carbonate of soda or ammonia. If these are not available, moistened wood ashes or charcoal may be used as a substitute. Emergency treatment which may give some relief is to rub the affected parts with the inner bark of the stinging tree itself or the lather made from the bark or leaves of the red ash. Stinging trees grow to a large size but the small specimens with leaves near the ground are the most dangerous. When cutting these trees, care must be exercised to avoid inhaling any flying hairs which will cause an intense irritation of the membranes of the nose and throat. To prevent this, a handkerchief should be tied over the nose and mouth.

Stinging Nettle. Stinging nettle causes a similar irritation but is less dangerous than the stinging trees. Generally, these occur in clearings and along tracks. The antidote is the same as for the stinging tree.

Irritant Saps. The juice of the milky mangrove (the only mangrove which has this white sap) causes severe pain and sometimes blindness if it gets into the eyes. It may produce blistering of the skin. One tablespoonful, if swallowed, is a fatal dose. The juice of pawpaws and of mangoes may cause inflammation when left in contact with the skin. Severe irritation is caused by the sap and also the crushed tissues of fruits of certain palms, especially the fish-tail palm and the sugar palm. The fruits of unknown palms must be handled with caution, particularly when crushed or decayed, because many have irritating crystals. Many plants of the taro family produce similar irritation, due to minute crystals of calcium exalate. Plants of this type should not be chewed or their tubers used for food unless properly prepared. The common cunjevoi, or green lily, is one of these plants.

Poisonous Fruits and Berries. Certain animals and birds can eat plants poisonous to humans. Signs of food having been eaten by animals or birds cannot be taken as evidence that it is fit for human consumption. Birds can eat the berries of the strychnine tree which are fatal to man. Tomatoes grow wild in certain jungle clearings, but any other tomato-like fruit is apt to be poisonous and must be avoided. Yams with an acrid taste or which sting the inside of the lips or tip of the tongue when a small piece is applied should not be eaten unless properly prepared and cooked, but without experience such preparation should not be attempted. The bitter cassava contains prussic acid and is poisonous unless the tuber is shredded and properly washed and dried before cooking.

Illustrations. A few of the common and more dangerous of the poisonous plants are illustrated.

Milky Mangrove or Blind-your-eyes (Excoecaria agellocha)

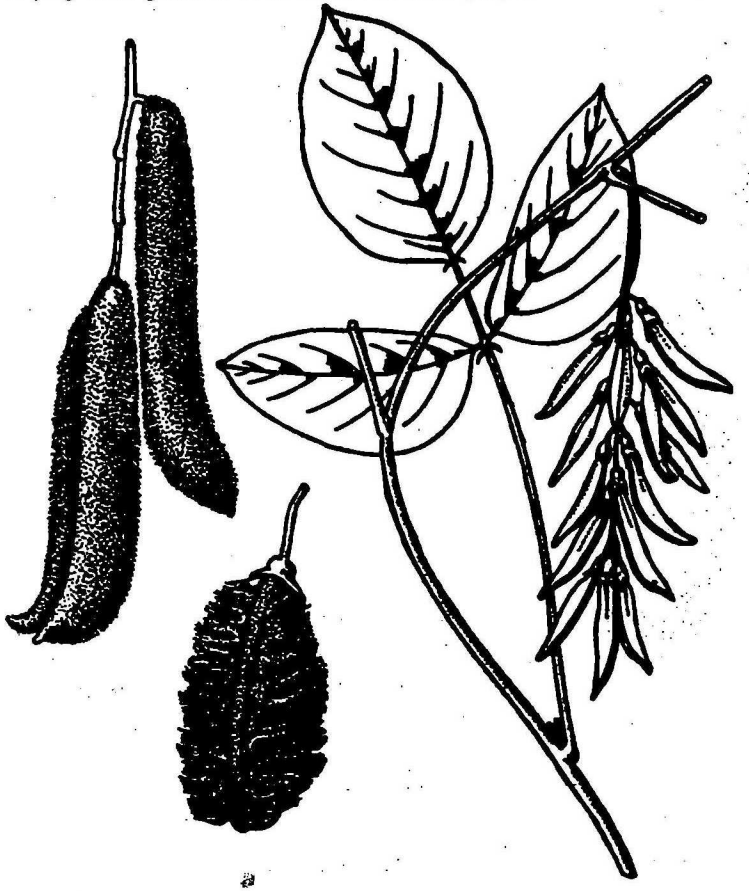
This small tree or shrub is only found in mangrove swamps on the coast or in estuaries. Do not touch, cut or even burn this tree, everything about it is an irritant, even the smoke. The milky juice which easily spurts out causes violent blistering and even blindness if it gets in the eyes.

This shrub is distinguished from other mangroves since it is the only one with a white milky sap. When in doubt do not cut the stems to find out — leave well alone; the juice may spurt in your face.

Milky Mangrove or Blind-your-eyes

Cowhage or Cowitch (Mucuna prureons) (Mucuna biplicata) (Mucuna cyanosperma)

These climbing plants are found in thickets and scrub, but are generally absent from true forest. The flowers and pods are covered with many stiff hairs which readily break off on touching and penetrate the skin. The hairs are not poisonous but cause considerable irritation; they are very dangerous if they get into the eyes. These climbers have flowers varying from greenish white to red or dark purple.



Nettle Tree (Laportea spp)

These small trees have large velvety leaves which are heart shaped. The many small flowers are green or green-white.

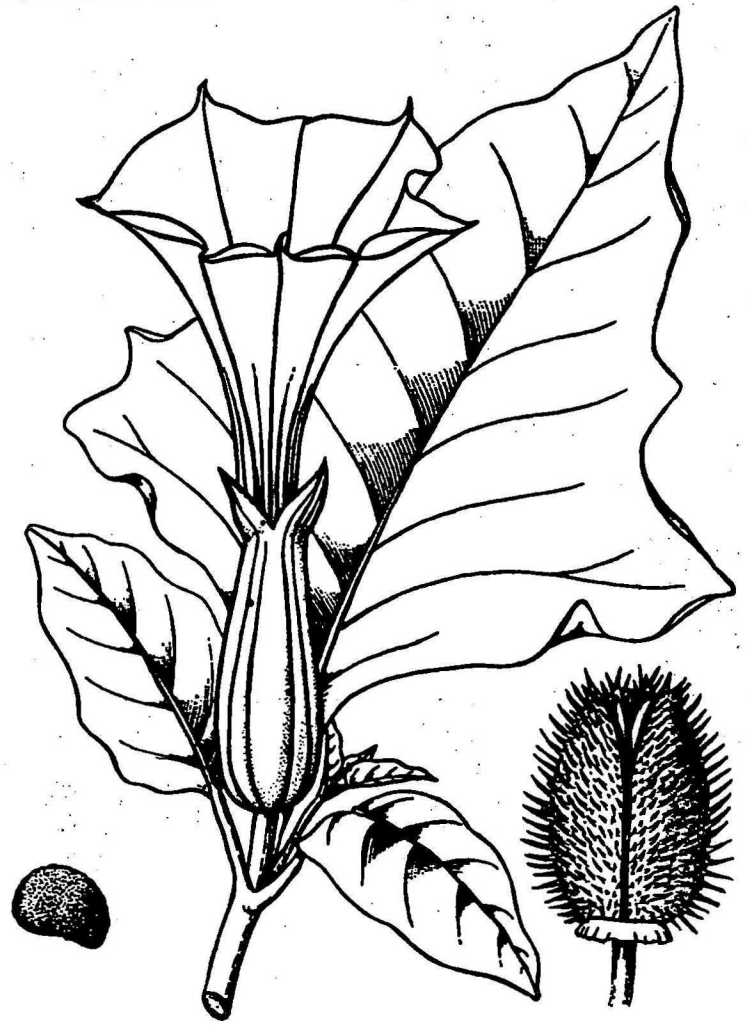
When touched the trees produce a burning sensation; the sting may be serious if a considerable area of skin is affected by the stinging hairs, easily laying up a man for days with intense pain and quite high fever. The nettle tree is especially common in and near ponds, so take care when washing or bathing.

Do not cut these trees down if it can be avoided; if not, tie a handkerchief around the face to prevent the hairs irritating nose or throat. If stung, relieve the irritation by applying carbonate of soda solution if available; if not, apply wood ashes or charcoal moistened with water.

Nettle Tree

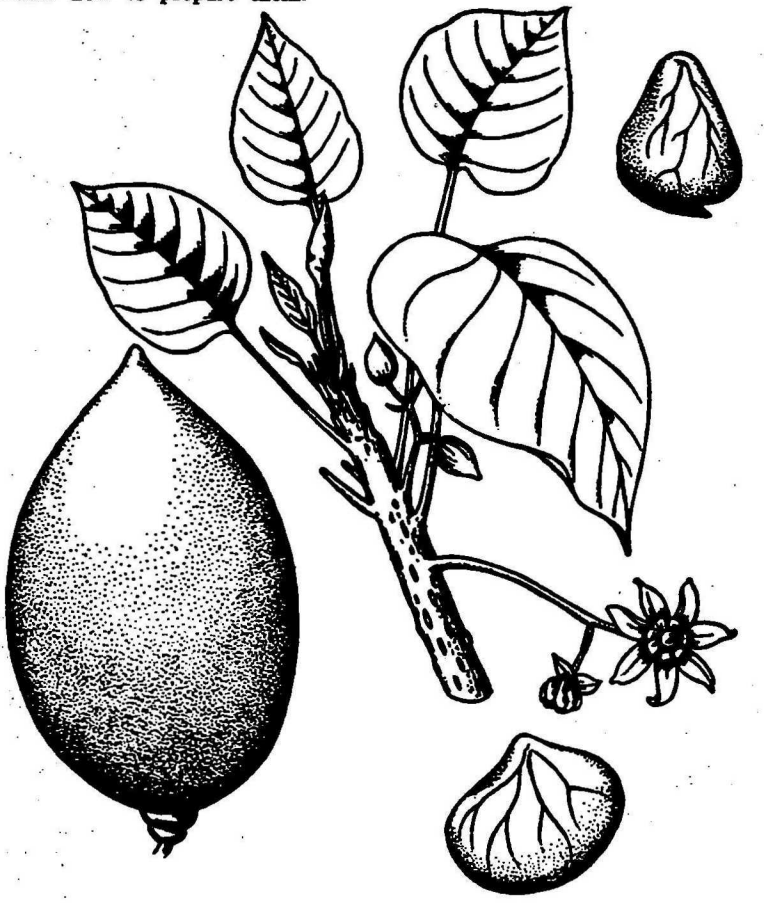
Thorn Apple (Datura metel)

A common weed of cultivated and waste land which grows into a branching shrubby plant. The flowers are whitish yellow and trumpet like; the fruits are rather like oblong horse chestnut fruits but more spiny. Do not eat any part of the plant as all parts are poisonous, especially the seeds.



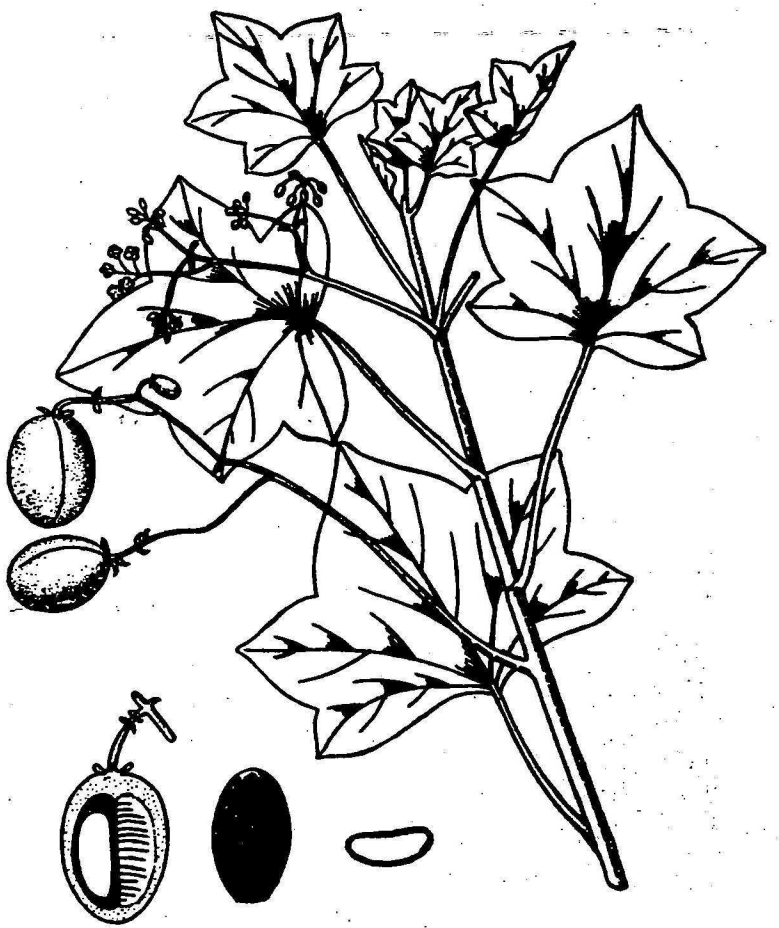
Pangi (Pangium edule)

A tall tree found in forests and also planted. The large fruits, up to 10 inches long are brown with rust coloured hairs. The seeds are very poisonous and contain prussic acid. Natives may eat them but they know how to prepare them.



Physic Nut (Jatropha curcas)

The physic nut is a shrub, common in fences and hedgerows. The large seeds are violently purgative and should not be eaten.



Castor Oil Bean (Ricinus communis)

The castor oil bean is a coarse upright shrub or shrub-like plant common in thickets and open sites. The mottled seeds with a protuberance at one end are poisonous and a violent purgative. In all circumstances leave well alone.

Rengas (Gluta, Melanorrhea spp)

There are several kinds of tall forest trees known jointly as rengas. The bark and timber contain a powerful irritant capable of causing a localized rash. They should not be used for timber.

Strychnine Plant.

This plant grows wild throughout the tropics. The seeds contain the deadly strychnine.