Severe Bleeding

Severe bleeding from any major blood vessel in the body is extremely dangerous. The loss of 1 litre of blood will produce moderate symptoms of shock. The loss of 2 litres will produce a severe state of shock that places the body in extreme danger. The loss of 3 litres is usually fatal.

Shock

Shock (acute stress reaction) is not a disease in itself. It is a clinical condition characterized by symptoms that arise when cardiac output is insufficient to fill the arteries with blood under enough pressure to provide an adequate blood supply to the organs and tissues.

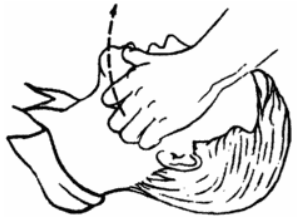
2.3 LIFESAVING STEPS

Control panic, both your own and the victim's. Reassure them and try to keep them quiet.

Perform a rapid physical exam. Look for the cause of the injury and follow the ABCs of first aid, starting with the airway and breathing, but be discerning. A person may die from arterial bleeding more quickly than from an airway obstruction in some cases.

2.3.1 OPEN AIRWAY AND MAINTAIN

You can open an airway and maintain it by using the following steps —

Step 1	Check if the victim has a partial or complete airway obstruction. If they can cough or speak, allow them to clear the obstruction naturally. Stand by, reassure the victim, and be ready to clear their airway and perform mouth-to-mouth resuscitation should they become unconscious. If their airway is completely obstructed, administer abdominal thrusts until the obstruction is cleared.
Step 2	Using a finger, quickly sweep the victim's mouth clear of any foreign objects, broken teeth, dentures, sand.
Step 3	Using the jaw thrust method, grasp the angles of the victim's lower jaw and lift with both hands, one on each side, moving the jaw forward. For stability, rest your elbows on the surface on which the victim is lying. If their lips are closed, gently open the lower lip with your thumb. 
Step 4	With the victim's airway open, pinch their nose closed with your thumb and forefinger and blow two complete breaths into their lungs. Allow the lungs to deflate after the second inflation and perform the following: • Look for their chest to rise and fall. • Listen for escaping air during exhalation. • Feel for flow of air on your cheek.
Step 5	If the forced breaths do not stimulate spontaneous breathing, maintain the victim's breathing by performing mouth-to-mouth resuscitation
Step 6	There is danger of the victim vomiting during mouth-to-mouth resuscitation. Check the victim's mouth periodically for vomit and clear as needed

ⓘ Cardiopulmonary resuscitation (CPR) may be necessary after cleaning the airway, but only after major bleeding is under control.

Keep Your Teeth Clean

Thoroughly clean your mouth and teeth with a toothbrush at least once each day. If you don't have a toothbrush, make a chewing stick. Find a twig about 20 cm long and 1 cm wide. Chew one end of the stick to separate the fibres. Now brush your teeth thoroughly. Another way is to wrap a clean strip of cloth around your fingers and rub your teeth with it to wipe away food particles. You can also brush your teeth with small amounts of sand, baking soda, salt, or soap.

If you have cavities, you can make temporary fillings by placing candle wax, pine tree resin, aspirin, hot pepper, tooth paste, or portions of a ginger root into the cavity. Make sure you clean the cavity by rinsing or picking the particles out of the cavity before placing a filling in the cavity. See **Field Dentistry** (Page 2-17) for more information.

Take Care of Your Feet

To prevent serious foot problems, break in your shoes before wearing them on any mission. Wash and massage your feet daily. Trim your toenails straight across. Wear an insole and the proper size of dry socks. Powder and check your feet daily for blisters.

If you get a small blister, do not open it. An intact blister is safe from infection. Apply a padding material around the blister to relieve pressure and reduce friction. If the blister bursts, treat it as an open wound. Clean and dress it daily and pad around it. Leave large blisters intact. To avoid having the blister burst or tear under pressure and cause a painful and open sore, do the following –

Step 1	Obtain a sewing-type needle and a clean or sterilized thread.
Step 2	Run the needle and thread through the blister after cleaning the blister.
Step 3	Detach the needle and leave both ends of the thread hanging out of the blister. The thread will absorb the liquid inside. This reduces the size of the hole and ensures that the hole does not close up.
Step 4	Pad around the blister.

Get Sufficient Rest

You need a certain amount of rest to keep going. Plan for regular rest periods of at least 10 minutes per hour during your daily activities. Learn to make yourself comfortable under less than ideal conditions. A change from mental to physical activity or vice versa can be refreshing when time or situation does not permit total relaxation.

Keep Camp Site Clean

Do not soil the ground in the camp site area with urine or faeces. Use latrines, if available. When latrines are not available, dig "cat holes" and cover the waste. Collect drinking water upstream from the camp site. Purify all water (by distillation if possible).

2.2 MEDICAL EMERGENCIES

Some common medical problems and emergencies you may be faced with include breathing problems, severe bleeding, and shock.

Breathing Problems

Any one of the following can cause airway obstruction, resulting in stopped breathing –

- Foreign matter in mouth of throat that obstructs the opening to the trachea.
- Face or neck injuries.
- Inflammation and swelling of mouth and throat caused by inhaling smoke, flames, and irritating vapours or by an allergic reaction.
- "Kink" in the throat (caused by the neck bent forward so that the chin rests upon the chest) may block the passage of air.

When unconscious, the tongue may block the passage of air to the lungs. The muscles of the lower jaw and tongue relax as the neck drops forward, causing the lower jaw to sag and the tongue to drop back and block the passage of air.

Animal Foods

Meat is more nourishing than plant food. In fact, it may even be more readily available in some places. However, to get meat, you need to know the habits of, and how to capture, the various wildlife.

To satisfy your immediate food needs, first seek the more abundant and more easily obtained wildlife, such as insects, crustaceans, molluscs, fish, and reptiles. These can satisfy your immediate hunger while you are preparing traps and snares for larger game.

2.1.3 PERSONAL HYGIENE

In any situation, cleanliness is an important factor in preventing infection and disease. It becomes even more important in a survival situation. Poor hygiene can reduce your chances of survival. If you feel like letting your hygiene go for a while, turn to (Page 2-15) to see what may be in your future.

A daily shower with hot water and soap is ideal, but you can stay clean without this luxury. Use a cloth and soapy water to wash yourself. Pay special attention to the feet, armpits, crotch, hands, and hair as these are prime areas for infestation and infection. If water is scarce, take an "air" bath. Remove as much of your clothing as practical and expose your body to the sun and air for at least 1 hour. Be careful not to sunburn.

If you don't have soap, use ashes or sand, or make soap from animal fat and wood ashes, if your situation allows.

To make soap

Step 1	Extract grease from animal fat by cutting the fat into small pieces and cooking them in a pot.
Step 2	Add enough water to the pot to keep the fat from sticking as it cooks.
Step 3	Cook the fat slowly, stirring frequently.
Step 4	After the fat is rendered, pour the grease into a container to harden.
Step 5	Place ashes in a container with a spout near the bottom.
Step 6	Pour water over the ashes and collect the liquid that drips out of the spout in a separate container. This liquid is the potash or lye. Another way to get the lye is to pour the slurry (the mixture of ashes and water) through a straining cloth.
Step 7	In a cooking pot, mix two parts grease to one part potash.
Step 8	Place this mixture over a fire and boil it until it thickens.

After the mixture – the soap – cools, you can use it in the semi-liquid state directly from the pot. You can also pour it into a pan, allow it to harden, and cut it into bars for later use.

Keep Your Hands Clean

Germs on your hands can infect food and wounds. Wash your hands after handling any material that is likely to carry germs, after visiting the latrine, after caring for the sick, and before handling any food, food utensils, or drinking water. Keep your fingernails closely trimmed and clean, and keep your fingers out of your mouth.

Keep Your Hair Clean

Your hair can become a haven for bacteria or fleas, lice, and other parasites. Keeping your hair clean, combed, and trimmed helps you avoid this danger.

Keep Your Clothing Clean

Keep your clothing and bedding as clean as possible to reduce the chance of skin infection as well as to decrease the danger of parasitic infestation. Clean your outer clothing whenever it becomes soiled. Wear clean underclothing and socks each day. If water is scarce, you can "air" clean your clothing by shaking, airing, and sunning for 2 hours. If you are using a sleeping bag, turn it inside out after each use, fluff it, and air it.

DOOM

SURVIVAL GUIDE

2 Basic Survival Medicine

Many survivors have reported difficulty in treating injuries and illness due to the lack of training and medical supplies. Survivors have related feeling of apathy and helplessness because they could not treat themselves in this environment.

One man with a fair amount of basic medical knowledge can make a difference in the lives of many. Without qualified medical personnel available, it is you who must know what to do to stay alive.

2.1 BASIC MAINTENANCE OF HEALTH

To survive, you need water and food. You must also apply high personal hygiene standards.

2.1.1 WATER

You replace the water as you lose it. Trying to make up a deficit is difficult in a survival situation, and thirst is not a sign of how much water you need.

Most people cannot comfortably drink more than 1 litre of water at a time. So, even when not thirsty, drink small amounts of water at regular intervals each hour to prevent dehydration.

If you are under physical and mental stress or subject to severe conditions, increase your water intake. Drink enough liquids to maintain a urine output of at least 0.5 litres every 24 hours.

With the loss of water there is also a loss of electrolytes (body salts). The average diet can usually keep up with these losses but in an extreme situation or illness, additional sources need to be provided. A mixture of 0.25 teaspoon of salt to 1 litre of water will provide a concentration that the body tissues can readily absorb.

The following are basic guidelines for the prevention of dehydration —

- Always drink water when eating. Water is used and consumed as a part of the digestion process and can lead to dehydration.
- Acclimatize. The body performs more efficiently in extreme conditions when acclimatized.
- Conserve sweat not water. Limit sweat-producing activities but drink water.
- Ration water. Until you find a suitable source, ration your water sensibly. A daily intake of 0.5 litres of a sugar-water mixture (2 teaspoons per litre) will suffice to prevent severe dehydration for at least a week, provided you keep water losses to a minimum by limiting activity and heat gain or loss.

2.1.2 FOOD

The two basic sources of food are plants and animals (including fish). In varying degrees both provide the calories, carbohydrates, fats, and proteins needed for normal daily body functions.

Calories are a measure of heat and potential energy. The average person needs 2,000 calories per day to function at a minimum level. An adequate amount of carbohydrates, fats, and proteins without an adequate caloric intake will lead to starvation and cannibalism of the body's own tissue for energy.

Plant Foods

These foods provide carbohydrates – the main source of energy. Many plants provide enough protein to keep the body at normal efficiency. Although plants may not provide a balanced diet, they will sustain you even in the arctic, where meat's heat-producing qualities are normally essential. Many plant foods such as nuts and seeds will give you enough protein and oils for normal efficiency. Roots, green vegetables, and plant food containing natural sugar will provide calories and carbohydrates that give the body natural energy.

- You can dry plants by wind, air, sun, or fire. This retards spoilage so that you can store or carry the plant food with you to use when needed.
- You can obtain plants more easily and more quietly than meat. This is extremely important when trying to maintain a low profile.

- Toilet paper. Remove from the roll to save space.
- 5 cigarette lighters. These are superior to matches and will dry quickly if you get them wet. 5 will last a long time if you only use them to light campfires. It will take you quite some time before you can make fire without one.
- A few firelighters. When this runs out carry small amounts of dry kindling.
- A couple of good quality knives.
- A good quality multi-tool (such as Gerber or Leatherman).
- Small hand axe.
- A hand-chainsaw will be handy for building larger shelters later.
- File and a sharpening stone.
- Camping shovel.
- Stainless steel billycan and other containers.
- Fishing kit. So-called 'suicide' hooks will not rust over time, as they are stainless steel.
- Plenty or cord and snare wire (enamelled winding wire also works well).
- 10 or more metres of rope. This is light and can be hung on the outside of your pack.
- Sewing kit. Include large needles and well as small ones.
- Shotgun or rifle and ammo if it suits you.
- Small tent or tarpaulin or similar sheet of plastic to create temporary shelters from. A tarp can be more versatile than a tent, but offers little shelter unless great care is taken in construction.
- Mosquito net.
- Sleeping bag or bedroll and blankets.
- Spare clothes and socks. These can be rolled up with your bedding.
- You may want to carry some assorted packets of seeds for when you reach a safe area.

1.6.3 LARGER SURVIVAL KITS

When you are travelling in a vehicle or with a group of people on foot, you can take a larger selection of goods and divide the weight amongst the group.

It should contain the same basic gear as the rucksack kit, scaled up for many people. Some extra items you may include are:

- As much food and water as the group can carry. If possible tinned foods should be carried. They take up more space but require little to no water to be used in the preparation.
- Large medical kit including books and medication.
- Fishing rods, nets and a large tackle kit. Crab pots do not take up much space.
- Cooking and eating utensils such as large pots and frypans.
- Hand tools for creating shelter and other items.

If you are planning to prepare an area for survival of a large group of people then the type of community you wish to create will dictate the items you need to acquire. Remember the guidelines of keeping a low profile and not attracting attention to yourself or your efforts might be in vein.

This guide does not address most of the issues that will be associated with such a setup, which may range from an early 1800's colony, to a hi-tech para-military operation. However, you may want to keep this book in mind if things do not turn out quite as planned.

1.4.2 SEAWATER

Sea water should never be drunk straight under any circumstances. The body uses more water than it gains from the seawater to remove the salt. Dinking nothing but seawater can kill you in a matter of hours.

1.4.3 DISTILLATION

The safest solution for any water source is distillation.

Be aware that drinking distilled water in a long term situation can leach nutrients from your body. There are many means by which to replace essential nutrients such as vitamin pills, or better yet, a varied diet.

Another method is to add a small amount of seawater to all the water you drink. You should *almost* be able to taste the salt.

1.5 SHELTER

Even if you have a strong bunker which survives the cataclysms, it will probably not suffice for the long term unless it is huge. If it is huge then you probably have enough money to have had people looking after you for a long time now and are not even reading this.

For most, shelter will have to be rebuilt. Shelter can be built from natural materials, and scrap materials you may find. Simple tee-pee and lean-to style huts may be adequate or larger structures constructed from wood, stone, mudbrick or anything else you can find.

The larger the structure the more time and resources will need to be dedicated towards building it so ensure the immediate needs of your group are met first.

Natural occurring shelters such as caves should be avoided if you have experienced large earthquakes in your area. More may be coming and even an aftershock can entomb you in darkness.

1.6 SURVIVAL KITS

Your survival kit may be large if you are staying put on a property, medium if you are travelling in a vehicle (or many people on foot) or a single person rucksack and whatever you can fit in your pockets. Below is a guideline only. Your kits will vary based on need.

1.6.1 QUALITY OF ITEMS

Quality is important in selection of all the items including clothing and footwear. They may have to last you the rest of your life. If you can't buy everything at once without buying cheap items, get them as you can afford them – assuming there is time. Remember, quality items rarely come in blister packs with the word 'quality' written in big red letters.

However, paying more money does not always mean more quality. There are many reviews available for survival items which should be researched carefully before spending good money. Once you know what you want, compare prices for that item to make sure you are not paying $200 when you can get the exact thing for $50 elsewhere.

1.6.2 BASIC SURVIVAL KIT

This pack will weigh at least 15 kg until the food and water start to be depleted. Therefore the pack itself should be sturdy. It doesn't have to be fancy, just strong. Pack it so it lays flat on your back because you might be carrying it for some time. Include plastic bags and sheeting to keep the contents dry. You may be travelling in the rain indefinitely.

- This book and another small book on the wild foods in your area.
- 5 or more litres of clean water. This is not nearly enough but it is hard to carry more. Be prepared to replenish it. Note that cargo pants can hold a litre bottle in each pocket.
- As much food as you can carry. Highly compact food such as rice, flour, dehydrated vegetables, instant mash potato, porridge oats, spaghetti etc. Stock cubes are small and add nutrients. Peanut butter is good to mix with rice and is excellent bait for traps. Expect to carry at least 5kg of food alone. Multivitamins should also be included.
- First aid kit.
- Water purifier or distiller kit. Spare filters if you have a purifier.

1.2.1 SURVIVOR CAMPS

You may come across survivor camps set up by the government or military. These camps will operate under the pretence that you will work in exchange for food, shelter and medical care. Depending on your country, government and the individuals running the camp, they will range from genuine humanitarian operations to full blown slave camps.

Your possessions will be confiscated and distributed. You may not be allowed to leave and if you do manage to escape it will be by the skin of your teeth with little to no equipment. Conditions will degrade quickly as stores are depleted without incoming replacements. You cannot assume those running the camp will be fair. Such a situation may even lead to cannibalism when the stores become depleted.

1.3 FOOD

Do not rely on a **large** hoard of goods. Depending on your location and local government, martial law may be declared. One of the first things that will happen in such a situation is that useful civilian goods will be seized and redistributed, rendering your stockpiling efforts useless.

Neighbours may notice you buying unusually large amounts of goods ahead of time and will remember when they are starving. If you are raided by looters, packaged dry goods are easy to take and you will be left with nothing.

It is advisable to start a garden and raise animals such as poultry and fish ahead of time. Such a setup is not suspicious and will keep producing when well tended. It will be far better for you than highly salted survival food anyway. It will be difficult and time consuming for thieves to harvest and is unlikely that they will clean you out. Deploy booby traps at your own discretion.

If you are not in a position to start farming you will need to know how to live off the new landscape. Traps and snares for animals and fish are effective, quiet and relatively easy to set up. Many wild plants can be eaten but care must be taken with identification.

Do not be scared to eat small critters like bugs and worms. These are highly nutritious and even favourable in many countries. They are also abundant in most places.

1.3.1 SEEDS

Seeds should be stored in areas that are cool, dark and dry. Some seeds last longer than others but should be viable for at least twelve months or more. Most seeds need time when they come off a plant to 'cure' before they can be germinated. This can range from days to months.

Keep a varied stock of many types of seeds. You can't assume your climate will remain unchanged and you may be surprised at which food will grow. If you are having trouble cultivating certain types of plant then wait until the weather changes otherwise you will burn through your entire seed stock.

Seeds can be eaten raw but this is not advised. Commercial seeds are guaranteed to germinate via hormones and chemicals. Good for plants, not so good for humans. Some seeds are naturally poisonous and this can vary between seasons. Seeds that may be good to eat in spring may be lethal in winter. Unless you are an expert, or a gambler, DO NOT EAT SEEDS. At the very least you will be trading future nourishment for a small amount of nourishment now.

1.4 WATER

Water is one of the most important survival needs. You will need an endless supply of clean water for drinking, cooking and personal hygiene.

1.4.1 CONTAMINATION OF TRADITIONAL WATER SOURCES

If you are near a flowing river or in an area of constant rainfall you may think you have all the water you need. However, chemical spills, acid rain, volcanic ash and many other factors can affect the quality of water. Commercial water filters can remove bacteria (0.22 micron, or 220 nm pore size) and even viruses (0.02 micron or, 20 nm pore size) but may not remove dangerous chemicals or heavy metals. Rain and groundwater can be contaminated with lead yet be completely clear and tasteless.

Clean water can be collected from condensation from cold surfaces, morning dew, or from plants but these methods take a long time to yield a small amount of water.

1 General Survival Guidelines

In the event of a worldwide catastrophe, emergency services will be stretched beyond their limit. There are simply not enough resources to look after everyone.

Do not expect rescue.

Any stockpiles the authorities may have will be depleted quickly, and more than likely will be distributed between greedy powers before you get a look in.

It is up to YOU to ensure the survival of you and your loved ones.

1.1 PLANNING YOUR SURVIVAL

In your survival strategy, do not make huge plans. Large operations are likely to be noticeable to others and there will be many who will not take steps for their own survival. Do not advertise your plans and limit your group to people you know – family and friends. Even if you don't get along with certain family members, at least you will be with people you know.

1.1.1 CHOICE OF LOCATION

Whether you have a remote property, plan to purchase one or to simply bug out at the last minute, research your location well. First choose a location that is far away from large city centres. When broad disaster strikes, people wander - even when they don't know where they are wandering to. City centres will be death traps and citizens will pour from them in large numbers. There will be a lot of starvation, desperation, confusion and fear. A stampede of scared, hungry people through your community will not do anyone any good.

A rule of thumb is to be 150 km (100 mi) from coastlines or more. Tsunamis can wash water over huge areas of land in a very short time. The power of moving water is immense and easy to underestimate, even when it is not very deep. Choose high ground, at least 20 m (60 ft) higher than the average surrounding level. Rivers can swell and floodplains will flood.

As well as being higher than the surrounding area, you should be about 200 m (600 ft) above sea level. This is the estimated rise in sea levels if the polar caps should melt.

Weather patterns as they stand today cannot be relied upon – even now the weather is changing quicker than experts can predict. Therefore you should consider the possibility of near constant downpour or drizzle in your area. Constant rainfall can liquefy soil, filling the air pockets with water and turning it into a type of quicksand. Coupled with jiggling, rumbling earthquakes, a solid bunker can sink completely into saturated soil, with you in it. The underlying ground should therefore be solid bedrock, and of course, not near a fault line.

1.1.2 TRAVELLING

When you need to travel it is best to keep a low profile. If you have a working vehicle and road travel is still possible, take the back roads. If asked, do not announce your plans or destination; say you are on a 'camping trip' or 'visiting relatives'. If you are on foot, you can follow a main road without travelling on the road itself. Keep yourself well hidden at a distance of 20-100 metres or so, depending on the cover available.

Avoid large gatherings of people. If you are well stocked with survival gear and food, there will be people who feel they deserve your gear more than you do, and will not be kind about it.

1.2 THE MAN

Authorities should generally be avoided. This includes government, military and law enforcement. When panic hits, the structure and rules of society will no longer apply and you cannot assume the police will protect you. Members of the establishment are people too and will be just as scared and confused as everyone else, except they will probably be better armed and more trained than you. Even if you are well armed and proficient with firearms, the last thing you and your family need is a gunfight.

In the confusion and panic, military units may turn rogue, with no fear of the consequences. Remember, those in authority with a heart will most likely be AWOL looking after their families, not roaming in armed gangs. Do not approach these groups.

2.9.5 DENTAL TRAUMA

Below is a list of common dental trauma.

Crown Chip	**Small lines or 'crazing' in the enamel.** These are harmless
Simple Crown and/or Root Fracture	**The tooth is fractured, but no pulp is exposed** This is usually not a problem, but the tooth can be cold sensitive. Smooth rough edges with a nail file and remove small fragments.
Complicated Crown and/or Root Fracture	**The pulp is exposed but the root is intact** Remove and fragments and flush the area thoroughly with saline. If the pulp has been exposed for more than 24 hours, remove about 2mm of the pulp tissue. Seal the exposed area with filling material. Extraction may be needed if pain continues or infection develops.
Intrusion	**The tooth is driven deeper into the socket** Use dental first aid measures. Long term survival of the tooth is poor so extraction may be the best option.
Extrusion	**The tooth is partially pulled out of the socket** Gently replace into the socket. Have the patient bite down gently to ensure the tooth is all the way in. Apply dental first aid measures and extract if pain continues or infection develops.
Tooth Loss	**The tooth is knocked completely from the socket** Do not touch the root segment or scrub the tooth or socket. Rinse the tooth and socket in saline until clean. If immediate replacement is not possible, store in saline, milk or saliva. This will usually not work if after 24 hours. Apply dental first aid.
Primary (baby) Teeth Injuries	**Normally these are not repaired unless needed** Apply dental first aid and consider extraction if pain continues or infection develops.

2.9.6 DENTAL EXTRACTIONS

Before antibiotics, this was the main treatment for dental infections. An infection in the root of the tooth was treated by pulling the tooth and allowing it to drain.

The basic principle is to loosen the tooth from the gum and the jaw, then gently rocking back and forward until loose enough to be removed. The key point is gentle rocking rather than simple pulling. The process however can be a lot more complicated.

Firstly, it will be very painful. Without local anaesthetic, the only option may be blacking out from the pain itself. Secondly, without the proper instruments, gripping the tooth will be difficult. Any solid gripping instrument, such as a pair of pliers can be used if the tips are wrapped in gauze or padded in some other way.

Extreme care must be taken not to shatter the tooth with the gripping device during extraction. This will make it impossible to remove the entire tooth and will result in complications such as infections.

2.9.7 DENTAL PROSTHETICS

Without the ability to chew food, survival will be a lot more difficult. You should take all measures to prevent running out of teeth.

Historically porcelain was used to manufacture dentures, but other materials may be used in a survival situation such as metal, bone and animal and human teeth properly shaped.

2.3.2 CONTROL BLEEDING

In a survival situation, you must control serious bleeding immediately because replacement fluids normally are not available and the victim can die within a matter of minutes. External bleeding falls into the following classifications (according to its source) —

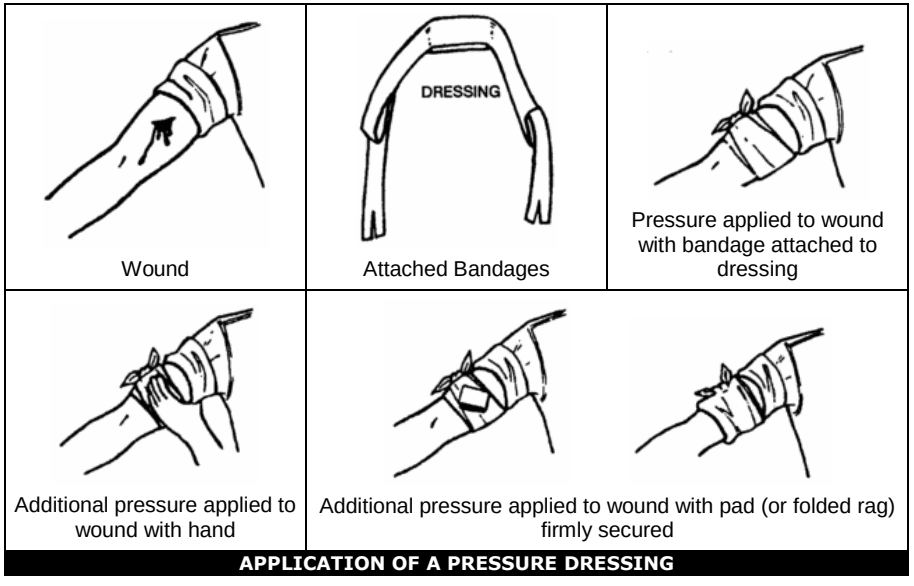
Arterial	Blood vessels called arteries carry blood away from the heart and through the body. A cut artery issues bright red blood from the wound in distinct spurts or pulses that correspond to the rhythm of the heartbeat. Because the blood in the arteries is under high pressure, an individual can lose a large volume of blood in a short period when damage to an artery of significant size occurs. Therefore, arterial bleeding is the most serious type of bleeding. If not controlled promptly, it can be fatal.
Venous	Venous blood is blood returning to the heart through blood vessels called veins. A steady flow of dark red, maroon, or bluish blood characterizes bleeding from a vein. You can usually control venous bleeding more easily than arterial bleeding.
Capillary	The capillaries are the extremely small vessels that connect the arteries with the veins. Capillary bleeding most commonly occurs in minor cuts and scrapes. This type of bleeding is not difficult to control.

You can control external bleeding by direct pressure, indirect (pressure points) pressure, elevation, digital ligation, or tourniquet.

Direct Pressure

The most effective way to control external bleeding is by applying pressure directly over the wound. This pressure must not only be firm enough to stop the bleeding, but it must also be maintained long enough to "seal off" the damaged surface.

If bleeding continues after 30 minutes, apply a pressure dressing. A thick dressing is applied directly over the wound and held in place with a tight bandage. It should be tighter than an ordinary compression bandage but not so tight that it impairs circulation. Once you apply the dressing, do not remove it, even when the dressing becomes blood soaked.



APPLICATION OF A PRESSURE DRESSING

Make fresh, daily dressing changes and inspect for signs of infection.

Elevation

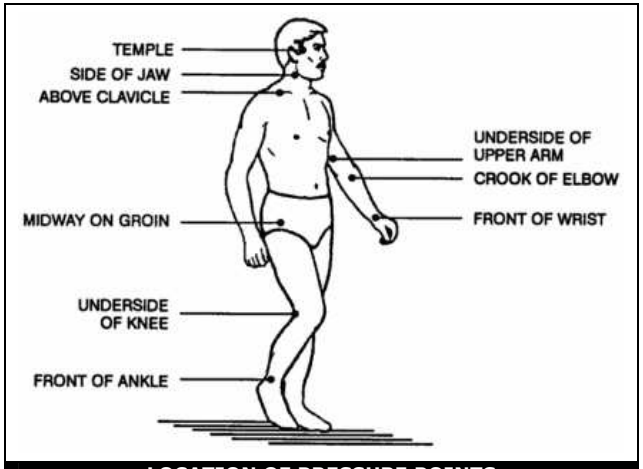
Raising an injured extremity as high as possible above the heart's level slows blood loss by aiding the return of blood to the heart and lowering the blood pressure at the wound. However, elevation alone will not control bleeding entirely; you must also apply direct pressure over the wound. When treating a snakebite however, keep the extremity lower than the heart.

Pressure Points

A pressure point is a location where the main artery to the wound lies near the surface of the skin or where the artery passes directly over a bony prominence.

You can use digital pressure on a pressure point to slow arterial bleeding until the application of a pressure dressing.

Pressure point control is not as effective for controlling bleeding as direct pressure exerted on the wound. It is rare when a single major compressible artery supplies a damaged vessel.



LOCATION OF PRESSURE POINTS

If you cannot remember the exact location of the pressure points, follow this rule: Apply pressure at the end of the joint just above the injured area. On hands, feet, and head, this will be the wrist, ankle, and neck, respectively.

WARNING!!!

Use caution when applying pressure to the neck.

Too much pressure for too long may cause unconsciousness or death.

Never place a tourniquet around the neck.

Digital Ligation

You can stop major bleeding immediately or slow it down by applying pressure with a finger or two on the bleeding end of the vein or artery. Maintain the pressure until the bleeding stops or slows down enough to apply a pressure bandage, elevation, and so forth.

Tourniquet

Use a tourniquet only when direct pressure over the bleeding point and all other methods did not control the bleeding. If you leave a tourniquet in place too long, the damage to the tissues can progress to gangrene, with a loss of the limb later. An improperly applied tourniquet can also cause permanent damage to nerves and other tissues at the site of the constriction.

If you must use a tourniquet, place it around the extremity, between the wound and the heart, 5 to 10 cm above the wound site. Never place it directly over the wound or a fracture. Use a stick as a handle to tighten the tourniquet and tighten it only enough to stop blood flow. When you have tightened the tourniquet, bind the free end of the stick to the limb to prevent unwinding.

After you secure the tourniquet, clean and bandage the wound. A lone survivor does not remove or release an applied tourniquet. In a buddy system, however, the buddy can release the tourniquet pressure every 10 to 15 minutes for 1 or 2 minutes to let blood flow to the rest of the extremity to prevent limb loss.

	Management is by incision and drainage through the gum to the level of the bone. Dental first aid should be applied and antibiotics may be required. Extraction of the tooth will be necessary if treatment is unsuccessful.
Gingival/ Periodontal Abscess	**Infection between the gum and tooth** The abscess is usually on the cheek side. The tooth is usually sensitive to agitation, but not heat or cold. Manage with incision, draining and dental first aid. Antibiotics are usually not necessary.
Pericoronitis	**Infection of the gum overlying a partially erupted tooth** Common in wisdom teeth. Muscle spasms in the chewing muscles are common. It is managed by cleaning out between the tooth and gum and dental first aid measures. Antibiotics are usually not necessary. At times removal of some of the redundant gum tissue may be helpful.
Deep Tissue/ Fascia Infections	Any oral infection can spread quickly through tissues to other areas in the neck causing tissue breakdown, bleeding and obstruction of the airway. Immediate incision and drainage is required along with aggressive antibiotic therapy. This is potentially life threatening and help should be sought if at all possible.

When to use antibiotics

Dental abscesses are best treated by drainage of any collection present. Antibiotics should be used in patients who are systematically unwell – high temperatures, chills, shakes, nausea, vomiting or gross local swelling.

Penicillin 500mg 4 times daily or Erythromycin 500mg 3 times daily are usually acceptable antibiotics. Broader spectrum drugs can also be used.

2.9.4 DRILLING AND FILLING

Cavities in teeth cause pain either because they allow infection into the inside of the tooth, or they expose nerve endings in the pulp of the tooth.

It is fairly easy to provide a temporary filling which covers the hole and protects exposed nerves. There is commercially available filling materials but if these aren't available consider using candle wax, pine tree resin, aspirin, hot pepper, tooth paste, or ginger root in the cavity.

Permanent fillings are more complicated and usually require the cavity to be opened up. The surface hole is usually too small, while there is a larger decayed area below. The cavity is opened up and cleaned with a dental drill.

A 'Dremel' type tool can be used for a dental drill. Use a thin diamond-tipped bit rather than a traditional drill bit. You want to 'route' out the cavity rather than drilling deep into it. Be sure to sterilise the bit first.

If you don't have a suitable drill, improvisation of one will be extremely difficult, especially because a low-rpm drill will be more painful for the patient. In this case, extraction of the tooth is probably the better option. Some cavities can be cleaned out with a scraping tool, if there is a large cavity in the tooth and is easily accessible.

This method should not be used when —

- There is presence of swelling or pus near the tooth.
- If the hole is too deep and the core/pulp of the tooth exposed.
- If the tooth has been painful for a long time, there may be a chronic infection of the pulp.
- The cavity cannot be easily reached, because of position or the size of the hole.

Finding a permanent filling material will be difficult. Gold is one option. After drilling and cleaning the cavity, a small ball of very thin gold film is placed in the cavity. It is slowly tapped and molded into place with a dental pick. This is more difficult than it sounds.

Another option is to fill the cavity with candle wax, then top off with pine pitch. This won't be permanent but may last many years.

2.9.3 DENTAL PAIN AND INFECTION

Standard Dental First Aid

This treatment is standard for many conditions. Symptoms are managed with oral anti-inflammatories, pain medication, local anaesthetic, cold packs, saline gargles and a soft diet.

Dental Pain

Pulpitis	**Inflammation of the dental pulp (toothache)** This pain is often referred to the surrounding area or other teeth. It can be difficult for the patient to identify the offending tooth. The tooth is usually not sensitive to agitation, but may be sensitive to heat, cold or sweets. Usually there is an obvious cause, such as a large cavity. Management is by standard dental first aid.
Periapical Inflammation	**Inflammation, but not infection, at the apex (root base)** The offending tooth is usually easy to locate. The tooth may protrude a bit and/or cause pain with chewing or agitation. Management is by standard dental first aid.
Aphthous Ulcers	**Lesion on oral mucus membrane – cause unclear** There are often multiple ulcers lasting 7 to 15 days. May be triggered by trauma or stress. Manage with standard dental first aid. Topical steroids may shorten healing time.
Muscle Pain and Spasm	**Chewing muscle dysfunction** This can be caused by teeth grinding, jaw clenching, heavy chewing. Manage by muscle rest, soft diet and anti-inflammatories.
Other Causes	Other causes of dental pain include infections (discussed below), facial nerve pain, herpes zoster, vascular pain-migraine, sinus pain and referred pain.

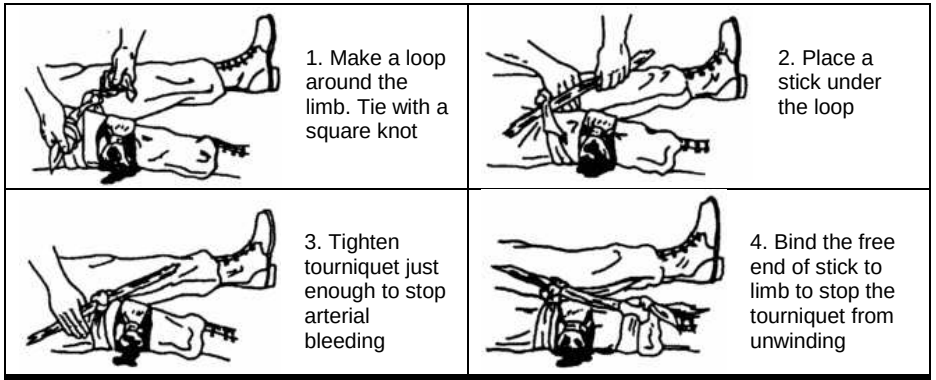
Infections

Herpes Labialis (viral)	**Cold sores on lips, tongue, gingival, palate** Often triggered by sunburn, stress and trauma. The patient often has a tingle of pain before a lesion appears. Manage with standard dental first aid.
Oral Candidiasis (fungal)	**Thrush, caused by the overgrowth of yeast normally found in the mouth** Often seen in the very ill, those with a weak immune system, or those recently taking antibiotics. It looks like white spots or patches in the mouth, may have a 'cottage cheese' appearance and can be rubbed off. The patients' mouth and throat are often very sore and red. Manage by eliminating sources of re-infection (boil toothbrushes in salty water and air dry) and with anti-fungal medication.

Bacterial Infections

Many different organisms present in the oral cavity can cause infections. An Infection can be life threatening if it spreads to deep tissues or into the brain. Fever, local swelling and lymph node swelling is common.

Apical Abscess/ Cellulitis	**Infection of the pulp extending down to the bone and gum.** The gum and tooth base appear normal. This is an infection at the very apex of the roots that has eaten through the thin bone of the jaw. Indications include fever, pain, often an abscess/pus pocket or swelling where the gum tissue meets the lip. No sensitivity to heat or cold.



APPLICATION OF A TOURNIQUET

2.3.3 PREVENT AND TREAT SHOCK

Anticipate shock in all injured personnel. Treat all injured persons as follows, regardless of what symptoms appear —

- If the victim is conscious, place them on a level surface with the lower extremities elevated 15 to 20 cm.
- If the victim is unconscious, place them on their side or abdomen with their head turned to one side to prevent choking on vomit, blood, or other fluids.
- If you are unsure of the best position, place the victim perfectly flat. Once the victim is in a shock position, do not move them.
- Maintain body heat by insulating the victim from the surroundings and, in some instances, applying external heat.
- If wet, remove all the victim's wet clothing as soon as possible and replace with dry clothing.
- Improvise a shelter to insulate the victim from the weather.
- Use warm liquids or foods, a pre-warmed sleeping bag, another person, warmed water in canteens, hot rocks wrapped in clothing, or fires on either side of the victim to provide external warmth.
- If the victim is conscious, slowly administer small doses of a warm salt or sugar solution, if available.
- If the victim is unconscious or has abdominal wounds, do not give fluids by mouth.
- Have the victim rest for at least 24 hours.
- If you are a lone survivor, lie in a depression in the ground, behind a tree, or any other place out of the weather, with your head lower than your feet.
- If you are with a buddy, reassess your patient constantly.

2.4 BONE AND JOINT INJURY

You may face bone and joint injuries that include fractures, dislocations, and sprains.

2.4.1 FRACTURES

There are basically two types of fractures: open and closed. With an open (or compound) fracture, the bone protrudes through the skin and complicates the actual fracture with an open wound. After setting the fracture, treat the wound as any other open wound. The closed fracture has no open wounds. Follow the guidelines for immobilization, and set and splint the fracture.

The signs and symptoms of a fracture are pain, tenderness, discoloration, swelling deformity, loss of function, and grating (a sound or feeling that occurs when broken bone ends rub together).

The dangers with a fracture are the severing or compression of a nerve or blood vessel. For this reason minimum manipulation should be done, and with caution. If the area below the break becomes numb, swollen, cool to the touch, or pale, and the victim shows signs of shock, a major vessel may have been severed. You must control this internal bleeding. Rest the victim for shock, and replace lost fluids.

Often you must maintain traction during the splinting and healing process. You can effectively pull smaller bones such as the arm or lower leg by hand. You can create traction by wedging a hand or foot in the V-notch of a tree and pushing against the tree with the other extremity. You can then splint the break.

Very strong muscles hold a broken thighbone (femur) in place making it difficult to maintain traction during healing. You can make an improvised traction splint using natural material as follows –

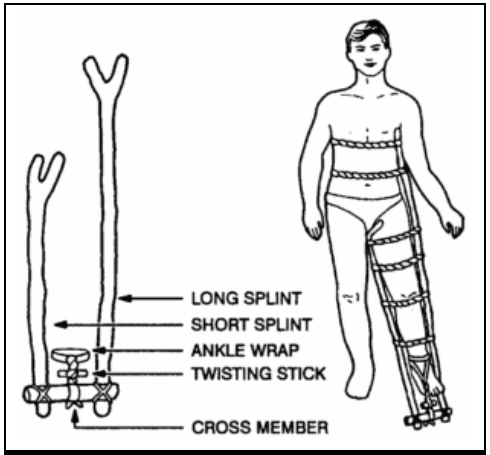
Step 1	Get two forked branches or saplings at least 5 cm in diameter. Measure one from the patient's armpit to 20-30 cm past their unbroken leg. Measure the other from the groin to 20-30 cm past the unbroken leg. Ensure that both extend an equal distance beyond the end of the leg.
Step 2	Pad the two splints. Notch the ends without forks and lash a 20-30 cm cross member made from a 5 cm diameter branch between them.
Step 3	Using available material (vines, cloth, rawhide), tie the splint around the upper portion of the body and down the length of the broken leg. Follow the splinting guidelines.
Step 4	With available material, fashion a wrap that will extend around the ankle, with the two free ends tied to the cross member.
Step 5	Place a 10 x 2.5 cm stick in the middle of the free ends of the ankle wrap between the cross member and the foot. Using the stick, twist the material to make the traction easier.
Step 6	Continue twisting until the broken leg is as long as or slightly longer than the unbroken leg.
Step 7	Lash the stick to maintain traction.

2.4.2 DISLOCATIONS

Dislocations are the separations of bone joints. These misalignments can be extremely painful and can cause an impairment of nerve or circulatory function. You must place these joints back into alignment as quickly as possible.

Signs and symptoms of dislocations are joint pain, tenderness, swelling, discoloration, limited range of motion, and deformity of the joint. You treat dislocations by reduction, immobilization, and rehabilitation.

Reduction or "setting" is placing the bones back into their proper alignment. You can use several methods, but manual traction or the use of weights to pull the bones is the safest and easiest. Once performed, reduction decreases the victim's pain and allows for normal function and circulation. Without an X-ray, you can judge proper alignment by the look and feel of the joint and by comparing it to the joint on the opposite side.



IMPROVISED TRACTION SPLINT

The most acceptable method for amputations in field conditions are as follows —

Step 1	Place a tourniquet above the amputation point to restrict blood flow.
Step 2	An incision is made around the limb through the skin and fat. This incision is made at the lowest viable level. This layer is allowed to retract, exposing the muscles.
Step 3	Go around the limb, cutting the muscle bundles as you go. The muscles are cut near the point where the first layer retracted, but a little further toward the body. As you cut the muscles, they will retract toward the body. As blood vessels are encountered they are cut and tied with sutures, sewn shut, tied with strong fine thread (such as un-waxed dental floss), cauterized or closed by any non-intrusive means possible. Anything used to close the vessel should be sterilised by boiling first. Major nerves should be cut at the highest level possible.
Step 4	Place upward pressure on the skin, fat and muscle mass to push it toward the body and further expose the bone. Cut the bone off at this higher level. The surgical wound should resemble an inverted cone. The idea is to leave as much flesh and skin to cover the stump of the bone to provide natural cushioning once it is healed.
Step 5	Apply bone wax to the end of the bone to prevent oozing. If bone wax is not available, any wax will do as long as it is properly sterilized. As a last resort, pine pitch can be used, but use sparingly. See **Natural Glues** (Page 9-10)
Step 6	Place a layer of fine mesh gauze over the wound and pack the recess loosely with fluffed gauze. Place a stockinette over the stump and secure using adhesive.
Step 7	Wrap the stump with elastic bandages (ace wraps) using compression. Apply about 2.5 kg (5 pounds) traction to pull the skin and muscles over the stump. Continued traction will result in secondary closure over the stump. The elastic bandage needs to be tight enough to hold it, but without restricting circulation.

If bandages are not available, cut cloth into strips and sterilise thoroughly before the procedure. Non-elastic materials will not provide the same traction as 'ace-wraps' so will need to be bound tighter. This will reduce circulation so will need to be loosened for five minutes out of every 12 to 15.

If the skin starts to turn blue/white or grey, then it is bandaged too tightly. The natural colour of healthy tissue is pink. Watch the colour of the area and watch for bleeding.

If pain killers such as pethidine, morphine or opiates are available, administer before and after the operation. Separate the first few doses after surgery by at least 15 minutes to make sure you see the effect on the poor patient. You don't want them to OD after that ordeal.

Watch the temperature, respiration and the wound itself very carefully in the first 12 hours.

2.9 FIELD DENTISTRY

The basics of dentistry can be broken down into 7 areas —

2.9.1 PREVENTATIVE DENTISTRY

Before finding yourself in a primitive living situation make sure you are brushing and flossing daily and getting regular checkups and appropriate treatments. When access to professional dental care is impossible, daily brushing and flossing is essential.

2.9.2 SCALING AND CLEANING

Regular brushing and flossing will minimise plaque build-up but it will still occur. Plaque is mineralised deposits at the edges of teeth and gums. It is difficult to remove with simple brushing. This is removed by simply scraping off with a sterilised scaler or dental pick.

Once through the hypodermis and muscle fascia, you will be able to visualise the underlying muscles. Devitalised (necrotic) muscle is characterised by —

- Poor colour – dark like liver, rather than beefy red.
- Poor consistency – mushy like jelly, rather than firm.
- Poor contractility – when you pinch healthy muscle with forceps, it will contract.
- Poor circulation – it doesn't bleed when cut.

Devitalised muscle must be removed. Muscles can't absorb oxygen like other tissue, and if deprived will die quickly. Pick up a small piece of devitalised muscle with the forceps and excise it with the scissors. Look at the cut muscle edge – if it is oozing bright red blood then you have probably removed enough muscle in that area.

The goal is to remove all dead tissue while leaving as much health tissue as possible.

Most oozing will simply stop on its own or with gentle direct pressure. Care must be taken not to sever large blood vessels, be prepared beforehand to clamp and close. Use a fine thread, such as cotton or un-waxed dental floss, to close the vessel. Try to clamp just the bleeding point and not the surrounding tissue. Sterilise the thread by boiling beforehand.

Yellow or white fat in the wound is a sign that nerves are nearby. Nerves are always well padded so observe carefully. If the fat is intact you should leave it alone. Severing a nerve will only bring more misery to your patient. This is why you should practice on a dead animal beforehand, taking note of the structure of the tissue, nerves, blood vessels, muscle, tendons and bones. You are trying to avoid future infection, while ending up with a functioning limb.

After all devitalised tissue and foreign objects are removed, pack the wound loosely with gauze and cover with a loose dressing. Wounds that require debridement are rarely closed immediately, but left open for inspection several days later. Closure may be done then but only by an experienced medical professional.

To summarise, the basic principles of debridement are —

- Obtain good exposure with anaesthetic, an adequate incision, good lighting and assistance.
- Incise the tissue, exposing the underlying muscle.
- Excise devitalised muscle until the remaining muscle is healthy.
- Continue to work downward into the wound, layer by layer, debriding as you go and trying to avoid the nerves and blood vessels that commonly run between the muscle layers.
- Try to preserve as much normal tissue as possible and try not to injure the nerves.
- Attempting to close these wounds is usually a very bad idea.

2.8.2 FIELD AMPUTATION

In the absence of antibiotics, infection from wounds, compound fractures and other injuries may result in life threatening infections. Amputation may be the only option.

General Guidelines for amputation	Indications for amputation
• Field amputations are difficult and different from normal amputations. • The amputation must include all dead, contaminated and bruised tissue. • Stump infection is very dangerous. • Use a tourniquet for surgery. • Leave enough soft tissue to cover bone. • Do not underestimate muscle swelling post procedure. • Never attempt primary closure of the stump. This should only ever be done by an experienced surgeon. • Amputations are done at the lowest level possible. All attempts should be made to save the knee and elbow joints.	• Massive gangrene. • Overwhelming local infection that endangers life despite antibiotic therapy and surgical measures. • Established death of a limb. • Massive injuries in which structures of the limb are obviously non-viable. • Secondary haemorrhaging. (When a wound starts to bleed several days after an injury which otherwise seems healed). • Limbs which are severely crushed or which otherwise have bone, muscle, skin and nerves in a state beyond separation. • Limbs with anaesthetic terminus (death of tissue due to incorrect use or too high a dosage of anaesthetic).

Immobilization

Immobilization is nothing more than splinting the dislocation after reduction. You can use any field-expedient material for a splint or you can splint an extremity to the body. The basic guidelines for splinting are —

- Splint above and below the fracture site.
- Pad splints to reduce discomfort.
- Check circulation below the fracture after making each tie on the splint.

To rehabilitate the dislocation, remove the splints after 7 to 14 days. Gradually use the injured joint until fully healed.

2.4.3 SPRAINS

The accidental overstretching of a tendon or ligament causes sprains. The signs and symptoms are pain, swelling, tenderness, and discoloration (black and blue).

When treating sprains —

- Rest injured area.
- Ice for 24 hours, then heat after that.
- Compression-wrapping and/or splinting to help stabilize. If possible, leave the boot on a sprained ankle unless circulation is compromised.
- Elevation of the affected area.

2.5 BITES AND STINGS

Insects and related pests are hazards in a survival situation. They not only cause irritations, but they are often carriers of diseases that cause severe allergic reactions in some individuals.

Ticks	Can carry and transmit diseases, such as the Lyme disease.
Mosquitoes	May carry malaria, dengue, and many other diseases.
Flies	Can spread disease from contact with infectious sources. They are causes of sleeping sickness, typhoid, cholera, and dysentery.
Fleas	Can transmit plague.
Lice	Can transmit typhus and relapsing fever.

If you get bitten or stung, do not scratch, it might become infected. Inspect your body at least once a day to ensure there are no insects attached to you. If you find ticks attached to your body, cover them with a substance, such as Vaseline, heavy oil, or tree sap, which will cut off their air supply. Without air, the tick releases its hold, and you can remove it. Take care to remove the whole tick. Use tweezers if you have them. Grasp the tick where the mouth parts are attached to the skin. Do not squeeze the tick's body. Wash your hands after touching the tick. Clean the tick wound daily until healed.

Bee and Wasp Stings

If stung by a bee, immediately remove the stinger and venom sac, if attached, by scraping with a fingernail or a knife blade. Do not squeeze or grasp the stinger or venom sac, as squeezing will force more venom into the wound. Wash the sting site thoroughly with soap and water to lessen the chance of a secondary infection.

Relieve the itching and discomfort caused by insect bites by applying —

- Cold compresses.
- A cooling paste of mud and ashes.
- Sap from dandelions.
- Coconut meat.
- Crushed cloves of garlic.
- Onion.

Spider Bites

The black widow spider is identified by a red hourglass on its abdomen. Only the female bites, and it has a neurotoxic venom. Severe local pain rapidly develops which gradually spreads over the entire body and settles in the abdomen and legs. Abdominal cramps and progressive nausea, vomiting, and a rash may occur. Weakness, tremors, sweating, and salivation may occur. Anaphylactic reactions can occur. Symptoms begin to regress after several hours and are usually gone in a few days. Treat for shock. Be ready to perform CPR. Clean and dress the bite area to reduce the risk of infection.

The funnelweb spider is a large brown or grey spider found in Australia. The symptoms and the treatment for its bite are as for the black widow spider.

Tarantulas are large, hairy spiders found mainly in the tropics. Most do not inject venom, but some South American species do. They have large fangs. If bitten, pain and bleeding are certain, and infection is likely. Treat a tarantula bite as for any open wound, and try to prevent infection. If symptoms of poisoning appear, treat as for the bite of the black widow spider.

Scorpion Stings

Scorpions are all poisonous to a greater or lesser degree. There are two different reactions, depending on the species —

- **Severe local reaction**, with pain and swelling around the area of the sting. Possible prickly sensation around the mouth and a thick-feeling tongue.
- **Severe systemic reaction**, with little or no visible local reaction. Local pain may be present. Systemic reaction includes respiratory difficulties, thick-feeling tongue, body spasms, drooling, gastric distension, double vision, blindness, involuntary rapid movement of the eyeballs, involuntary urination and defecation, and heart failure. Death is rare, occurring mainly in children and adults with high blood pressure or illnesses.

Treat scorpion stings as you would a black widow bite.

Snakebites

The chance of a snakebite in a survival situation is rather small, if you are familiar with the various types of snakes and their habitats. However, you should know how to treat a snakebite. Failure to treat a snakebite properly can result in needless tragedy.

The primary concern in the treatment of a snakebite is to limit the amount of eventual tissue destruction around the bite area.

A bite wound, regardless of the type of animal that inflicted it, can become infected from bacteria in the animal's mouth. With non-poisonous as well as poisonous snakebites, this local infection is responsible for a large part of the residual damage that results.

Snake venoms not only contain poisons that attack the victim's central nervous system (neurotoxins) and blood circulation (hemotoxins), but also digestive enzymes (cytotoxins) to aid in digesting their prey. These poisons can cause a very large area of tissue death, leaving a large open wound. This condition could lead to the need for amputation if not treated.

Shock and panic in a person bitten by a snake can also affect the person's recovery. Panic can speed up the circulation, causing the body to absorb the toxin quickly.

Before you start treating a snakebite, determine whether the snake was poisonous or non-poisonous. Bites from a non-poisonous snake will show rows of teeth. Bites from a poisonous snake may have rows of teeth showing, but will have one or more distinctive puncture marks caused by fang penetration. Symptoms of a poisonous bite may be spontaneous bleeding from the nose and anus, blood in the urine, pain at the site of the bite, and swelling at the site of the bite within a few minutes or up to 2 hours later.

Breathing difficulty, paralysis, weakness, twitching, and numbness are also signs of neurotoxin venoms. These signs usually appear 1.5 to 2 hours after the bite.

If you determine that a poisonous snake bit an individual, take the following steps —

- Reassure the victim and keep them still.
- Set up for shock and force fluids or give an intravenous (IV).
- Remove watches, rings, bracelets, or other constricting items.
- Clean the bite area.

2.8 FIELD SURGERY

These procedures should never be attempted if professional help is at all possible. They are only provided for a reference in a scenario where external medical help is non-existent. Do not take these procedures lightly. Incorrect implementation WILL result in serious injury or death.

Before any of these procedures are undertaken, your group – including the patient – should discuss the pros, cons, risks and the actual procedure at length. Have all materials and tools sterilised, razor sharp and on hand before you start and make sure everyone participating understands what is going to happen.

If possible, practice on a dead animal beforehand to know what to expect when dealing with the muscles, nerves, blood vessels and other tissue. Visual and tactile feedback is important.

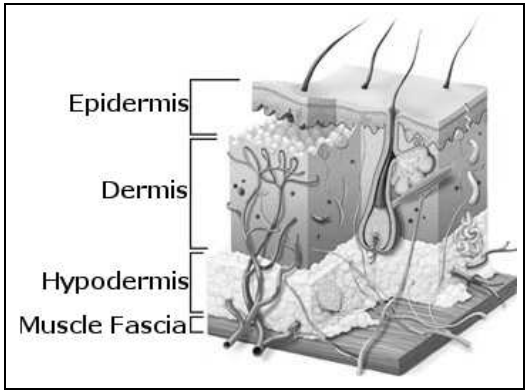
2.8.1 WOUND DEBRIDEMENT

Following injury from severe puncturing or a bullet, soft tissue wounds may need debridement.

This means removal of dead tissue, and other foreign bodies, such as metal or bone fragments, pieces of wood, clothing, skin, hair etc.

High velocity projectiles such as bullets can cause shock waves that disrupt and destroy tissues as far as several inches away from the missile tract.

Incomplete debridement increases the risk of infection and complications such as gangrene and death.



TISSUE LAYERS

Tissue Layers

The main layers of body tissue consist of the epidermis, dermis, hypodermis and muscle.

Epidermis	This is the outer skin. It is the foremost defence against disease and infection.
Dermis	The dermis is a layer of skin between the epidermis and hypodermis. Structural components include collagen and elastic fibres.
Hypodermis	Also called subcutaneous tissue or superficial fascia, this layer is used mainly for fat storage.

Debridement Method

Normally, skin incisions for debridement in the arms and legs are made parallel to the bone.

Starting at the wound, use a scalpel to incise the skin, long enough to expose injured tissues. Then make another incision in the opposite direction.

Try not to cut deeper than the skin to avoid damaging healthy tissue. If the wound or incisions involves a joint, obtain consultation if possible as some incisions over joints are better than others.

Normally, very little if any skin needs to be removed. Skin that is shredded can be removed, as well as any crushed and obviously necrotic skin.

After you are through the skin use scissors and tissue forceps to isolate and incise the hypodermis down to the muscle fascia. Do not put your fingers in the wound. There may be razor sharp metal or glass fragments that can cut you. Try to work each layer one at a time. This will help prevent further injury to healthy tissue.

As you work down through the wound, remove any loose foreign bodies and excise any damaged or necrotic tissue. Be careful not to sever any major blood vessels. Fatty tissue can hide nerves so be careful not to sever any nerves if you can avoid it.

Sterile irrigation fluid such as saline, or lightly salted distilled water should be poured into the wound periodically to help float out clots and foreign matter. Gauze sponges will help to keep the wound clear for you to see. Good lighting and assistance is essential.

By this time the victim is in severe shock. Cool the victim as rapidly as possible by dipping them in a cool stream. If one is not available, douse the victim with urine, water, or at the very least, apply cool wet com-presses to all the joints, especially the neck, armpits, and crotch and head. Heat loss through the scalp is great.

Expect, during cooling —

- Vomiting.
- Diarrhoea.
- Struggling.
- Shivering.
- Shouting.
- Prolonged unconsciousness.
- Rebound heatstroke within 48 hours.
- Cardiac arrest; be ready to perform CPR.

Treat for dehydration with lightly salted water.

Hypothermia

Hypothermia is defined as the body's failure to maintain a temperature of 36°C (97°F). Exposure to cool or cold temperature over a short or long time can cause hypothermia. Dehydration and lack of food and rest predispose the survivor to hypothermia.

Unlike heatstroke, you must gradually warm the hypothermia victim. Get the victim into dry clothing. Replace lost fluids, and warm them.

Diarrhoea

A common, debilitating ailment caused by a change of water and food, drinking contaminated water, eating spoiled food, becoming fatigued, and using dirty dishes. You can avoid most of these causes by practicing preventive medicine. If you get diarrhoea, however, and do not have anti-diarrhoeal medicine, one of the following treatments may be effective —

- Limit your intake of fluids for 24 hours.
- Drink one cup of a strong tea solution every 2 hours until the diarrhoea slows or stops. The tannic acid in the tea helps to control the diarrhoea. Boil the inner bark of a hardwood tree for 2 hours or more to release the tannic acid.
- Make a solution of one handful of ground chalk, charcoal, or dried bones and treated water. If you have some apple pomace or the rinds of citrus fruit, add an equal portion to the mixture to make it more effective. Take 2 tablespoons of the solution every 2 hours until the diarrhoea slows or stops.

Intestinal Parasites

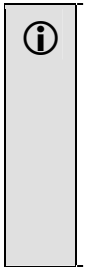
You can usually avoid intestinal parasites if you take preventive measures. For example, never go barefoot. Never eat uncooked meat or raw vegetables contaminated by raw sewage or human waste used as a fertilizer. However, should you become infested and lack proper medicine, you can use home remedies. Keep in mind that these home remedies work on the principle of changing the environment of the gastrointestinal tract. The following are home remedies you could use —

Salt water	Dissolve 4 tablespoons of salt in 1 litre of water and drink. Do not repeat this treatment.
Tobacco	Eat 1 to 1.5 cigarettes. The nicotine in the cigarette will kill or stun the worms long enough for your system to pass them. If the infestation is severe, repeat the treatment in 24 to 48 hours, but no sooner.
Kerosene	Drink 2 tablespoons of kerosene but no more. If necessary, you can repeat this treatment in 24 to 48 hours. Be careful not to inhale the fumes. They may cause lung irritation.
Hot peppers	Peppers are effective only if they are a steady part of your diet. You can eat them raw or put them in soups or rice and meat dishes. They create an environment that is prohibitive to parasitic attachment.

- Maintain an airway (especially if bitten near the face or neck) and be prepared to administer mouth-to-mouth resuscitation or CPR.
- Use a constricting band between the wound and the heart.
- Immobilize the site.
- Remove the poison as soon as possible by using a mechanical suction device or by squeezing.

Do not —

- Give the victim alcoholic beverages or tobacco products.
- Give morphine or other central nervous system (CNS) depressors.
- Make any deep cuts at the bite site. Cutting opens capillaries that in turn open a direct route into the blood stream for venom and infection.
- Put your hands on your face or rub your eyes, as venom may be on your hands. Venom may cause blindness.
- Break open the large blisters that form around the bite site.



If medical treatment is over one hour away, make an incision (no longer than 6 mm and no deeper than 3 mm) over each puncture, cutting just deep enough to enlarge the fang opening, but only through the first or second layer of skin. Place a suction cup over the bite so that you have a good vacuum seal. Suction the bite site 3 to 4 times.

Use mouth suction ***only as a last resort*** and only if you do not have open sores in your mouth. Spit the envenomed blood out and rinse your mouth with water. This method will draw out 25 to 30 percent of the venom.

After caring for the victim as described above, take the following actions to minimize local effects —

- If infection appears, keep the wound open and clean.
- Use heat after 24 to 48 hours to help prevent the spread of local infection. Heat also helps to draw out an infection.
- Keep the wound covered with a dry, sterile dressing.
- Have the victim drink large amounts of fluids until the infection is gone.

2.6 WOUNDS

Wounds could be open wounds, skin diseases, frostbite, trench foot, and burns.

2.6.1 OPEN WOUNDS

Open wounds are serious in a survival situation, not only because of tissue damage and blood loss, but also because they may become infected. By taking proper care of the wound you can reduce further contamination and promote healing. Clean the wound as soon as possible after it occurs by —

- Removing or cutting clothing away from the wound.
- Always looking for an exit wound if a sharp object, gun shot, or projectile caused a wound.
- Thoroughly cleaning the skin around the wound.
- Rinsing (not scrubbing) the wound with large amounts of water under pressure. You can use fresh urine if water is not available.

The "open treatment" method is the safest way to manage wounds in survival situations. Do not try to close any wound by suturing or similar procedures. Leave the wound open to allow the drainage of any pus resulting from infection. As long as the wound can drain, it generally will not become life-threatening, regardless of how unpleasant it looks or smells.

Cover the wound with a clean dressing. Place a bandage on the dressing to hold it in place. Change the dressing daily to check for infection.

To treat an infected wound

- Place a warm, moist compress directly on the infected wound. Change the compress when it cools, keeping a warm compress on the wound for a total of 30 minutes. Apply the compresses three or four times daily.
- Drain the wound. Open and gently probe the infected wound with a sterile instrument.
- Dress and bandage the wound.
- Drink a lot of water.

Continue this treatment daily until all signs of infection have disappeared.

If you do not have antibiotics and the wound has become severely infected, does not heal, and ordinary **Debridement** (Page 2-15) is impossible, consider maggot therapy —

- Expose the wound to flies for one day and then cover it.
- Check daily for maggots.
- Once maggots develop, keep wound covered but check daily.
- Remove all maggots when they have cleaned out all dead tissue and before they start on healthy tissue. Increased pain and bright red blood in the wound indicate that the maggots have reached healthy tissue.
- Flush the wound repeatedly with sterile water or fresh urine to remove the maggots.
- Check the wound every four hours for several days to ensure all maggots have been removed.
- Bandage the wound and treat it as any other wound. It should heal normally.

If possible, raise sterile maggots. This is achieved by collecting eggs and immersing them in a dilute antiseptic. A weak salt-water solution will also work. Then raise the maggots on sterile food. The next generation eggs will produce sterile maggots.

2.6.2 SKIN DISEASES AND AILMENTS

Although boils, fungal infections, and rashes rarely develop into a serious health problem, they cause discomfort and you should treat them.

Boils

Apply warm compresses to bring the boil to a head. Then open the boil using a sterile knife, wire, needle, or similar item. Thoroughly clean out the pus using soap and water. Cover the boil site, checking it periodically to ensure no further infection develops.

Fungal Infections

Keep the skin clean and dry, and expose the infected area to as much sunlight as possible. Do not scratch the affected area. During the Southeast Asian conflict, soldiers used antifungal powders, lye soap, chlorine bleach, alcohol, vinegar, concentrated salt water, and iodine to treat fungal infections with varying degrees of success. As with any "unorthodox" method of treatment, use it with caution.

Rashes

To treat a skin rash effectively, first determine what is causing it. This determination may be difficult even in the best of situations. Observe the following rules to treat rashes —

- If it is moist, keep it dry.
- If it is dry, keep it moist.
- Do not scratch it.

Use a compress of vinegar or tannic acid derived from tea or from boiling acorns or the bark of a hardwood tree to dry weeping rashes. Keep dry rashes moist by rubbing a small amount of rendered animal fat or grease on the affected area.

Remember, treat rashes as open wounds and clean and dress them daily. There are many substances available to survivors in the wild or in captivity for use as antiseptics to treat wound —

Iodine tablets	Use 5 to 15 tablets in a litre of water to produce a good rinse for wounds during healing.

Garlic	Rub it on a wound or boil it to extract the oils and use the water to rinse the affected area.
Salt water	Use 2 to 3 tablespoons per litre of water to kill bacteria.
Bee honey	Use it straight or dissolved in water.
Sphagnum moss	Found in boggy areas worldwide, it is a natural source of iodine. Use as a dressing.

Frostbite

This injury results from frozen tissues. Light frostbite involves only the skin that takes on a dull, whitish pallor. Deep frostbite extends to a depth below the skin. The tissues become solid and immovable. Your feet, hands, and facial areas are particularly vulnerable to frostbite.

When with others, prevent frostbite by using the buddy system. Check your buddy's face often and make sure that they check yours. If you are alone, periodically cover your nose and lower part of your face with your mittens.

Do not try to thaw the affected areas by placing them close to a fire. Gently rub them in lukewarm water. Dry the part and place it next to your skin to warm it at body temperature.

Trench Foot

This condition results from prolonged exposure to wet or damp conditions at a temperature just above freezing. The nerves and muscles sustain the main damage, but gangrene can occur. In extreme cases the flesh dies and it may become necessary to amputate. The best prevention is to keep your feet dry. Carry extra socks with you in a waterproof packet. Dry wet socks against your body. Wash your feet daily and put on dry socks.

Burns

The following field treatment for burns relieves the pain somewhat, seems to help speed healing, and offers some protection against infection —

- First, stop the burning process. Put out the fire by removing clothing, dousing with water or sand, or by rolling on the ground. Cool the burning skin with ice or water. For burns caused by white phosphorous, pick out the white phosphorous with tweezers; do not douse with water.
- Soak dressings or clean rags for 10 minutes in a boiling tannic acid solution (obtained from tea, inner bark of hardwood trees, or acorns boiled in water).
- Cool the dressings or clean rags and apply over burns.
- Treat as an open wound.
- Replace fluid loss.
- Maintain airway.
- Treat for shock.
- Consider using morphine, unless the burns are near the face.

2.7 ENVIRONMENTAL INJURIES

Heatstroke, hypothermia, diarrhoea, and intestinal parasites are environmental injuries you could face.

Heatstroke

The breakdown of the body's heat regulatory system (body temperature more than 40.5°C (105°F) causes heatstroke. Other heat injuries, such as cramps or dehydration, do not always precede a heatstroke. Signs and symptoms of heatstroke are —

- Swollen, beet-red face.
- Reddened whites of eyes.
- Victim not sweating.
- Unconsciousness or delirium, which can cause pallor, a bluish colour to lips and nail beds (cyanosis), and cool skin.

'Figure-9' Deadfall

A forked stick is placed vertically on the ground. Carve a notch to accept the baitstick. Bend a sapling around as shown to support the deadfall weight and provide the trigger.

Paiute Deadfall

This deadfall uses a piece of cordage, a top stick and a catch stick.

Tie one end of cordage to the lower end of the top stick. Tie the other end to a stick about 5 cm long. This is the catch stick. Bring the cord halfway around the vertical stick with the catch stick at a 90° angle. Place the bait stick with one end against the drop weight, and the other against the catch stick.

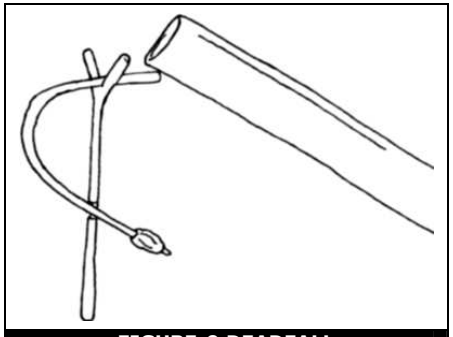
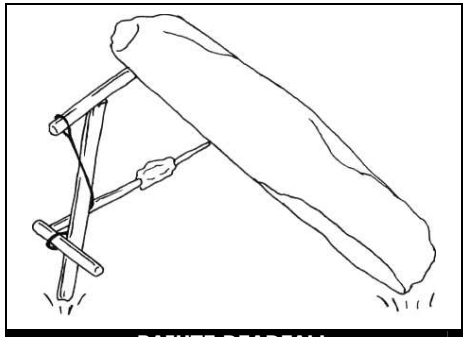


FIGURE-9 DEADFALL

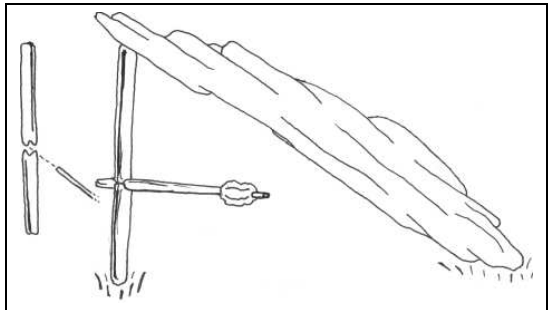


PAIUTE DEADFALL

Split-stick Deadfall

To build this trap, take a strong pole and cut it in two pieces. Carve a notch in each of the pieces for a baitstick to slot into. With a heavy weight this trap is very unstable and will trip with only a slight movement of the baitstick.

With all deadfall traps, it is best to make sure the weight falls directly over the bait, crushing only the head of the prey, not to crush the entire animal and other organs, such as the bladder, which will ruin the catch.



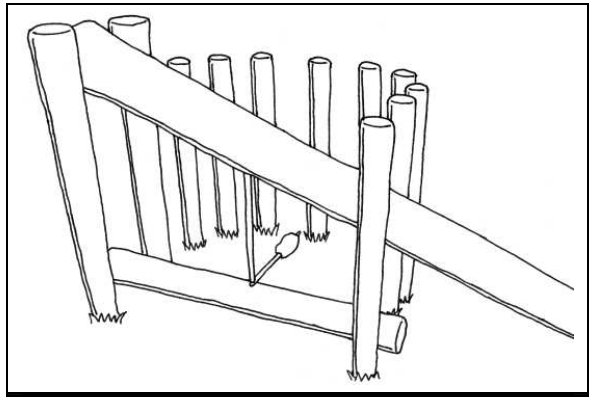
SPLIT-STICK DEADFALL

Beaver Press

This trap is time consuming to construct, but semi-permanent.

The area surrounding the baitstick is confined by placing stakes in the ground, or anything else you can find. This area should be only large enough to contain the target animals head. Ideally the weight will fall on the targets neck.

The deadfall weight is held by a stick balanced on the baitstick. The vertical stick should be weak so it breaks easily and the surface it rests on should be curved.



BEAVER PRESS

3 Water Procurement

Water is one of your most urgent needs in a survival situation. You can't live long without it, especially in hot areas where you lose water rapidly through perspiration. Even in cold areas, you need a minimum of 2 litres of water each day to maintain efficiency.

More than three-quarters of your body is composed of fluids. Your body loses fluid as a result of heat, cold, stress, and exertion. To function effectively, you must replace the fluid your body loses. So, one of your first goals is to obtain an adequate supply of water.

3.1 WATER SOURCES

Almost any environment has water present to some degree. This table lists possible sources of water in various environments. It also provides information on how to make the water potable (drinkable).

SOURCES OF WATER AND MEANS OF OBTAINING AND/OR MAKING DRINKABLE		
Frigid Areas	Snow and ice	Melting: **DO NOT** eat without melting! Eating snow and ice can reduce body temperature and lead to more dehydrating. Snow and ice are no purer than the water from which they come Sea ice that is grey or opaque is salty. Do not use without desalting it. Sea ice that is clear with a bluish colour has little ice in it.
At Sea	Seawater	Use desalter kit or still. **DO NOT** drink straight seawater. Ever.
	Rain	Catch in tarps or other containers. If tarp containers have become encrusted with salt, wash in seawater first. Very little salt will remain.
	Sea Ice	See above remarks for frigid areas.
Beach	Ground	Dig hole deep enough to allow water to seep in, or fill a container with seawater. Heat rocks in a fire and drop in water. Absorb steam with cloth and wring out. Fresh water can often be obtained by digging behind sand dunes. Normally water is found at 1 – 3 metres.
	Sandstone cliffs	Freshwater soaks can sometimes be found on the seaward side of sandstone cliffs. These are usually indicated by a fault or crack in the cliff, plus a gathering of ferns and mosses.
Desert	Ground	• In valleys and low areas • concave banks of dry river beds • at foot of cliffs or rock outcrops • at first depression behind first sand dune of dry desert lakes • wherever you find damp surface sand • wherever you find green vegetation Dig holes deep enough to allow water to seep in. In a sand dune belt, any available water will be found beneath the original valley floor at the edge of dunes.
	Cacti	Cut off the top of a barrel cactus and mash, squeeze or suck the pulp. **CAUTION!** Do not eat pulp. Suck out juice and discard. Without a machete, cutting into a cactus is difficult because of the long spines and tough rind.
	Depressions or holes in rocks	Periodic rainfall may collect in pools, seep into fissures, or collect in holes in rocks. Water can be obtained from fissures or porous rock with a length of flexible tubing.

Condensation on metal	Extreme temperature variations between night and day may cause condensation on metal surfaces. Use a flat piece of metal or plastic to scrape the droplets over the edge and collect in a container. Alternatively use cloth to absorb water, then wring water from cloth.

Following are signs to watch for in the desert to help you find water:

- All trails lead to water. You should follow in the direction in which the trails converge. Signs of camps, campfire ashes, animal droppings, and trampled terrain may mark trails.
- Flocks of birds will circle over water holes. Some birds fly to water holes at dawn and sunset. Their flight at these times is generally fast and close to the ground. Birds tracks or chirping sounds in the evening or early morning sometimes indicate that water is nearby

If you do not have a canteen, a cup, a can, or other type of container, improvise one from plastic or water-resistant cloth. Shape the plastic or cloth into a bowl by pleating it. Use pins or other suitable items – even your hands – to hold the pleats.

If you do not have a reliable source to replenish your water supply, stay alert for ways in which your environment can help you.

DO NOT use the following fluids as a substitute for water —

Alcohol	Dehydrates the body, depletes motor skills, reaction time and judgement.
Urine	Despite what you may have seen in German pornography, it is never a good idea to drink urine. It contains harmful body wastes and is about 2 percent salt.
Blood	Is salty and consider a food; therefore, requires additional body fluids to digest. May transmit disease.
Seawater	Is about 4 percent salt. It takes about 2 litres of body fluids to rid the body of waste from 1 litre of saltwater. Therefore, by drinking seawater you deplete your body's water supply, which can cause death.

Heavy dew can provide water. Tie rags or tufts of fine grass around your ankles and walk through dew-covered grass before sunrise. As the dew is absorbed, wring the water into a container. Repeat the process until you have a supply of water or until the dew is gone.

Bees or ants going into a hole in a tree may point to a water-filled hole. Siphon the water with plastic tubing or scoop it up with an improvised dipper. You can also stuff cloth in the hole to absorb the water and then wring it from the cloth.

Water sometimes gathers in tree crotches or rock crevices. Use the above procedures to get the water. In arid areas, bird droppings around a crack in the rocks may indicate water in or near the crack.

3.1.1 WATER FROM VEGETABLE SOURCES

Green bamboo thickets are an excellent source of fresh water. Water from green bamboo is clear and odourless. To get the water, bend a green bamboo stalk, tie it down, and cut off the top. The water will drip freely during the night. Old, cracked bamboo may contain water.

Note – The water should be purified before drinking.

Wherever you find banana or plantain trees, you can get water. Cut down the tree, leaving about a 30-centimeter stump, and scoop out the centre of the stump so that the hollow is bowl-shaped. Water from the roots will immediately start to fill the hollow. The first three fillings of water will be bitter, but succeeding fillings will be palatable. The stump will supply water for up to four days. Be sure to cover it to keep out insects.

Some tropical vines can give you water. Cut a notch in the vine as high as you can reach, then cut the vine off close to the ground. Catch the liquid in a container or your mouth.

Many trees can be used for water no matter how dry conditions are. The best way to get water from a tree is to drain the roots. Do this by digging them up at dawn when the tree has finished its night dew-collecting. Cut them at a 45° angle into 1 metre lengths and hang them over a container.

Squirrel Pole

A squirrel pole is placed against a tree in an area showing a lot of squirrel activity. Place nooses along the top and sides of the pole so that a squirrel trying to move along the pole will have to pass through one or more of them.

Position the nooses (5 to 6 cm in diameter) about 2.5 cm off the pole. Place the top and bottom wire nooses 45 cm from the top and bottom of the pole to prevent the squirrel from getting its feet on a solid surface. If this happens, the squirrel will chew through the wire.

Squirrels are naturally curious. After a period of initial caution, they will try to go up or down the pole and will get caught. They will soon fall from the pole and strangle. Others will soon follow and, in this way, you can catch several squirrels. You can place multiple poles to increase the catch.

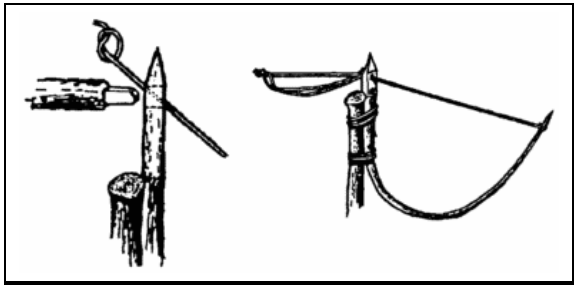
Ojibwa Bird Pole

An Ojibwa bird pole is a snare used by Native Americans for centuries. To be effective, place it in a relatively open area away from tall trees. For best results, pick a spot near feeding areas, dusting areas, or watering holes.

Cut a pole about 2 meters long and trim away all limbs and foliage. Do not use resinous wood such as pine that may glue parts of the trap together. Sharpen the upper end to a point, then drill a small diameter hole 5 - 7.5 cm down from the top. Cut a small stick 10 to 15 cm long and shape one end so that it will almost fit into the hole. This is the perch.

Plant the long pole in the ground with the pointed end up. Tie a small weight, about equal to the weight of the targeted species, to a length of cordage. Or lash a twitch-up as shown to create the tension.

Pass the free end of the cordage through the hole, and tie a slip noose that covers the perch.



OJIBWA BIRD POLE

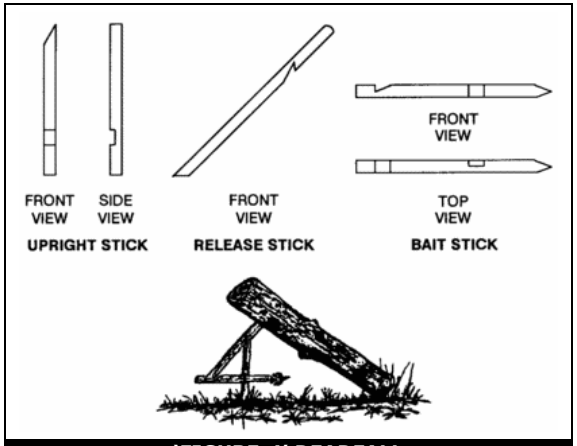
Tie a single overhand knot in the cordage and place the perch against the hole. Allow the cordage to slip through the hole until the overhand knot rests against the pole and the top of the perch. The tension of the knot against the pole and perch will hold the perch in position.

Spread the noose over the perch, ensuring it covers the perch and drapes over on both sides. As soon as the bird lands, the perch will fall, releasing the knot and allowing the tension to pull the noose tight around the bird's feet, capturing it. Note – if there is too much tension, it will cut the bird's feet off, allowing it to escape.

'Figure-4' Deadfall

The figure-4 is a trigger used to drop a weight onto a prey and crush it. The type of weight should be heavy enough to kill or incapacitate the prey.

Construct using three notched sticks. These notches hold the sticks together in a figure-4 pattern when under tension.



'FIGURE-4' DEADFALL

This trap is difficult to set so consider the figure-9 or other deadfalls before relying on this one.

Snare-wire

If you don't have snare wire, enamelled copper wire used in transformers and coils is cheap, strong, and because it is a dull orange colour it blends into the environment very well. Ask for winding wire in an electronics store (such as Radio Shack or Dick Smith) and they'll know what you mean. 0.5mm is strong enough to strangle and entrap an animal, anything thinner than that is better used for breakaway parts of your trap. 1 mm or thicker will snare a large animal.

Twitch-up

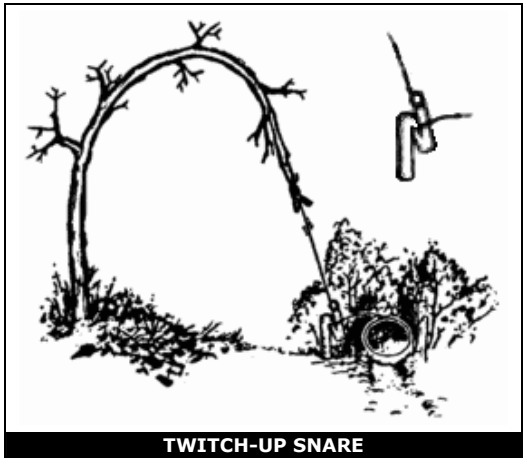
A twitch-up is a flexible sapling, which, when bent over and secured with a triggering device, will provide power to a variety of snares. Select a hardwood sapling along the trail. A twitch-up will work much faster and with more force if you remove all the branches and foliage.

Twitch-up Snare

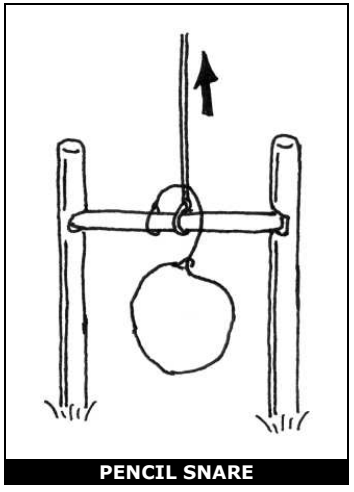
A simple twitch-up snare uses two forked sticks, each with a long and short leg. Bend the twitch-up and mark the trail below it. Drive the long leg of one forked stick firmly into the ground at that point.

Ensure the cut on the short leg of this stick is parallel to the ground. Tie the long leg of the remaining forked stick to a piece of cordage secured to the twitch-up. Cut the short leg so that it catches on the short leg of the other forked stick.

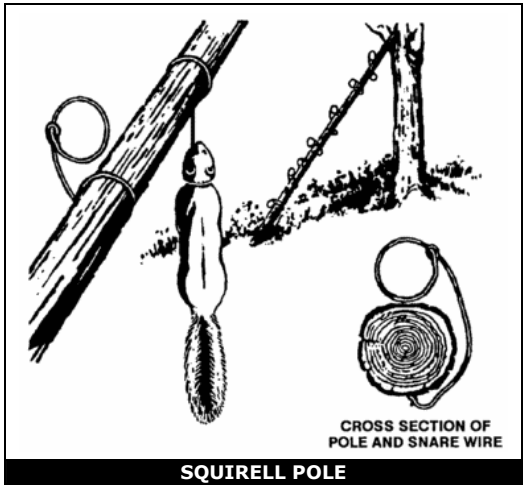
Extend a noose over the trail. Set the trap by bending the twitch-up and engaging the short legs of the forked sticks. When an animal catches its head in the noose, it pulls the forked sticks apart, allowing the twitch-up to spring up and hang the prey.



TWITCH-UP SNARE



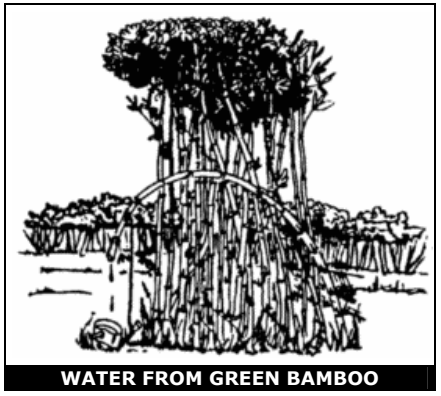
PENCIL SNARE



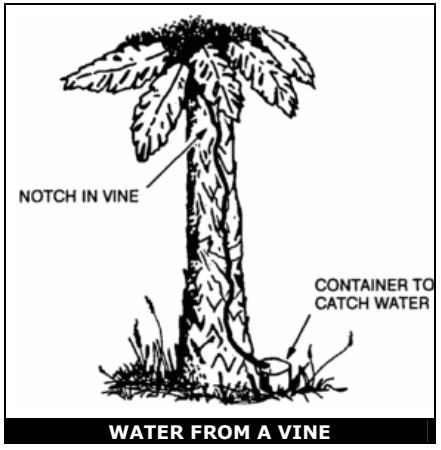
SQUIRELL POLE

Pencil Snare

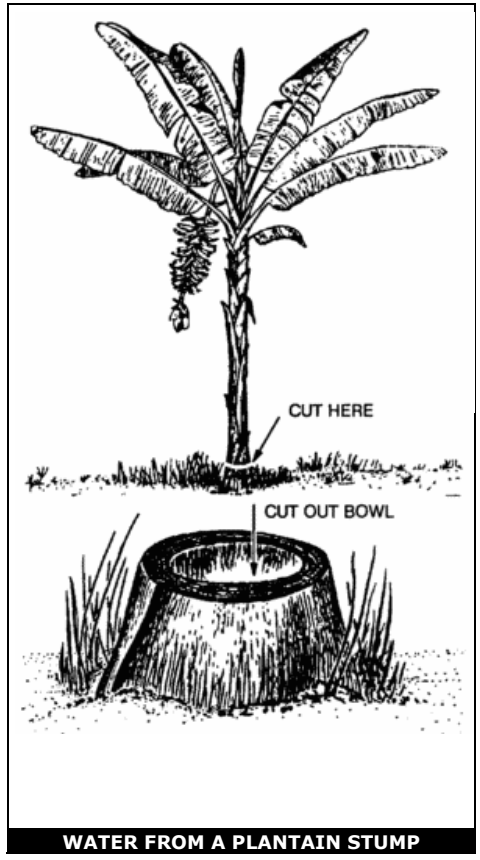
Set this snare in a game trail. Like a drag noose or simple snare it is effective when you can channel your prey into the loop. Use a bent sapling or improvise to provide the upwards tension. When the animal runs through the loop, the horizontal stick will release from the notches in the vertical poles.



WATER FROM GREEN BAMBOO



WATER FROM A VINE

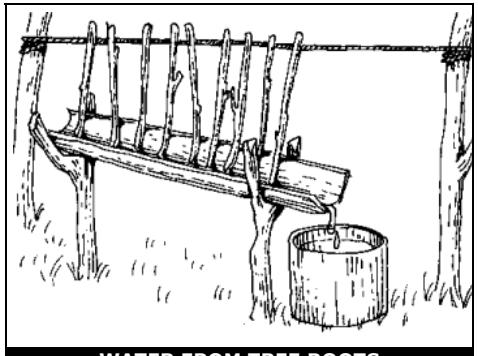


WATER FROM A PLANTAIN STUMP

You can get water from plants with moist pulpy centres. Cut off a section of the plant and squeeze or smash the pulp so that the moisture runs out. Catch the liquid in a container.

Plant roots may provide water. Dig or pry the roots out of the ground, cut them into short pieces, and smash the pulp so that the moisture runs out. Catch the liquid in a container.

Fleshy leaves, stems, or stalks, such as bamboo, contain water. Cut or notch the stalks at the base of a joint to drain out the liquid.



WATER FROM TREE ROOTS

! **CAUTION –** Do not drink the water from roots or vines if it is sticky, milky or bitter tasting. Do not let the water-sap mixture stand as it may contain natural sugars and can ferment. Use it immediately

The milk from green (unripe) coconuts is a good thirst quencher. However, the milk from mature coconuts contains an oil that acts as a laxative. Drink in moderation only.

In the tropics you may find large trees whose branches support air plants. These air plants may hold a considerable amount of rainwater in their overlapping, thickly growing leaves. Strain the water through a cloth to remove insects and debris.

The following trees can also provide water —

Palms	Palms, such as the buri, coconut, sugar, rattan, and nips, contain liquid. Bruise a lower frond and pull it down so the tree will "bleed" at the injury.
Travellers tree	Found in Madagascar, this tree has a cuplike sheath at the base of its leaves in which water collects.
Umbrella tree	The leaf bases and roots of this tree of western tropical Africa can provide water.
Boabab	This tree of the sandy plains of northern Australia and Africa collects water in its bottlelike trunk during the wet season.

Frequently, you can find clear, fresh water in these trees after weeks of dry weather.

3.2 STILL CONSTRUCTION

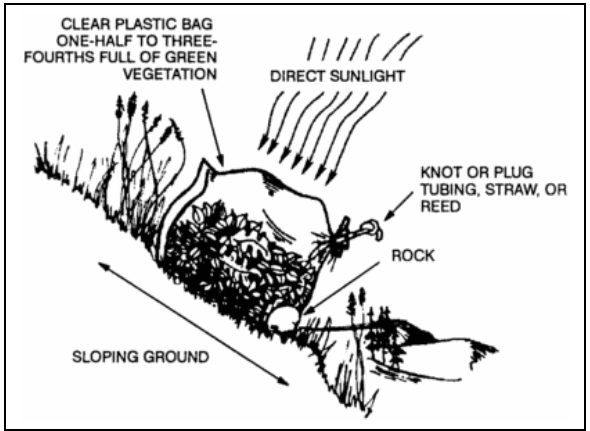
You can use stills in various areas of the world. They draw moisture from the ground and from plant material. You need certain materials to build a still, and you need time to let it collect the water. It takes about 24 hours to get 0.5 to 1 litre of water.

3.2.1 ABOVEGROUND STILL

To make the aboveground still, you need a sunny slope on which to place the still, a clear plastic bag, green leafy vegetation, and a small rock.

To make the still –

- Fill the bag with air and 3/4 full of green vegetation.
- Remove all hard sticks or sharp spines that might puncture the bag.
- Place weight in the bag.
- Close the bag and tie the mouth securely as close to the end of the bag as possible to keep the maximum amount of air.
- If you have a piece of tubing, a small straw, or a hollow reed, insert one end in the mouth of the bag before you tie it. Then tie off or plug the tubing so that air will not escape. This tubing will allow you to drain out condensed water without untying the bag.
- Place the bag, mouth downhill, on a slope in full sunlight. Position the mouth of the bag slightly higher than the low point in the bag.
- Settle the bag in place so that the rock works itself into the low point in the bag.



ABOVEGROUND STILL

To get the condensed water from the still, loosen the tie around the bag's mouth and tip the bag so that the water collected around the rock will drain out. Then retie the mouth securely and reposition the still to allow further condensation.

Change the vegetation in the bag after extracting most of the water from it. This will ensure maximum output of water.

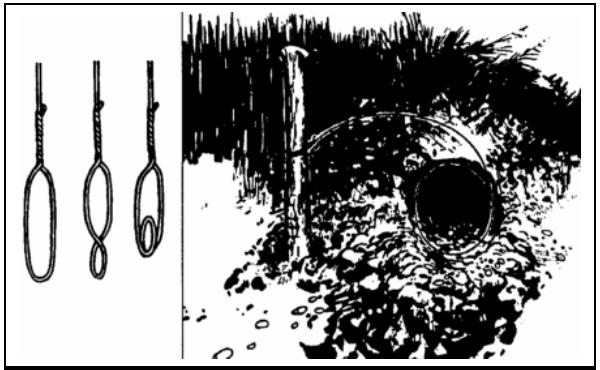
designed to catch and hold or to catch and kill. Snares are traps that incorporate a noose to accomplish either function.

Simple Snare

A simple snare consists of a noose placed over a trail or den hole and attached to a stake.

If the noose is some type of cordage placed upright on a game trail, use small twigs or blades of grass to hold it up. Consider filaments from spider webs for holding nooses open because they are strong and difficult to see.

Make sure the noose is large enough to pass freely over the animal's head. As the animal continues to move, the noose tightens around its neck. The more the animal struggles, the tighter the noose gets.


SIMPLE SNARE

This type of snare usually does not kill the animal. If you use cordage, it may loosen enough to slip off the animal's neck. Wire is therefore the best choice for a simple snare.

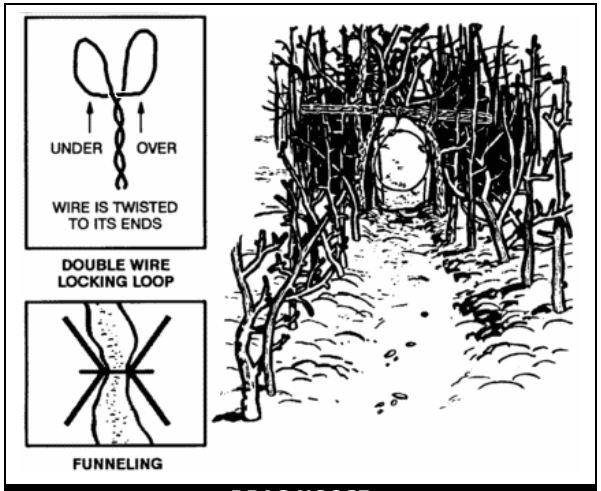
Drag Noose

Use a drag noose on an animal run.

Place forked sticks on either side of the run and lay a sturdy beam across them.

Tie the noose to the cross beam and hang it at a height above the animal's head. (Nooses designed to catch by the head should never be low enough for the prey to step into with a foot.)

As the noose tightens around the animal's neck, the animal pulls the cross member from the forked sticks and drags it along. The surrounding vegetation quickly catches the cross member and the animal becomes entangled.



DRAG NOOSE

Noosing Wand

A noose wand is useful for capturing roosting birds or small mammals. It requires a patient operator. This wand is more a weapon than a trap.


NOOSING WAND

It consists of a long pole with a slip noose of wire or stiff cordage at the small end. To catch an animal, you slip the noose over the neck and pull it tight. You can also place it over a den hole and hide in a nearby blind. When the animal emerges from the den, you jerk the pole to tighten the noose and capture the animal. Carry a stout club to kill the prey.

Position your traps where you know animals pass through. Determine if it is a 'run' or 'trail.' A trail will show use by several species and will be rather distinct. A run is usually smaller and less distinct and will only contain signs of one species. A perfect snare will not catch anything if haphazardly placed. Animals have bedding areas, waterholes, and feeding areas with trails between. You must place snares and traps around these areas to be effective.

It is important not to create a disturbance that will alarm the animal and cause it to avoid the trap. If you must dig remove all fresh dirt from the area. Most animals will instinctively avoid a pitfall-type trap. Prepare the various trap parts away from the site, carry them in, and set them up. Such actions make it easier to avoid disturbing the vegetation, thereby alerting the prey. Do not use freshly cut, live vegetation to construct a trap or snare. It may 'bleed' sap that has an odour the prey can smell. It is an alarm signal to the animal.

You must remove or mask the human scent around the trap you set. Although birds do not have a developed sense of smell, nearly all mammals depend on smell even more than on sight. Even the slightest human scent on a trap will alarm the prey and cause it to avoid the area. Actually removing the scent from a trap is difficult but masking it is relatively easy. Use the fluid from the gall and urine bladders of previous kills. Do not use human urine. Mud, particularly from an area with plenty of rotting vegetation, is also good. Use it to coat your hands when handling the trap and to coat the trap when setting it.

Most animals know the smell of burned vegetation and smoke. It is only when a fire is actually burning that they become alarmed. Therefore, smoking the trap parts is an effective means to mask your scent. If one of the above techniques is not practical, and if time permits, allow a trap to weather for a few days and then set it. Do not handle a trap while it is weathering. When you position the trap, camouflage it as naturally as possible to prevent detection by others and to avoid alarming the prey.

Traps or snares placed on a trail or run should use channelisation. To build a channel, construct a funnel-shaped barrier extending from the sides of the trail toward the trap, with the narrowest part nearest the trap. Channelisation should be inconspicuous to avoid alerting the prey. As the animal gets to the trap, it cannot turn left or right and continues into the trap. Few wild animals will back up, preferring to face the direction of travel.

A channel does not have to be an impassable barrier. It only has to be inconvenient to go over or through. For best effect, the channel should reduce the trails width to just slightly wider than the targeted animals body. Maintain this constriction at least as far back from the trap as the animals body length, then start widening toward the mouth of the funnel.

4.2.1 USE OF BAIT

Baiting a trap or snare increases your chances of catching an animal. When catching fish, you must bait nearly all the devices. Success with an unbaited trap depends on its placement in a good location. A baited trap can actually draw animals to it.

The bait should be something the animal knows. This bait, however, should not be so readily available in the immediate area. For example, baiting a trap with corn in the middle of a corn field would not be likely to work. Likewise, if corn is not grown in the region, a corn-baited trap may arouse an animal's curiosity. Under such circumstances it may not go for the bait.

One bait that works well on small mammals is peanut butter, another is Vegemite. Salt is also good. When using such baits, scatter bits of it around the trap to give the prey a chance to sample it and develop a craving for it. The animal will then overcome some of its caution before it gets to the trap.

If you bait a trap for one species but another takes the bait without being caught, try to determine what the animal was. Then set a proper trap for that animal, using the same bait.

4.2.2 TRAP AND SNARE CONSTRUCTION

Traps and snares crush, choke, hang, or entangle the prey. A single trap or snare will commonly incorporate two or more of these principles. The mechanisms that provide power to the trap are almost always very simple. The struggling victim, the force of gravity, or a bent saplings tension provides the power.

The heart of any trap or snare is the trigger. When planning a trap or snare, ask yourself how it should affect the prey, what is the source of power, and what will be the most efficient trigger. Your answers will help you devise a specific trap for a specific species. Traps are

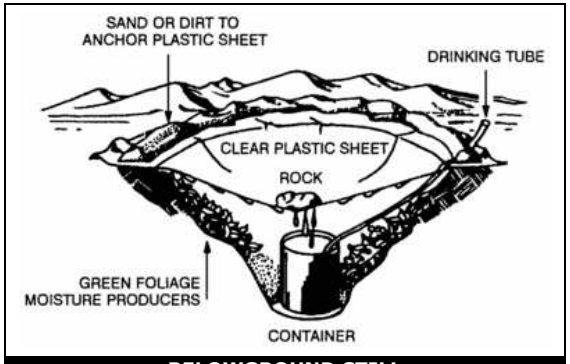
3.2.2 BELOWGROUND STILL

To make a belowground still, you need a digging tool, a container, a clear plastic sheet, a drinking tube, and a rock.

Select a site where soil will contain moisture (such as a dry stream bed or a low spot where rainwater has collected). Sunlight must hit the site most of the day.

To construct the still —

- Dig a hole about 1 meter across and 60 cm deep.
- Dig a sump in the centre of the hole to fit the container. Place the container in.
- Anchor the tubing to the container's bottom by forming a loose overhand knot in the tubing. Pull the other end over the lip of the hole.
- Place the plastic sheet over the hole, covering its edges with soil to hold it in place.
- Place a rock in the centre of the plastic sheet.



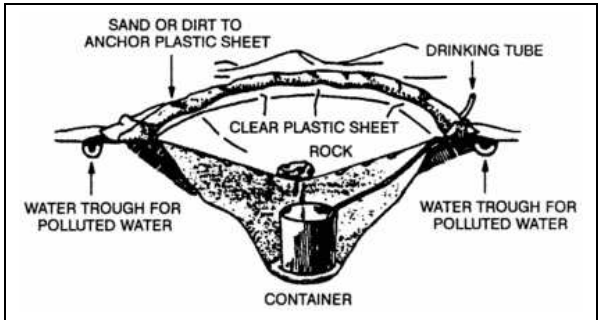
BELOWGROUND STILL

- Lower the plastic sheet into the hole until it is about 40 cm below ground level. It now forms an inverted cone with the rock at its apex. Make sure that the cone's apex is directly over your container. Also make sure the plastic cone does not touch the sides of the hole because the earth will absorb the condensed water.
- Put more soil on the edges of the plastic to hold it securely and prevent moisture loss.
- Prevent moisture from evaporating from the tube by folding the end over and tying.
- You can use plants as a moisture source. If so, dig out additional soil from the sides of the hole to form a slope on which to place the plants.

If polluted water is your only source, dig a small trough outside the hole about 25 cm from the still's lip. Dig the trough about 25 cm deep and 8 cm wide.

Pour the polluted water in the trough. Be sure you do not spill any polluted water around the rim of the hole where the plastic sheet touches the soil.

The trough holds the polluted water and the soil filters it as the still draws it.



BELOWGROUND STILL FOR POLLUTED WATER

The water then condenses and drains into the container. This works well with salt water.

You will need at least three stills to meet your individual daily water intake needs.

3.2.3 COOKING POT STILL

If you have the materials, a cooking pot still can be improvised —

- Place a small container in the centre of a cooking pot. Place a rock or other heavy item in the small container so it does not float.
- Pour contaminated water around the small container. Only put in enough to fill the small container. Too much water will bubble up ('spew') into the small container.

- Place the lid of the pot upside-down on the top or fashion an inverted lid from aluminium foil. Plastic sheet or wrap can also be used if weighed down and tied on with cord.
- Place the pot on a fire and wait for the water to boil and collect in the container. If using plastic for the lid, wait until the fire dies to coals to prevent the plastic melting.

3.2.4 PRECAUTIONS FOR DISTILLED WATER

When drinking distilled water exclusively there is a long term danger of nutrients absorbing into the water and leaching from your body. In this situation add a small amount (you should barely taste the salt) of sea salt or sea water to all the water you drink. Sea salt is an excellent source of vitamins and minerals. Multivitamin tablets will also be of great help but cannot last forever.

3.3 WATER PURIFICATION

Rainwater collected in clean containers or in plants is usually safe for drinking. However, heavy pollutants in the atmosphere such as iron ore dust or volcanic ash may render all water sources unhealthy. Ideally all water sources should be distilled. At the very least boil and filter your water until the rain runs clear again.

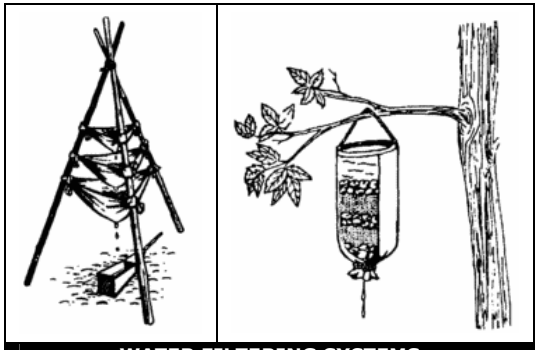
Non-contaminated water can be purified by —

- Using water purification tablets. (Follow the directions provided).
- Placing 5 drops of 2 percent tincture of iodine in a canteen full of clear water. If the canteen is full of cloudy or cold water, use 10 drops. (Let the canteen of water stand for 30 minutes before drinking).
- Boiling water for 15 minutes will kill any virus or bacteria that you are likely to encounter.

By drinking non-potable water you may contract diseases or swallow organisms that can harm you. Examples of such diseases or organisms are —

Dysentery	Severe, prolonged diarrhoea with bloody stools, fever, and weakness.
Cholera and typhoid	You may be susceptible to these diseases regardless of inoculations.
Flukes	Stagnant, polluted water—especially in tropical areas—often contains blood flukes. If you swallow flukes, they will bore into the bloodstream, live as parasites, and cause disease.
Leeches	If you swallow a leech, it can hook onto the throat passage or inside the nose. It will suck blood, create a wound, and move to another area. Each bleeding wound may become infected.

3.4 WATER FILTRATION DEVICES

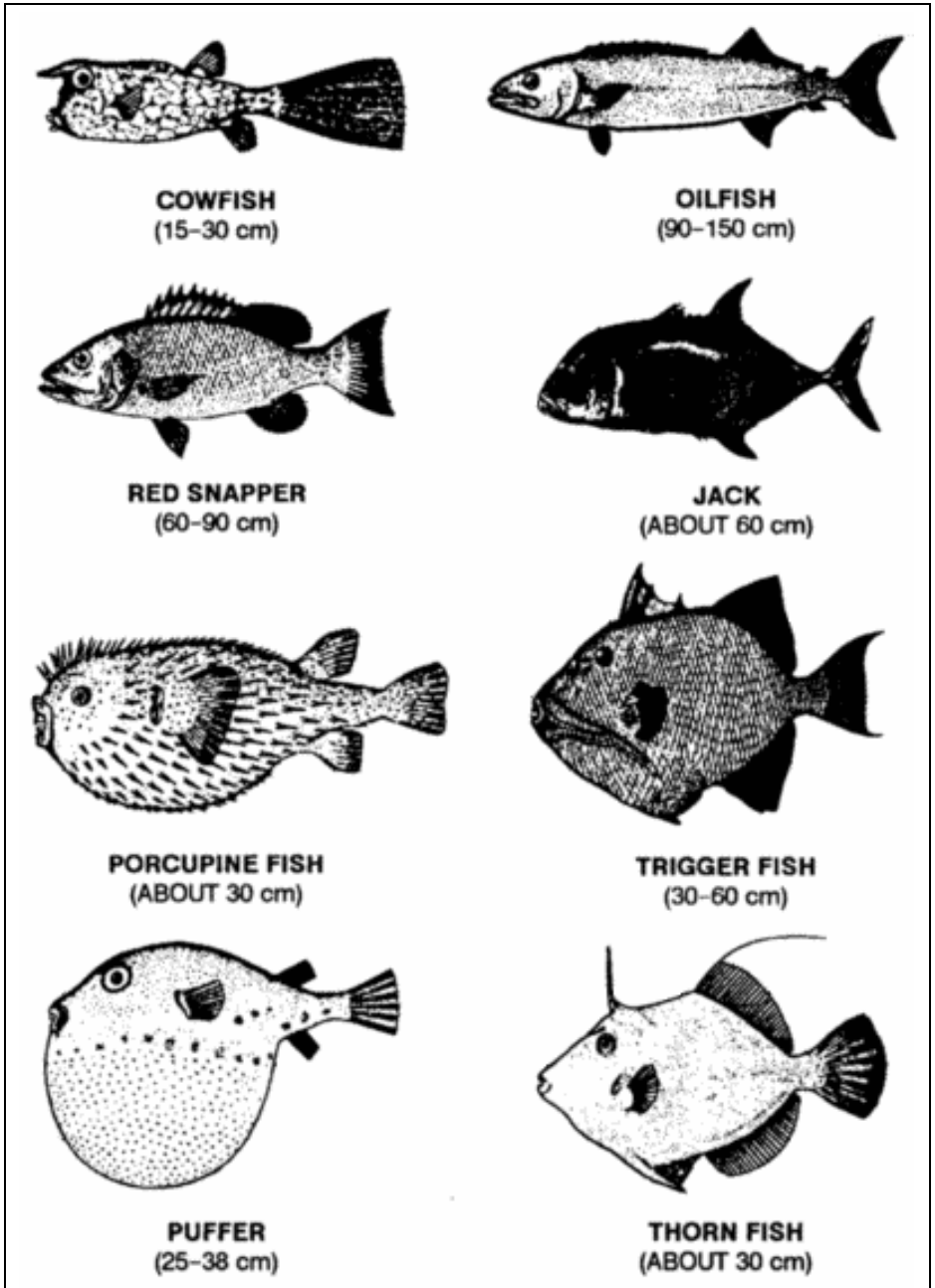


WATER FILTERING SYSTEMS

If water is muddy it can be cleared by letting it stand for 12 hours. If it is polluted or stagnant, it must be filtered.

To make a filtering system, place layers of filtering material such as sand, crushed rock, charcoal, or cloth in bamboo, a hollow log, or an article of clothing.

Remove the odour from water by adding charcoal from your fire. Charcoal will absorb a lot of the impurities so remove it from the water. Let the water stand for 45 minutes before drinking it.



FISH WITH POISONOUS FLESH

4.1.7 REPTILES

Reptiles are a good protein source and relatively easy to catch. You should cook them, but in an emergency, you can eat them raw. Their raw flesh may transmit parasites, but because reptiles are cold-blooded, they do not carry the blood diseases of the warm-blooded animals.

The box turtle is a common turtle that you should not eat. It feeds on poisonous mushrooms and may build up a toxic poison in its flesh. Cooking does not destroy this toxin. Avoid the hawksbill turtle, found in the Atlantic Ocean, because of its poisonous thorax gland. Poisonous snakes, alligators, crocodiles, and large sea turtles present obvious hazards to the survivor.

4.1.8 MAMMALS

Mammals are an excellent protein source and (arguably) the most tasty food. There are some drawbacks to obtaining mammals. When trying to lay low, others may detect any traps or snares placed on land. All mammals have teeth and nearly all will bite in self-defence. Even a squirrel can inflict a serious wound and any bite presents a serious risk of infection. Also note that a mother can be extremely aggressive in defence of her young, and any animal with no route of escape will fight, ferociously, when cornered.

All mammals are edible; however, some arctic creatures have toxic levels of vitamin A in their livers. The platypus, native to Australia and Tasmania, is an egg-laying, semi-aquatic mammal that has poisonous glands. Scavenging mammals, such as the opossum, may carry diseases.

4.1.9 FISH

Fish represent a good source of protein and fat. They offer some distinct advantages to the survivor or evader. They are usually more abundant than mammal wildlife, and the ways to get them are silent. To be successful at catching fish, you must know their habits. For instance, fish tend to feed heavily before a storm. Fish are not likely to feed after a storm when the water is muddy and swollen. Light often attracts fish at night. When there is a heavy current, fish will rest in places where there is an eddy, such as near rocks. Fish will also gather where there are deep pools, under overhanging brush, and in and around submerged foliage, logs, or other objects that offer them shelter.

There are no poisonous freshwater fish. However, the catfish species has sharp, needle like protrusions. These can inflict painful puncture wounds that quickly become infected.

Cook all freshwater fish to kill parasites. Also cook saltwater fish caught within a reef or within the influence of a freshwater source as a precaution. Any marine life obtained farther out in the sea will not contain parasites because of the saltwater environment. You can eat these raw.

Certain saltwater species of fish have poisonous flesh. In some species the poison occurs seasonally in others, it is permanent. Examples of poisonous saltwater fish are the porcupine fish, triggerfish, cowfish, thorn fish, oilfish, red snapper, jack, and puffer. The barracuda, while not actually poisonous itself, may transmit ciguatera (fish poisoning) if eaten raw.

4.2 TRAPS AND SNARES

For an unarmed survivor, or when the sound of a rifle shot could be a problem, trapping or snaring wild game is a good alternative. Several well-placed traps have the potential to catch much more game than a man with a rifle is likely to shoot. To be effective with any type of trap or snare, you must —

- Be familiar with the species of animal you intend to catch.
- Be capable of constructing a proper trap.
- Not alarm the prey by leaving signs of your presence.

You must determine what species are in a given area and set your traps specifically with those animals in mind. Look for the following –

- Runs and trails.
- Tracks.
- Droppings.
- Chewed or rubbed vegetation.
- Nesting or roosting sites.
- Feeding and watering areas.

4 Food Procurement

After water, your most urgent requirement is food. In contemplating virtually any survival situation, the mind immediately turns to thoughts of food. Unless the situation occurs in an arid environment, even water, which is more important to maintaining body functions, will almost always follow food in our initial thoughts.

4.1 ANIMALS FOR FOOD

Unless you have the chance to take large game, concentrate your efforts on the smaller animals, due to their abundance and ease of preparation. You must not know all the animal species that are suitable as food. Few are poisonous, and make a smaller list to remember.

What is important is to learn the habits and behavioural patterns of classes of animals. Animals that are excellent for trapping, that inhabit a particular range and occupy a den or nest, that have somewhat fixed feeding areas, and those that have trails leading from one area to another. Larger, herding animals, such as elk, caribou roam vast areas are somewhat more difficult to trap. Also, you must understand the food choices of a particular species.

You can, with few exceptions, eat anything that crawls, swims, walks, or flies. The first obstacle is overcoming your natural aversion to a particular food source. People in starvation situations will eat everything imaginable. A person who ignores a healthy food source due to a personal bias is risking their own survival.

4.1.1 INSECTS

The most abundant life-form on earth, insects are easily caught. Insects provide 65 to 80 percent protein compared to 20 percent for beef. Insects to avoid include all adults that sting or bite, hairy or brightly coloured insects, and caterpillars and insects that have a pungent odour. Also avoid spiders and common disease carriers such as ticks, flies, and mosquitoes.

Rotting logs on the ground are good places to look for insects including ants, termites, beetles, and grubs. Do not overlook insect nests on or in the ground. Grassy areas are good to search because the insects are easily seen. Check stones, boards, or other materials on the ground.

Insect larvae are also edible. Insects such as beetles and grasshoppers that have a hard outer shell will have parasites. Cook them before eating. Remove any wings and barbed legs also. You can eat most insects raw. The taste varies from one species to another. Wood grubs are bland, while some species of ants store honey in their bodies.

You can grind a collection of insects into a paste, mix them with edible vegetation or cook them to improve their taste.

4.1.2 WORMS

Worms are an excellent protein source. Dig for them in damp humus soil or watch for them on the ground after a rain. After capturing them, drop them into clean, potable water for a few minutes. The worms will naturally purge themselves out, after which you can eat them raw.

4.1.3 CRUSTACEANS

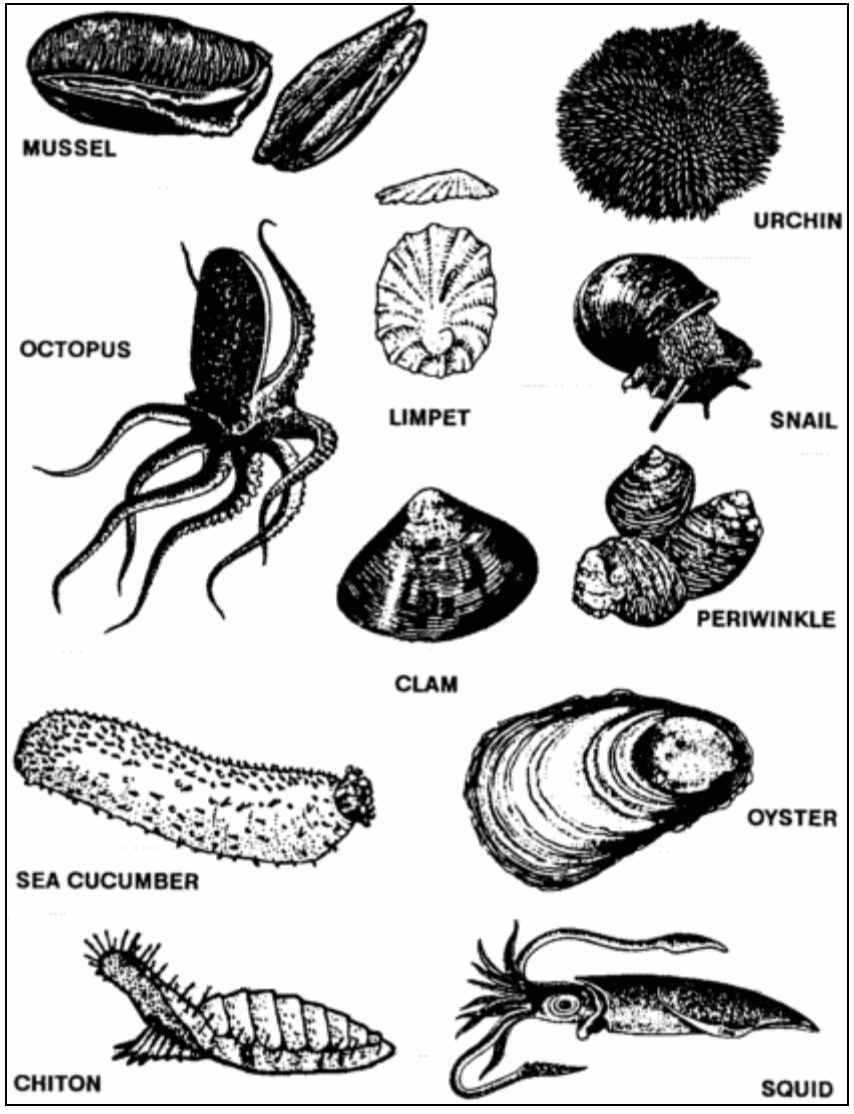
Freshwater shrimp range in from 0.25 – 2.5 cm. They can form rather large colonies in mats of floating algae or in mud bottoms of ponds and lakes.

Crayfish are active at night, but you can locate them in the daytime by looking under and around stones in streams. You can also find them by looking in the soft mud near the chimney like breathing holes of their nests. You can catch crayfish by tying bits of offal or internal organs to a string. When the crayfish grabs the bait, pull it to shore before it has a chance to release the bait.

You find saltwater lobsters, crabs, and shrimp from the surf's edge out to water 10 meters deep. Shrimp may come to a light at night where you can scoop them up with a net. You can catch lobsters and crabs with a baited trap or a baited hook. Crabs will come to bait placed at the edge of the surf, where you can trap or net them. Lobsters and crabs are nocturnal and caught best at night.

4.1.4 MOLLUSCS

This class includes octopuses and freshwater and saltwater shellfish such as snails, clams, mussels, bivalves, barnacles, periwinkles, chitons, and sea urchins. You find bivalves similar to freshwater mussel and terrestrial and aquatic snails worldwide under all water conditions.



River snails or freshwater periwinkles are plentiful in rivers, streams, and lakes of northern coniferous forests. These snails may be pencil point or globular in shape.

In fresh water, look for molluscs in the shallows, especially in water with a sandy or muddy bottom. Look for the narrow trails they leave in the mud or for the dark elliptical slit of their open valves.

Near the sea, look in the tidal pools and the wet sand. Rocks along beaches or extending as reefs into deeper water often bear clinging shellfish. Snails and limpets cling to rocks and seaweed from the low water mark upward. Large snails, called chitons, adhere tightly to rocks above the surf line.

Mussels usually form dense colonies in rock pools, on logs, or at the base of boulders.

! **CAUTION –** Mussels may be poisonous in tropical zones during the summer!

Steam, boil, or bake molluscs in the shell. They make excellent stews in combination with greens and tubers.

! **CAUTION –** Do not eat shellfish that are not covered by water at high tide!

4.1.5 BIRDS

All species of birds are edible, although the flavour will vary considerably. You may skin fish-eating birds to improve their taste. As with any wild animal, you must understand birds' habits to have a chance of capturing them. You can take pigeons and some other species from their roost at night by hand. During the nesting season, some species will not leave the nest even when approached. Knowing where and when the birds nest makes catching them easier.

Birds tend to have regular flyways going from the roost to a feeding area, to water, and so forth. Careful observation should reveal where these flyways are and indicate good areas for catching birds in nets stretched across the flyways. Roosting sites and waterholes are some of the most promising areas for trapping or snaring.

TYPES OF BIRDS	FREQUENT NESTING PLACES	NESTING PERIODS
Inland birds	Trees, woods, or fields	Spring and early summer in temperate and artic regions; year round in the tropics
Crane and herons	Mangrove swamps or high trees near water	Spring and early summer
Some species of owls	High trees	Late December through March
Ducks, geese, and swans	Tundra areas near ponds, rivers, or lakes	Spring and early summer in arctic regions
Some sea birds	Sandbars or low sand island	Spring and early summer intemperate and artic regions
Gulls, auks, murres, and cormorants	Steep rocky coasts	Spring and early summer in temperate and arctic regions

Nesting birds present another food source—eggs. Remove all but two or three eggs from the clutch, marking the ones that you leave. The bird will continue to lay more eggs to fill the clutch. Continue removing the fresh eggs, leaving the ones you marked.

4.1.6 AMPHIBIANS

Frogs and salamanders are easily found around bodies of fresh water. Frogs seldom move from the water's edge. At the first sign of danger, they plunge into the water and bury themselves in the mud and debris. There are few poisonous species of frogs. Avoid any brightly coloured frog or one that has a distinct "X" mark on its back. Do not confuse toads with frogs. You normally find toads in drier environments. Several species of toads secrete a poisonous substance through their skin as a defence against attack. Therefore, to avoid poisoning, do not handle, eat or lick toads.

Salamanders are nocturnal. The best time to catch them is at night using a light. They can range in size from a few cm to well over 60 cm in length. Look in water around rocks and mud banks for salamanders.

Before testing a plant for edibility, make sure there are enough plants to make the testing worth your time and effort. Each part of a plant (roots, leaves, flowers, and so on) requires more than 24 hours to test. Do not waste time testing a plant that is not relatively abundant in the area.

Remember, eating large portions of plant food on an empty stomach may cause diarrhoea, nausea, or cramps. Two good examples of this are such familiar foods as green apples and wild onions. Even after testing plant food and finding it safe, eat it in moderation.

You can see from the steps and time involved in testing for edibility just how important it is to be able to identify edible plants.

To avoid potentially poisonous plants, stay away from any wild or unknown plants that have —

- Milky or discoloured sap.
- Beans, bulbs, or seeds inside pods.
- Bitter or soapy taste.
- Spines, fine hairs, or thorns.
- Dill, carrot, parsnip, or parsley like foliage.
- "Almond" scent in woody parts and leaves.
- Grain heads with pink, purplish, or black spurs.
- Three-leaved growth pattern.

Using the above criteria as eliminators when choosing plants for the Universal Edibility Test will cause you to avoid some edible plants. More important, these criteria will often help you avoid plants that are potentially toxic to eat or touch.

5.1.3 MYTHS ABOUT BUSH FOODS

The following is a list of misconceptions about bush foods that are **wrong** —

- If it tastes good it's edible – wrong!
- If it smells good it's edible – wrong!
- Cooking destroys toxins that are harmful – wrong! Although heat can destroy some toxins.
- If the fruit, or any other part of the plant is edible, the whole plant is edible – wrong! Many plants have some edible part and some parts highly poisonous.
- If other animals eat them they are okay for humans – wrong!

5.1.4 SEAWEEDS

One plant you should never overlook is seaweed. It is a form of marine algae found on or near ocean shores. There are also some edible freshwater varieties. Seaweed is a valuable source of iodine, other minerals, and vitamin C.

> **!** **CAUTION –** Large quantities of seaweed in an unaccustomed stomach can produce a severe laxative effect.

When gathering seaweeds for food, look for living plants attached to rocks or floating free. Seaweed washed onshore any length of time may be spoiled or decayed. You can dry freshly harvested seaweeds for later use.

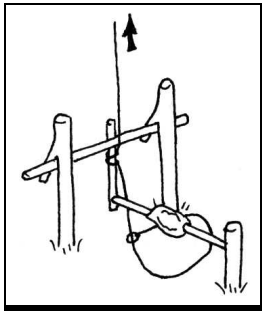
Its preparation for eating depends on the type of seaweed. You can dry thin and tender varieties in the sun or over a fire until crisp. Crush and add these to soups or broths. Boil thick, leathery seaweeds for a short time to soften them. Eat them as a vegetable or with other foods. You can eat some varieties raw after testing for edibility.

5.1.5 PREPARATION OF PLANT FOOD

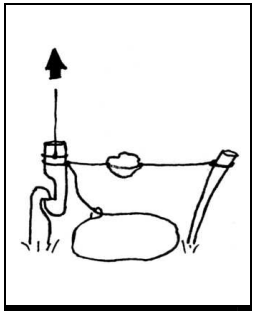
Although some plants or plant parts are edible raw, you must cook others to be edible or palatable. Edible means that a plant or food will provide you with necessary nutrients, while palatable means that it actually is pleasing to eat. Many wild plants are edible but barely palatable. Learn to identify, prepare, and eat wild foods.

Methods used to improve the taste of plant food include soaking, boiling, cooking, or leaching.

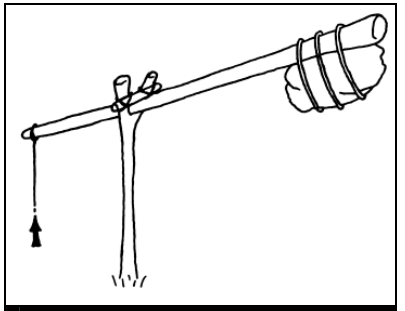
- Leaching is done by crushing the food (for example, acorns), placing it in a strainer, and pouring boiling water through it or immersing it in running water.
- Boil leaves, stems, and buds until tender, changing the water, if necessary, to remove any bitterness.



WHIP SNARE



WHIP SNARE



LEVER TWITCH-UP

Whip Snare

The classic whip snare uses a twitch-up to whip the prey into the air out of reach of predators and away from the ground so it can't pull itself free. The snare is activated when the prey tries to take the bait, pulling the bait rod off the toggle which releases and pulls the snare loop up.

A second whip snare is shown using notched pegs. The flyaway peg is attached to the twitch-up, the snare loop and wire with bait attached. The second peg should be loose in the ground so it releases with the snare loop.

The snare loop should be placed wide enough on the ground to ensure the prey is caught no matter how it approaches the bait.

Alternates to Twitch-Up

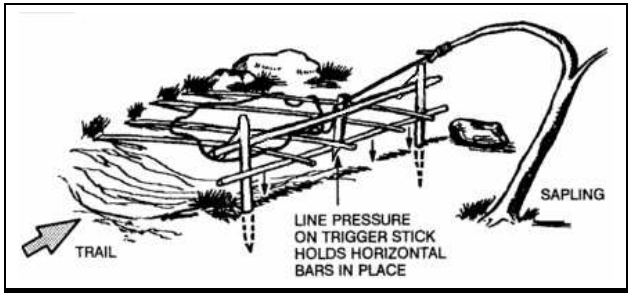
If a suitable sapling for a twitch-up is unavailable where you would like to place a trap, many alternatives are available. A heavy weight can be suspended over a tree limb, a weighted lever may be improvised, a bungee cord can also be used if available.

Treadle Spring Snare

Use a treadle snare against small game on a trail. Dig a shallow hole in the trail. Then drive two forked sticks into the ground on either side of the hole, on the same side of the trail. Make sure the forks are pointed down.

Tie one end of cordage to a twitch-up or weight suspended over a tree limb. Bend the twitch-up down, or raise the suspended weight to determine where to tie to a 10 cm or so trigger stick.

Tie to the stick about half-way along the cordage leaving enough length to form a noose with the rest.



TREADLE SPRING SNARE

Find two fairly straight sticks that span the forks. Place one stick under the forks and the other below that. Hold the sticks in place with the trigger stick under tension from the twitch-up or suspended weight. Adjust the bottom stick so that it will barely hold against the trigger.

Place several sticks over the hole with one end on the lower horizontal stick and the other on the ground on the other side of the hole. Place enough sticks so an animal is sure to step on one. Open and spread the noose over the entire trap.

When an animal steps on a stick, the bottom horizontal stick falls and releases the trigger stick. The tension will then pull the noose tight, snaring the animal.

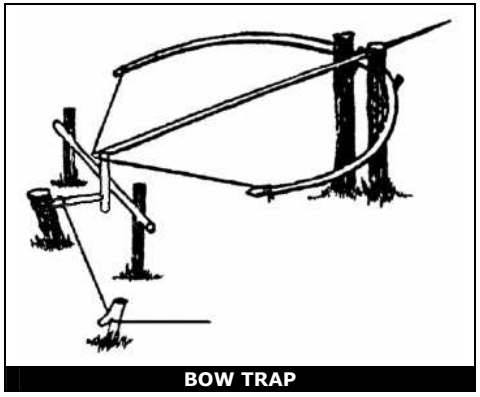
Because of the disturbance on the trail, an animal will be wary. You must therefore channel the trail into your trap.

Bow Trap

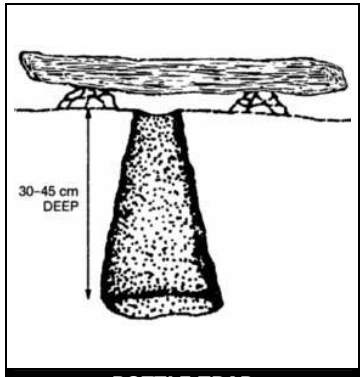
A bow trap is dangerous to man as well as animals. To construct this trap, build a bow and anchor it to the ground with pegs.

Adjust the aiming point as you anchor the bow. Lash a toggle stick to the trigger stick. Two upright sticks driven into the ground hold the trigger stick in place at a point where the toggle stick will engage the pulled bow string.

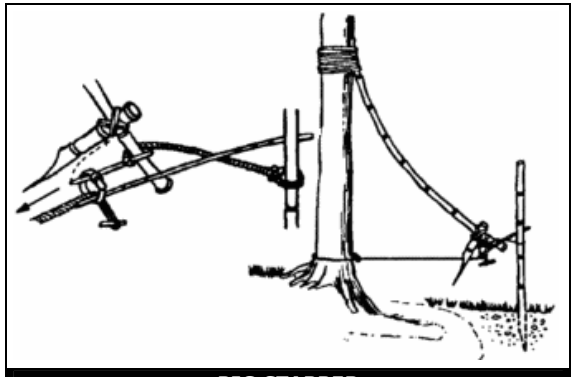
Place a catch stick between the toggle stick and a stake driven into the ground. Tie a trip wire or cordage to the catch stick and route it around stakes and across the game trail where you tie it off. When the prey trips the trip wire, the bow looses an arrow into it. A notch in the bow serves to help aim the arrow.



BOW TRAP



BOTTLE TRAP



PIG STABBER

Pig Stabber

To construct the pig stabber, select a stout pole about 2.5 meters long. At the smaller end, firmly lash several small stakes. Lash the large end tightly to a tree along the game trail.

Tie a length of cordage to another tree across the trail. Tie a sturdy, smooth stick to the other end of the cord. From the first tree, tie a trip wire or cord low to the ground, stretch it across the trail, and tie it to a catch stick.

Make a slip ring from vines or other suitable material. Encircle the trip wire and the smooth stick with the slip ring. Place one end of another smooth stick within the slip ring and its other end against the second tree. Pull the smaller end of the spear shaft across the trail and position it between the short cord and the smooth stick. As the animal trips the trip wire, the catch stick pulls the slip ring off the smooth sticks, releasing the spear shaft that springs across the trail and impales the prey against the tree.

Bottle Trap

A bottle trap is a simple trap for mice and voles. Dig a hole 30 - 45 cm deep that is wider at the bottom than at the top. Make the top of the hole as small as possible. Place a piece of bark or wood over the hole with small stones under it to hold it up 2.5 - 5 cm off the ground.

Mice or voles will hide under the cover to escape danger and fall into the hole. They cannot climb out because of the wall's backward slope.

! **CAUTION –** Be careful when checking this trap – it is an excellent hiding place for snakes.

Taproots resemble carrots and may be single-rooted or branched, but usually only one plant stalk arises from each root. Tubers are like potatoes and daylilies and you will find these structures either on strings or in clusters underneath the parent plants.

Rhizomes are large creeping rootstock or underground stems and many plants arise from the "eyes" of these roots. Corms are similar to bulbs but are solid when cut rather than possessing rings. A crown is the type of root structure found on plants such as asparagus and looks much like a mop head under the soil's surface.

Learn as much as possible about plants you intend to use for food and their unique characteristics. Some plants have both edible and poisonous parts. Many are edible only at certain times of the year. Others may have poisonous relatives that look very similar to the ones you can eat or use for medicine.

5.1.2 UNIVERSAL EDIBILITY TEST

There are many plants throughout the world. Tasting or swallowing even a small portion of some can cause severe discomfort, extreme internal disorders, and even death. Therefore, if you have the slightest doubt about a plant's edibility, apply the Universal Edibility Test before eating any portion of it.

1	Test only one part of a potential food plant at a time.
2	Separate the plants into its basic components – leaves, stems, roots, buds, and flowers.
3	Smell the food for strong or acid odours. Remember, smell alone does not indicate a plant is edible or inedible.
4	Do not eat for 8 hours before starting the test.
5	During the 8 hours you abstain from eating, test for contact poisoning by placing a piece of the plant part you are testing on the inside of your elbow or wrist. Usually 15 minutes is enough time to allow for a reaction
6	During the test period, take nothing by mouth except purified water and the plant part you are testing.
7	Select a small portion of a single part and prepare it the way you plan to eat it.
8	Before placing the prepared plant part in your mouth, touch a small portion (a pinch) to the outer surface of your lip to test for burning or itching.
9	If after 3 minutes there is no reaction on your lip, place the plant part on your tongue, holding it there for 15 minutes.
10	If there is no reaction, thoroughly chew a pinch and hold it in your mouth for 15 minutes. Do not swallow.
11	If no burning, itching, numbing, stinging or other irritation occurs during the 15 minutes, swallow the food.
12	Wait 8 hours. If any ill effects occur during this period, induce vomiting and drink a lot of water.
13	If no ill effects occur, eat 0.25 cup of the same plant part prepared the same way. Wait another 8 hours. If no ill effects occur, the plant part as prepared is safe for eating.

! CAUTION – Test all parts of the plant for edibility, as some plants have both edible and inedible parts. Do not assume that a part that proved edible when cooked is also edible when raw. Test the part raw to ensure edibility before eating raw. The same part or plant may produce varying reactions in different individuals.

The corm (bulb) of the jack-in-the-pulpit is known as the "Indian turnip," but you can eat it only after removing these crystals by slow baking or by drying.

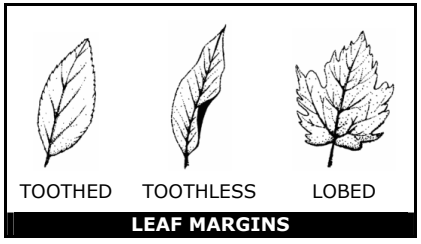
WARNING!!!

Do not eat mushrooms in a survival situation! The only way to tell if a mushroom is edible is by positive identification. There is no room for experimentation. Symptoms of the most dangerous mushrooms affecting the central nervous system may show up after several days have passed when it is too late to reverse their effects.

5.1.1 PLANT IDENTIFICATION

You identify plants, other than by memorizing particular varieties through familiarity, by using such factors as leaf shape and margin, leaf arrangements, and root structure.

The basic leaf margins are toothed, lobed, and toothless or smooth.

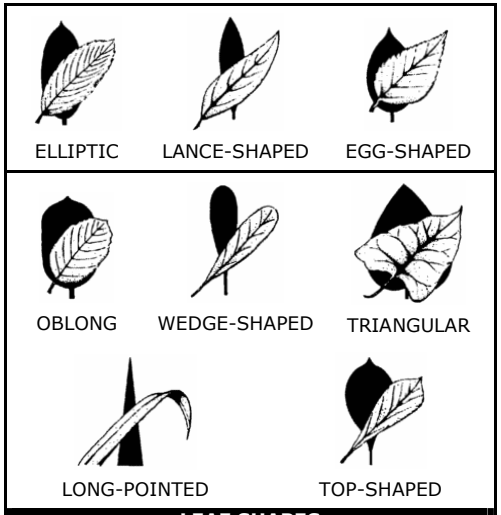


LEAF MARGINS

These leaves may be lance-shaped, elliptical, egg-shaped, oblong, wedge-shaped, triangular, long-pointed, or top-shaped.

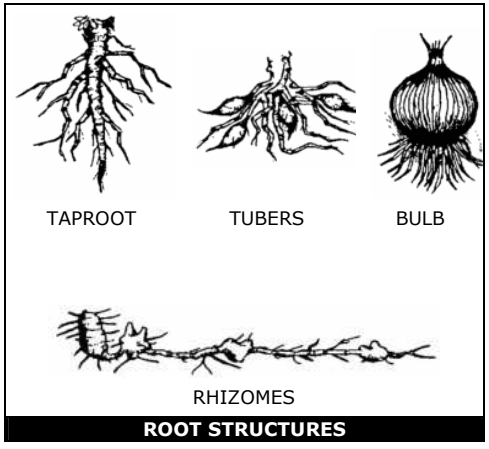
The basic types of leaf arrangements are opposite, alternate, compound, simple, and basal rosette.

The basic types of root structures are the bulb, clove, taproot, tuber, rhizome, corm, and crown. Bulbs are familiar as onions and, when sliced in half, will show concentric rings.

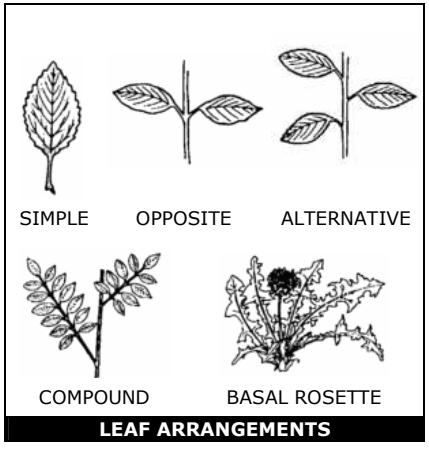


LEAF SHAPES

Cloves are those bulblike structures that remind us of garlic and will separate into small pieces when broken apart. This characteristic separates wild onions from wild garlic.



ROOT STRUCTURES



LEAF ARRANGEMENTS

4.3 KILLING DEVICES

There are simple devices that you can help you obtain small game. The rabbit stick and the spear are such devices. More are described in **Weapons Tools and Equipment** (Chapter 9)

Rabbit Stick

One of the simplest and most effective killing devices is a stout stick as long as your arm, from fingertip to shoulder, called a "rabbit stick." You can throw it overhand or sidearm with considerable force. It is very effective against small game that stops and freezes as a defence.

Spear

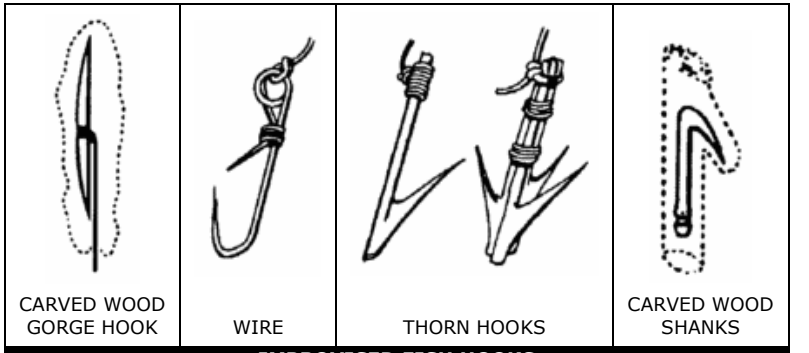
For construction and use of a spear, see **Spearfishing** (Page 4-15).

4.4 FISHING DEVICES

You can make your own fishhooks, nets and traps and use several methods to obtain fish.

4.4.1 IMPROVISED FISHHOOKS

Fishhooks can be made from pins, needles, wire, small nails, or any piece of metal, wood, bone, coconut shell, thorns, flint, seashell, tortoise shell or a combination of these.



IMPROVISED FISH HOOKS

To make a wooden hook, cut a piece of hardwood about 2.5 cm long and about 6 mm in diameter to form the shank. Cut a notch in one end in which to place the point. Place the point (piece of bone, wire, or nail) in the notch. Hold the point in the notch and tie securely so that it does not move out of position. This is a fairly large hook. To make smaller hooks, use smaller material.

A gorge is a small shaft of wood, bone, metal, or other material. It is sharp on both ends and notched in the middle where you tie cordage. Bait the gorge by placing a piece of bait on it lengthwise. When the fish swallows the bait, it also swallows the gorge.

4.4.2 IMPROVISED FISHING LURES

Lures can be improvised from any material that will attract the attention of fish. Foil can be fashioned around hooks into the shape of a small fish. Plastic bags or cloth can be torn into strips and attached to the lure to give the impression of tentacles. Sometimes a piece of colourful cloth attached to a hook will catch fish in the right place.

Lures can be carved from wood with hooks lashed to the body. These can be painted or decorated with foil, plastic, colourful feathers or whatever is on hand.

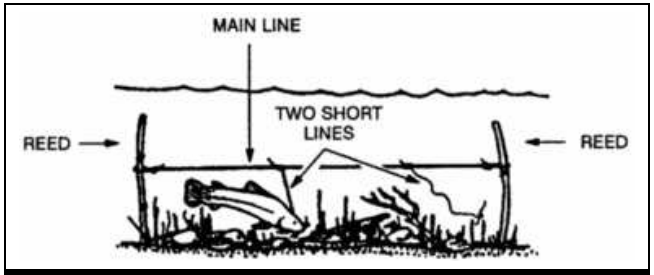
When using lures, cast them out to where there is evidence of fish (visual evidence or splashing in the water) and pull them in at a steady rate. Lures need to move to attract attention. Sometimes the movement of water will do this for you.

4.4.3 LIVE BAIT

When using live bait, be careful not to pierce the spine of the bait fish. Loop the hook under and around the spine to ensure the bait does not become incapacitated.

4.4.4 STAKEOUT

A stakeout is a fishing device you can use in a hostile environment.



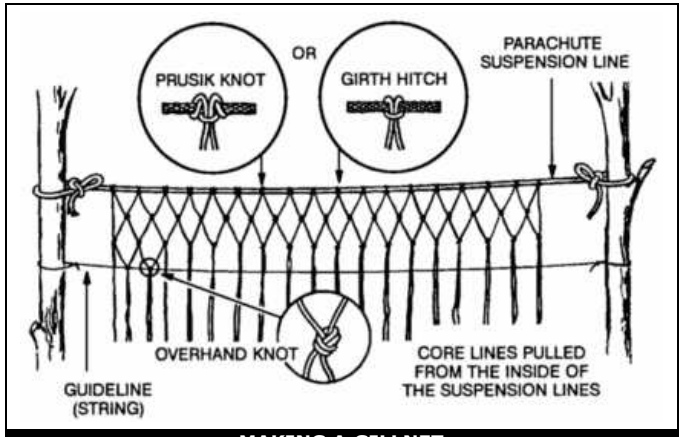
STAKEOUT

To construct a stakeout, drive two supple saplings into the bottom of the lake, pond, or stream with their tops just below the water surface.

Tie a cord between them and slightly below the surface. Tie two short cords with hooks or gorges to this cord, ensuring that they cannot wrap around the poles or each other. They should also not slip along the long cord. Bait the hooks or gorges.

4.4.5 GILL NET

If a gill net is not available, you can make one using parachute suspension line or similar material.



MAKING A GILLNET

Remove the core lines from the suspension line and tie the easing between two trees. Attach several core lines to the easing by doubling them over and tying them with prusik knots or girth hitches.

The length of the desired net and the size of the mesh determine the number of core lines used and the space between them. Starting at one end of the easing, tie the second and the third core lines together using an overhand knot. Then tie the fourth and fifth, sixth and seventh, and so on, until you reach the last core line.

You should now have all core lines tied in pairs with a single core line hanging at each end. Start the second row with the first core line, tie it to the second, the third to the fourth, and so on.

To keep the rows even and to regulate the size of the mesh, tie a guideline to the trees. Position the guideline on the opposite side of the net you are working on. Move the guideline down after completing each row. The lines will always hang in pairs and you always tie a cord from one pair to a cord from an adjoining pair. Continue tying rows until the net is the desired width. Thread a suspension line easing along the bottom of the net to strengthen it. Use the gill net as shown.

5 Survival Use of Plants

After solving the problems of finding water, shelter, and food, you will have to consider the use of plants you can eat. In a survival situation you should always be on the lookout for familiar wild foods and live off the land whenever possible.

You must not count on being able to go for days without food as some sources would suggest. Even in the best situation, maintaining health through a complete and nutritious diet is essential to maintaining strength and peace of mind.

You must learn as much as possible beforehand about the flora of the region where you will be operating. Plants can provide you with medicines in a survival situation. Plants can supply you with weapons and raw materials to construct shelters and build fires. Plants can even provide you with chemicals for poisoning fish, preserving animal hides, and for camouflaging yourself and your equipment.

5.1 EDIBILITY OF PLANTS

Plants are valuable sources of food because they are widely available, easily procured, and, in the proper combinations, can meet all your nutritional needs.

WARNING!!!

The critical factor in using plants for food is to avoid accidental poisoning. Eat only those plants you can positively identify and you know are safe.

Absolutely identify plants before using them as food. Poison hemlock has killed people who mistook it for its relatives, wild carrots and wild parsnips.

At times you may find yourself in a situation for which you could not plan. In this instance you may not have had the chance to learn the plant life of the region in which you must survive. In this case you can use the **Universal Edibility Test** (Page 5-3) to determine which plants you can eat and those to avoid.

It is important to be able to recognize both cultivated and wild edible plants in a survival situation. Most of the information in this chapter is directed towards identifying wild plants because information relating to cultivated plants is more readily available.

Remember the following when collecting wild plants for food —

- Plants growing near occupied buildings or along roadsides may have been sprayed with pesticides. Wash them thoroughly. In highly developed countries with many automobiles, avoid roadside plants, if possible, due to contamination from exhaust emissions.
- Plants growing in contaminated water or in water containing Giardia lamblia and other parasites are contaminated themselves. Boil or disinfect them.
- Some plants develop extremely dangerous fungal toxins. Do not eat any fruit that is starting to spoil or showing signs of mildew or fungus.
- Plants of the same species may differ in their toxic or subtoxic compounds content because of genetic or environmental factors. One example of this is the foliage of the common chokecherry. Some chokecherry plants have high concentrations of deadly cyanide compounds while others have low concentrations or none. Avoid any weed, leaves, or seeds with an almond like scent, a characteristic of the cyanide compounds.
- Some people are more susceptible to gastric distress than others. If you are sensitive in this way, avoid unknown wild plants. If you are extremely sensitive to poison ivy, avoid products from this family, including any parts from sumacs, mangoes, and cashews.
- Some edible wild plants, such as acorns and water lily rhizomes, are bitter. These bitter substances, usually tannin compounds, make them unpalatable. Boiling them in several changes of water will usually remove these bitter properties.
- Many valuable wild plants have high concentrations of oxalate compounds, also known as oxalic acid. Oxalates produce a sharp burning sensation in your mouth and throat and damage the kidneys. Baking, roasting, or drying usually destroys these oxalate crystals.

4.4.6 CHOP FISHING

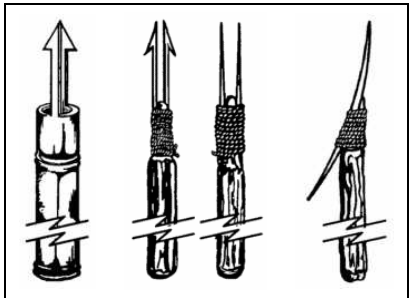
At night, in an area with a good fish density, you can use a light to attract fish. Then, armed with a machete or similar weapon, you can gather fish using the back side of the blade to strike them. Do not use the sharp side as you will cut them in two pieces and end up losing some of the fish.

4.4.7 SPEARFISHING

If you are near shallow water where the fish are large and plentiful, you can spear them. To make a spear, cut a long straight sapling and sharpen the end to a point or attach a knife, jagged piece of bone, or sharpened metal.

You can also make a spear by splitting the shaft a few inches down from the end and inserting a piece of wood to act as a spreader. You then sharpen the two separated halves to points.

To spear fish, find an area where fish either gather or where there is a fish run. Place the spear point into the water and slowly move it toward the fish. Then, with a sudden push, impale the fish on the stream bottom.



TYPES OF SPEARPOINTS

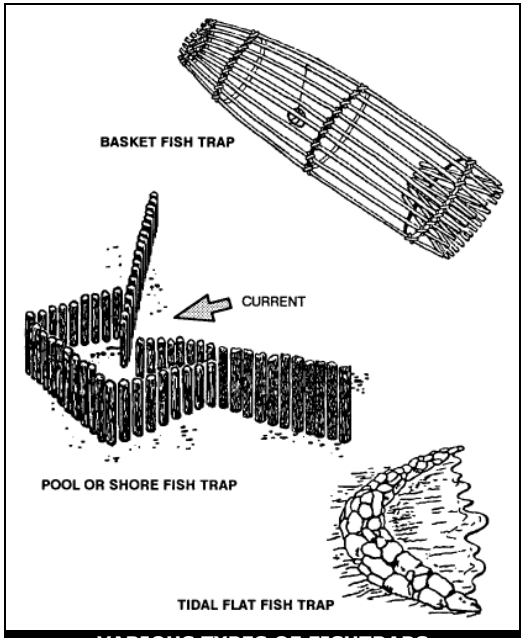
Do not try to lift the fish with the spear, as it with probably slip off and you will lose it; hold the spear with one hand and grab and hold the fish with the other. Do not throw the spear, especially if the point is a knife. You cannot afford to lose a knife in a survival situation.

Be alert to the problems caused by light refraction when looking at objects in the water. You can compensate for this by moving through the water with the tip submerged.

4.4.8 FISH TRAPS

You may trap fish using several methods. Fish baskets are one method. Construct them by lashing several sticks together into a funnel shape. You close the top, leaving a hole large enough for the fish to swim in, but difficult to swim out. The bait should be suspended in the centre of the basket so fish and crustaceans cannot pick at it from the outside.

You can also use traps to catch saltwater fish, as schools regularly approach the shore with the incoming tide and often move parallel to the shore.



VARIOUS TYPES OF FISHTRAPS

Pick a location at high tide and build the trap 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 sandbars and the ditches they enclose.

Build the trap as a low stone wall extending outward into the water and forming an angle with the shore.

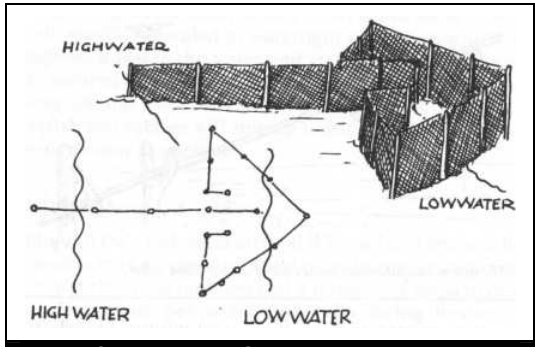
Arrowhead Fish Trap

This is a permanent trap which will provide ample supply of fish in all seasons under ideal conditions.

It is suitable for coastal areas where the difference between high tide and low tide is 1-2 metres.

Select a site where the beach slopes evenly. Run a fence of wire netting that will be above the high water mark and will have at least 30 cm water at the low water mark. If wire netting is not available, poles can be used as long as they are close together and hammered in deep enough to hold steady with the movement of the water.

From the low water end run the 'arrowhead' back towards the high water end at about 45°, up to about the mid water mark. Complete construction as pictured. Clear the trap at low tide, taking only the fish that you need. Leave the rest alive in the trap. Some will undoubtedly escape at high tide, but others will remain trapped.

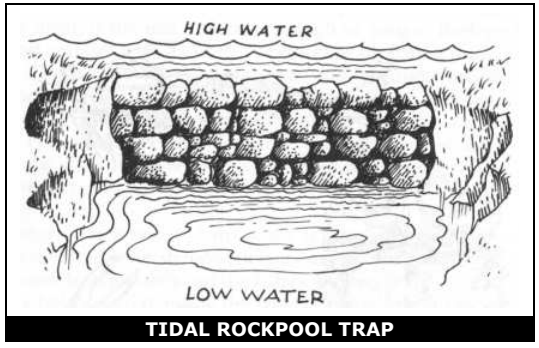


'ARROWHEAD' TIDAL FISH TRAP

Tidal Rockpool Trap

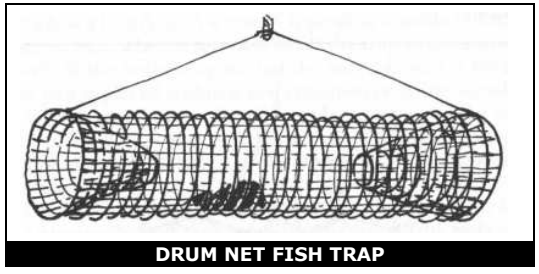
These traps are useful on rocky shorelines. Find a site where there are rockpools that are well covered at high tide, and almost dry at low tide. Bait the pool heavily with crushed up shellfish and crap like that.

Build a wall at the normal opening that will be well covered at high tide and above the water at low tide. The wall can be made from rocks, driftwood or other available material.



TIDAL ROCKPOOL TRAP

The fish with gather to feed at night during a high tide and will remain trapped when the water level drops. You can them gather them by hand or with a net.

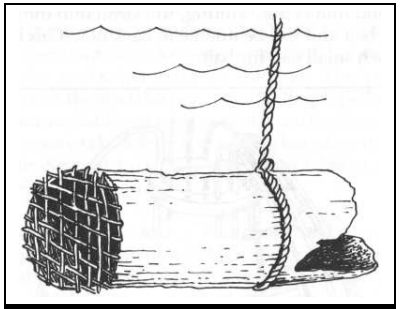

DRUM NET FISH TRAP

Drum Net Fish Trap

A drum net is a cylindrical wire cage with inverted cone-shaped entrances at each end. These entrances allow easy entry for the fish, but make it difficult to escape.

You can place the trap mid-stream, or dropped into a deep river pool or anywhere where fish regularly feed.

Almost any bait will do. Stinky inedible meat or fish works well. If possible suspend the bait in the centre of the trap so fish and other creatures must enter to feed, rather than pick it out through the mesh.


HOLLOW LOG TRAP

4.5.4 OTHER PRESERVATION METHODS

You can also preserve meats using the freezing or brine and salt methods.

Freezing

In cold climates, you can freeze and keep meat indefinitely. Freezing is not a means of preparing meat. You must still cook it before eating.

Brine and Salt

You can preserve meat by soaking it thoroughly in a saltwater solution. The solution must cover the meat. You can also use salt by itself. Wash off the salt before cooking.

Corning Meat

To corn meat use a large pot, preferably stainless steel (never aluminium).

Place 3 cups of salt in the pot and enough hot water to dissolve the salt. Add enough cold water to fill the pot half way and allow the mixture to cool.

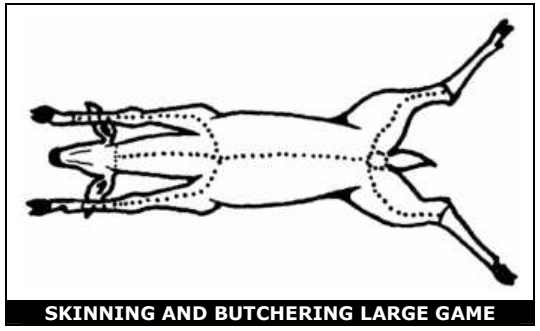
Rinse the meat to be corned with clean water and place in the brine solution. Cover the mixture with the upside down lid to push the meat completely under the liquid. Weigh the lid down.

After 5 days, remove and rinse the meat with clean water, replace the brine solution with a fresh batch and return the meat. Let this stand for another 10 days.

This meat will keep refrigerated for up to a week when complete, and can be consumed at anytime during the corning process. Rinse with clean water first.

Cut the hindquarters off where they join the body. You must cut around a large bone at the top of the leg and cut to the ball and socket hip joint. Cut the ligaments around the joint and bend it back to separate it.

Remove the large muscles (the tenderloin) that lie on either side of the spine. Separate the ribs from the backbone. There is less work and less wear on your knife if you break the ribs first, then cut through the breaks.



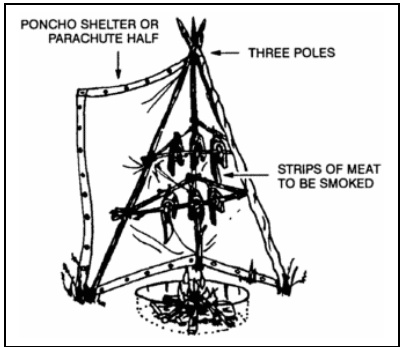
SKINNING AND BUTCHERING LARGE GAME

Cook large meat pieces over a spit or boil them. You can stew or boil smaller pieces, particularly those that remain attached to bone after the initial butchering, as soup or broth. You can cook body organs such as the heart, liver, pancreas, spleen, and kidneys using the same methods as for muscle meat. You can also cook and eat the brain. Cut the tongue out, skin it, boil it until tender, and eat it.

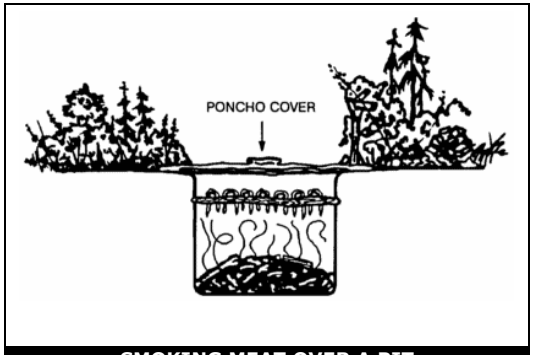
4.5.2 SMOKING MEAT

To smoke meat, prepare an enclosure around a fire. The fire does not need to be big or hot. The intent is to produce smoke, not heat.

Do not use resinous wood in the fire because its smoke will ruin the meat. Use hardwoods to produce good smoke. The wood should be somewhat green. If it is too dry, soak it. Cut the meat into thin slices, no more than 5 cm thick (2 in), and drape them over a framework. Make sure none of the meat touches another piece. Keep the poncho enclosure around the meat to hold the smoke and keep a close watch on the fire. Do not let the fire get too hot. Meat smoked overnight in this manner will last about 1 week. Two days of continuous smoking will preserve the meat for 2 to 4 weeks. Properly smoked meat will look like a dark, curled, brittle stick and you can eat it without further cooking. You can also use a pit to smoke meat.



TEEPEE SMOKER



SMOKING MEAT OVER A PIT

4.5.3 DRYING MEAT

To preserve meat by drying, cut it into 6 mm (1/4 in) strips with the grain. Hang the meat strips on a rack in a sunny location with good air flow. Make sure the strips of meat do not touch each other and there is plenty of airflow between the strips.

Keep the strips out of the reach of animals and cover them to keep blowflies off. Allow the meat to dry thoroughly before eating. Properly dried meat will have a dry, crisp texture and will not feel cool to the touch.

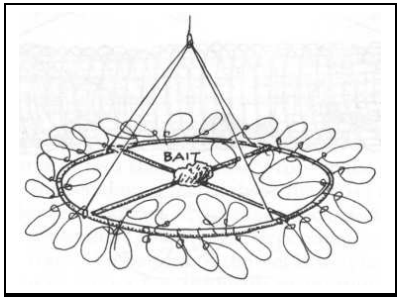
Hollow Log Trap

This trap can work because most fish cannot swim backwards. Cover a hollow log at one end with netting or other material which allows water to flow through freely. Make sure the log is not large enough to allow fish to turn around. Tie a rope securely towards the open end so when you pull it upwards, the fish is forced toward the netting. When you pull it up, do so in one smooth motion. Don't forget to bait it.

Crayfish or Yabbie Snare

Make a circle out of heavy gauge wire about 30-50 cm in diameter. Keep it rigid with two crosspieces of equally heavy material. Tie a series of running nooses, no more than 5 cm diameter, around the perimeter. Heavy nylon fishing line is a good material to use.

Tie the bait to the centre and fix three or four cords to the outside and to a central rope to drop in and pull the trap up. If necessary, use heavy stones to weigh the trap down, although a bit of movement can help with snaring the prey.



CRAYFISH OR YABBIE SNARE

4.4.9 FISH POISON

Another way to catch fish is by using poison. Poison works quickly and allows you to remain concealed while it takes effect. It also enables you to catch several fish at one time. Some plants that grow in warm regions of the world contain rotenone, a substance that stuns or kills cold-blooded animals but does not harm persons who eat the animals.

ANAMIRTAS COCCULUS

This woody vine grows in southern Asia and on islands of the South Pacific. Crush the bean-shaped seeds and throw them in the water.

CROTON TIGLIUM

This shrub or small tree grows in waste areas on islands of the South Pacific. It bears seeds in three angled capsules. Crush the seeds and throw them into the water.

BARRINGTONA

These large trees grow near the sea in Malaya and parts of Polynesia. They bear a fleshy one-seeded fruit. Crush the seeds and bark and throw into the water.

DERRIS ELIPTICA

This large genus of tropical shrubs and woody vines is the main source of commercially produced rotenone. Grind the roots into a powder and mix with water. Throw a large quantity of the mixture into the water.

DUBOISIA

This shrub grows in Australia and bears white clusters of flowers and berrylike fruit. Crush the plants and throw them into the water.

TEPHROSIA

This species of small shrubs, which bears beanlike pods, grows throughout the tropics. Crush or bruise bundles of leaves and stems and throw them into the water.

OTHER SOURCES

- **LIME:** You can get lime from commercial sources and in agricultural areas. You may produce your own by burning coral or seashells. Throw the lime into the water.
- **NUT HUSKS:** Crush green husks from butternuts or black walnuts then throw into the water.

SOURCES OF FISH POISON

The best place to use rotenone, is in ponds or the headwaiters of small streams containing fish. Rotenone works quickly on fish in water 20°C (70°F) or above. The fish rise helplessly to the surface.

It works slowly in water 10 - 20°C (50 - 70°F) and is ineffective in water below 10°C (50°F).

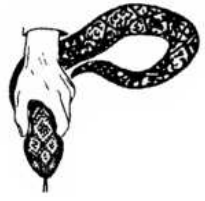
4.5 PREPARATION OF FISH AND GAME

You must know how to prepare fish and game for cooking and storage in a survival situation. Improper cleaning or storage can result in inedible fish or game.

Fish

Do not eat fish that appears spoiled. Cooking does not ensure that spoiled fish will be edible. Signs of spoilage are:

- Sunken eyes.
- Peculiar odour.
- Suspicious colour. (Gills should be red to pink. Scales should be a pronounced shade of grey, not faded.)
- Dents stay in the fish's flesh after pressing it with your thumb.
- Slimy, rather than moist or wet body.
- Sharp or peppery taste.



1. GRIP THE DEAD SNAKE FIRMLY BEHIND THE HEAD

2. CUT AT LEAST 15 cm BEHIND THE HEAD

3. SLIT BELLY AND REMOVE INNARDS

4. SKIN

CLEANING A SNAKE

Eating spoiled or rotten fish may cause diarrhoea, nausea, cramps, vomiting, itching, paralysis, or a metallic taste in the mouth. These symptoms appear suddenly, one to six hours after eating. Induce vomiting if symptoms appear.

Fish spoils quickly after death, especially on a hot day. Prepare fish for eating as soon as possible after catching it. Cut out the gills and large blood vessels that lie near the spine. Gut fish that is more than 10 cm long. Scale or skin the fish.

You can impale a whole fish on a stick and cook it over an open fire. However, boiling the fish with the skin on is the best way to get the most food value. The fats and oil are under the skin and, by boiling, you can save the juices for broth. You can use any of the methods used to cook plant food to cook fish. Pack fish into a ball of clay and bury it in the coals of a fire until the clay hardens. Break open the clay ball to get to the cooked fish. Fish is done when the meat flakes off. If you plan to keep the fish for later, smoke or fry it. To prepare fish for smoking, cut off the head and remove the backbone.

Snakes

To skin a snake, first cut off its head and bury it. Then cut the skin down the body 15 - 20 cm. Peel the skin back, then grasp the skin in one hand and the body in the other and pull apart. On large, bulky snakes it may be necessary to slit the belly skin. Cook snakes in the same manner as small game. Remove the entrails and discard. Cut the snake into small sections and boil or roast it.

Birds

After killing the bird, remove its feathers by either plucking or skinning. Remember, skinning removes some of the food value. Open up the body cavity and remove its entrails, saving the craw (in seed-eating birds), heart, and liver. Cut off the feet. Cook by boiling or roasting over a spit. Before cooking scavenger birds, boil them at least 20 minutes to kill parasites.

4.5.1 SKINNING AND BUTCHERING GAME

Bleed the animal by cutting its throat. If possible, clean the carcass near a stream. Place the carcass belly up and split the hide from throat to tail, cutting around all sexual organs. Remove the musk glands at points A and B to avoid tainting the meat.

For smaller mammals, cut the hide around the body and insert two fingers under the hide on both sides of the cut and pull both pieces off.

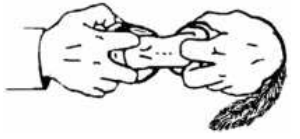
Remove the entrails from smaller game by splitting the body open and pulling them out with the fingers.

Do not forget the chest cavity. For larger game, cut the gullet away from the diaphragm.

Roll the entrails out of the body. Cut around the anus, then reach into the lower abdominal cavity, grasp the lower intestine, and pull to remove.

Remove the urine bladder by pinching it off and cutting it below the fingers. If you spill urine on the meat, wash it to avoid tainting the meat.

CUT THE HIDE OUT AROUND THE BODY



INSERT TWO FINGERS UNDER THE HIDE ON BOTH SIDES OF THE CUT AND PULL BOTH PIECES OFF.

SKINNING AND BUTCHERING SMALL GAME

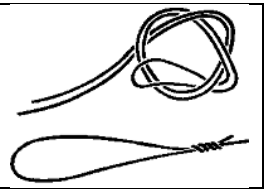
Save the heart and liver. Cut these open and inspect for signs of worms or other parasites. Also inspect the livers colour; it could indicate a diseased animal. The liver's surface should be smooth and wet and its colour deep red or purple. If the liver appears diseased, discard it. However, a diseased liver does not indicate you cannot eat the muscle tissue.

Cut along each leg from above the foot to the previously made body cut. Remove the hide by pulling it away from the carcass, cutting the connective tissue where necessary. Cut off the head and feet.

Cut larger game into manageable pieces. First, slice the muscle tissue connecting the front legs to the body. There are no bones or joints connecting the front legs to the body on four-legged animals.

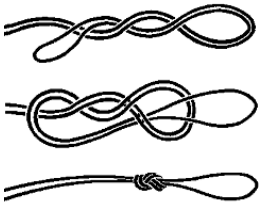
Surgeon's Loop

This is used to quickly create a loop in a line.



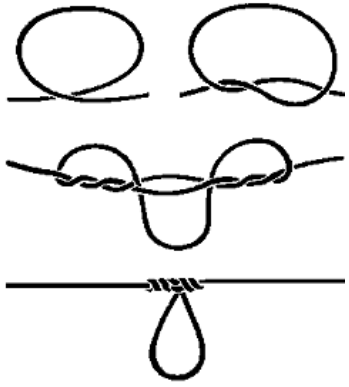
Blood Bight Knot

Another end loop that is quick and easy to tie.



Dropper Loop

This is very neat loop that stands at right angles to the line when pulled in.



7.4 LASHINGS

There are several types of lashings that are commonly used —

- Square Lashing
- Diagonal Lashing
- Sheer Lashing
- Figure of Eight Lashing

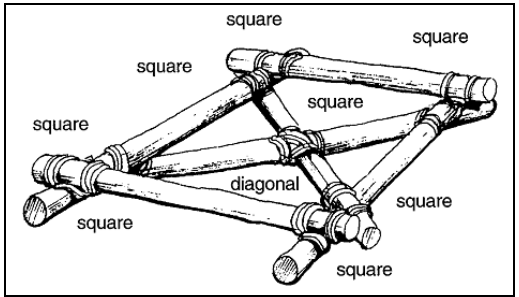
A square lashing is most commonly used and is used when the spars will try to slide over each other regardless of the angle that they cross.

A diagonal lashing is used when the spars have to be pulled together or when they tend to spring apart from each other. For example, the cross-brace of a framework.

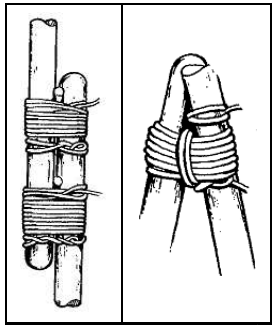
Sheer lashing has two purposes, for joining two poles end to end, and for making 'sheer legs', where the spars are opened to form an inverted 'V'.

Figure of eight lashing is sometimes known as the round, or tripod lashing. It is used to bring three spars together to form a tripod.

The usual way to start a lashing is with a clove hitch or timber hitch. If using a timber hitch, it is important to pull straight through the eye and not back from it. Pulling back can cut the lashing material.



SQUARE AND DIAGONAL LASHINGS



SHEER LASHINGS

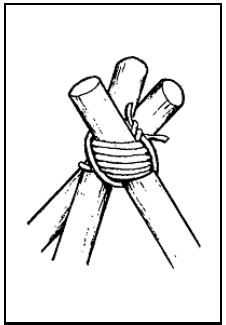


FIGURE OF EIGHT

- Boil, bake, or roast tubers and roots. Drying helps to remove caustic oxalates from some roots like those in the Arum family.
- Leach acorns in water, if necessary, to remove the bitterness. Some nuts, such as chestnuts, are good raw, but taste better roasted.
- You can eat many grains and seeds raw until they mature. When hard or dry, you may have to boil or grind them into meal or flour.
- The sap from many trees, such as maples, birches, walnuts, and sycamores, contains sugar. You may boil these saps down to a syrup for sweetening. It takes about 35 litres of maple sap to make one litre of maple syrup!

5.2 PLANTS FOR MEDICINE

In a survival situation you will have to use what is available. In using plants and other natural remedies, positive identification of the plants involved is as critical as in using them for food. Proper use of these plants is equally important.

Terms and Definitions

The following terms, and their definitions, are associated with medicinal plant use —

Poultice	The name given to crushed leaves or other plant parts, possibly heated, that you apply to a wound or sore either directly or wrapped in cloth or paper.
Infusion or tisane or tea	The preparation of medicinal herbs for internal or external application. You place a small quantity of a herb in a container, pour hot water over it, and let it steep (covered or uncovered) before use.
Decoction	The extract of a boiled down or simmered herb leaf or root. You add herb leaf or root to water. You bring them to a sustained boil or simmer to draw their chemicals into the water. The average ratio is about 28 to 56 grams (1 to 2 ounces) of herb to 0.5 litre of water.
Expressed juice	Liquids or saps squeezed from plant material and either applied to the wound or made into another medicine.

Many natural remedies work slower than the medicines you know. Therefore, start with smaller doses and allow more time for them to take effect. Naturally, some will act more rapidly than others.

Specific Remedies

The following remedies are for use only in a survival situation, not for routine use —

Diarrhoea	Drink tea made from the roots of blackberries and their relatives to stop diarrhoea. White oak bark and other barks containing tannin are also effective. However, use them with caution when nothing else is available because of possible negative effects on the kidneys. You can also stop diarrhoea by eating white clay or campfire ashes. Tea made from cowberry or cranberry or hazel leaves works too.
Antihemorrhagics	Make medications to stop bleeding from a poultice of the puffball mushroom, from plantain leaves, or most effectively from the leaves of the common yarrow or woundwort (Achillea millefolium).
Antiseptics	Use to cleanse wounds, sores, or rashes. You can make them from the expressed juice from wild onion or garlic, or expressed juice from chickweed leaves or the crushed leaves of dock. You can also make antiseptics from a decoction of burdock root, mallow leaves or roots, or white oak bark. All these medications are for external use only.

Fevers	Treat a fever with a tea made from willow bark, an infusion of elder flowers or fruit, linden flower tea, or elm bark decoction.
Colds and sore throats	Treat these illnesses with a decoction made from either plantain leaves or willow bark. You can also use a tea made from burdock roots, mallow or mullein flowers or roots, or mint leaves.
Aches, pains, and sprains	Treat with externally applied poultices of dock, plantain, chickweed, willow bark, garlic, or sorrel. You can also use salves made by mixing the expressed juices of these plants in animal fat or vegetable oils.
Itching	Relieve the itch from insect bites, sunburn, or plant poisoning rashes by applying a poultice of jewelweed (Impatiens biflora) or witch hazel leaves (Hamamelis virginiana). The jewelweed juice will help when applied to poison ivy rashes or insect stings. It works on sunburn as well as aloe vera.
Sedatives	Get help in falling asleep by brewing a tea made from mint leaves or passionflower leaves.
Haemorrhoids	Treat them with external washes from elm bark or oak bark tea, from the expressed juice of plantain leaves, or from a Solomon's seal root decoction.
Constipation	Relieve constipation by drinking decoctions from dandelion leaves, rose hips, or walnut bark. Eating raw daylily flowers will also help.
Worms or intestinal parasites	Using moderation, treat with tea made from tansy (Tanacetum vulgare) or from wild carrot leaves.
Gas and cramps	Use a tea made from carrot seeds as an antiflatulent; use tea made from mint leaves to settle the stomach.
Antifungal washes	Make a decoction of walnut leaves or oak bark or acorns to treat ringworm and athlete's foot. Apply frequently to the site, alternating with exposure to direct sunlight.

5.3 MISCELLANEOUS USES OF PLANTS

- Make dyes from various plants to colour clothing or to camouflage your skin. Usually, you will have to boil the plants to get the best results. Onion skins produce yellow, walnut hulls produce brown, and pokeberries provide a purple dye.
- Make fibres and cordage from plant fibres. Most commonly used are the stems from nettles and milkweeds, yucca plants, and the inner bark of trees like the linden. Rope making is discussed in detail in **Making Ropes and Cord** (Page 7-1).
- Make fish poison by immersing walnut hulls in a small area of quiet water. This poison makes it impossible for the fish to breathe but doesn't adversely affect their edibility.
- Make tinder for starting fires from cattail fluff, cedar bark, lighter knot wood from pine trees, or hardened sap from resinous wood trees.
- Make insulation by fluffing up female cattail heads or milkweed down.
- Make insect repellents by applying the expressed juice of wild garlic or onion to the skin, by placing sassafras leaves in your shelter, or by burning or smudging cattail seed hair fibres.
- Plants can be your ally as long as you use them cautiously. The key to the safe use of plants is positive identification whether you use them as food or medicine or in constructing shelters or equipment.

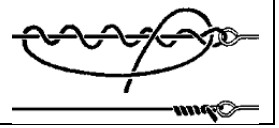
7.3.6 FISHING KNOTS

Loop Knot

This simple loop is easy to tie and is adequate for most purposes.

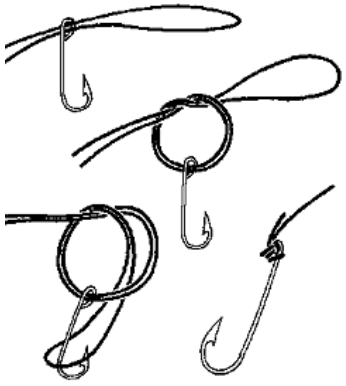
Clinch Knot

Used to attach line to leaders, swivels or hooks.



Palomar Knot

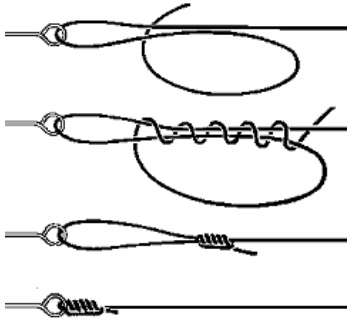
This simple knot is regarded as the strongest known fishing knot.



Hangman's Knot

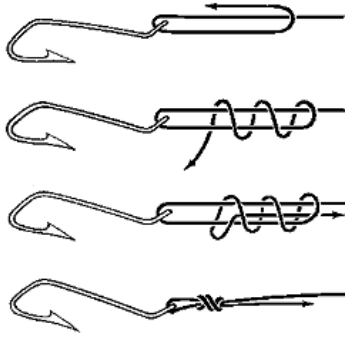
This is one of many variations on the hangman's knot. If tied in fishing line, only 5 turns are used.

Make sure you work the knot up neatly.



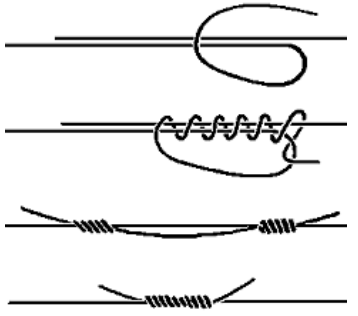
Scaffold Knot

This is a variant of the Hangman's Knot.



Uni-Knot

This knot is used to join two lines of equal thickness.



Surgeon's Knot

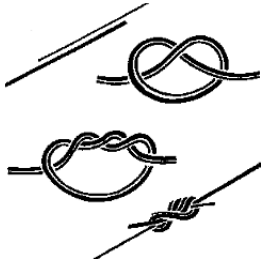
This knot is used to join line of different thickness.

Lay the two lines against each other, overlapping by about 20 cm.

Working the two lines as one, tie an overhand knot. It will be necessary to pull one line (say the leader) completely through this loop.

Pull the leader through this loop again. Then pass the other end through the loop.

The formed knot can now be worked into shape.

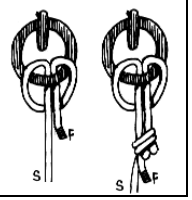


Cats Paw Hitch

For securing a rope to a hook or beam. Useful because it is so easy to tie.

Larks Head

This is an easy method of securing a rope to a ring or beam. It can be made more secure by tying an overhand or thumb knot as shown.

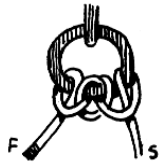


Double Larks Head

The bight is first made then the ends are passed through it. This knot is very secure.

Triple Larks Head

This knot can be made by passing the bight through the ring, then passing the ends through the bight and up through the ring.

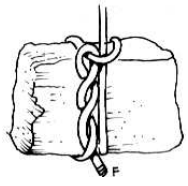


Sailor's Backhand Knot

Used to secure rope to a ring or beam. Very similar to the rolling hitch.

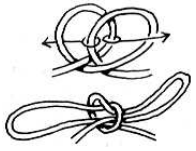
Kellick Hitch

Good for fastening to a stone that will hold in rocky sea floors where an anchor might foul. It is a timber hitch finished off with a half hitch.



Tom Fool's Knot

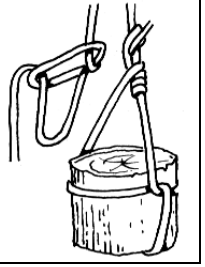
Formed by making two loops overlapping each other then pulling the inner loops through the outside.



This is useful for improvising carry handles.

Drum Sling

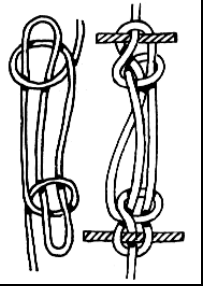
A slip knot is made as indicated. The drum is then placed in the slip knot and the free end tied with an overhand knot to the standing end.



7.3.5 SHORTENING ROPES

Sheepshank

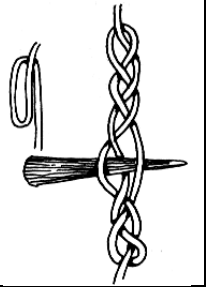
A knot to quickly shorten the length of a rope. By inserting toggles in the end bights as shown, the sheepshank is secured from slipping.



Twist Knot

This is another method of shortening a rope. The rope is first laid out as shown then the strands are braided together.

A spike is inserted between the ropes in the centre to hold the braid secure.



6 Firecraft

In many survival situations, the ability to start a fire can make the difference between living and dying. Fire can provide warmth and comfort. It cooks and preserves food.

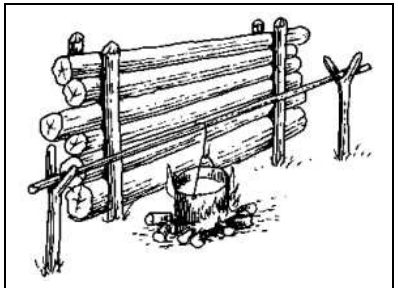
You can use fire to purify water, sterilize bandages and provide protection from animals. You can also use fire to produce tools and weapons.

Fire can also cause problems. Others can detect the smoke and light. Remember weigh your need for fire against your need to avoid detection.

6.1 SITE SELECTION AND PREPARATION

Look for a dry spot that —

- Is protected from the wind.
- Is suitably placed in relation to your shelter.
- Will reflect heat in the direction you desire.
- Has a supply of wood or other fuel available.



FIRE WALL

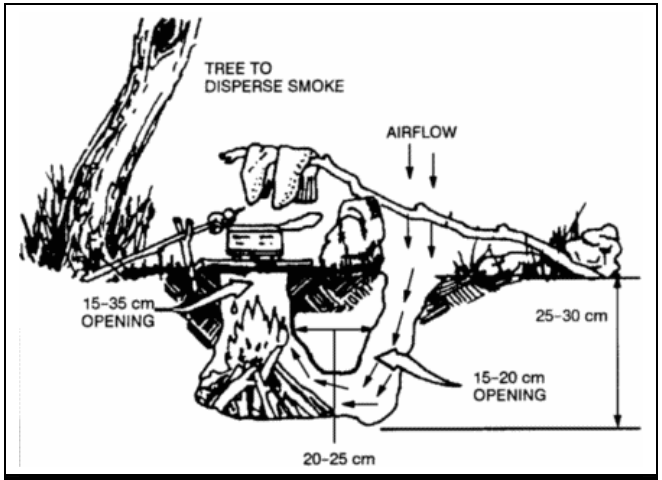
If you are in a wooded or brush-covered area, clear the brush and scrape the surface soil from the spot you have selected. Clear a circle at least 2 metres in diameter so there is little chance of the fire spreading.

If time allows, construct a fire wall using logs or rocks. This wall will help to reflect the heat where you want it. It will also reduce flying sparks and cut down on the amount of wind blowing into the fire. However, you will need enough wind to keep the fire burning.

> **CAUTION –** Do not use porous rocks, such as sandstone or rocks found in a river bed as they may explode with quite some force when heated.

In some situations, you may find that an underground fireplace will best meet your needs. It conceals the fire and serves well for cooking food. To make an underground fireplace or Dakota fire hole —

- Dig a hole in the ground.
- On the upwind side of this hole, poke or dig a large connecting hole for ventilation.
- Build your fire in the hole as illustrated.



DAKOTA FILE-HOLE

If you are in a snow-covered area, use green logs to make a dry base for your fire. Trees with wrist-sized trunks are easily broken in extreme cold. Cut or break several green logs and lay them side by side on top of the snow. Add one or two more layers. Lay the top layer of logs opposite those below it.

6.2 FIRE MATERIAL SELECTION

You need three types of materials to build a fire – tinder, kindling, and fuel.

Tinder is dry material that ignites with little heat – a spark starts a fire. The tinder must be absolutely dry to be sure just a spark will ignite it. If you only have a device that generates sparks, charred cloth will be almost essential. It holds a spark for long periods, allowing you to put tinder on the hot area to generate a small flame. You can make charred cloth by heating cotton cloth until it turns black, but does not burn. Once it is black, you must keep it in an airtight container to keep it dry. Prepare this cloth well in advance of any survival situation. Add it to your individual survival kit.

Kindling is readily combustible material that you add to the burning tinder. Again, this material should be absolutely dry to ensure rapid burning. Kindling increases the fire's temperature so that it will ignite less combustible material.

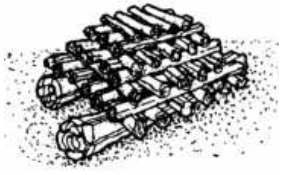
Fuel is less combustible material that burns slowly and steadily once ignited.

6.3 HOW TO BUILD A FIRE

There are several methods for laying a fire, each of which has advantages. The situation you find yourself in will determine which fire to use.

Teepee

To make this fire, arrange the tinder and a few sticks of kindling in the shape of a tepee or cone. Light the centre. As the tepee burns, the outside logs will fall inward, feeding the fire. This type of fire burns well even with wet wood.



Pyramid

To lay this fire, place two small logs or branches parallel on the ground. Place a solid layer of small logs across the parallel logs. Add three or four more layers of logs or branches, each layer smaller than the layer below it. Start a fire on top of the pyramid. As the fire burns, it will ignite the logs below it. This gives you a fire that burns downward, requiring no attention overnight.

There are several other ways to lay a fire that are quite effective. Your situation and the material available in the area may make another method more suitable.

6.4 HOW TO LIGHT A FIRE

Always light your fire from the upwind side. Make sure to lay your tinder, kindling, and fuel so that your fire will burn as long as you need it. Igniters provide the initial heat required to start the tinder burning. They fall into two categories: modern methods and primitive methods.

6.4.1 MODERN METHODS

Matches

Make sure these matches are waterproof. Also, store them in a waterproof container along with a dependable striker pad.

Convex Lens

Use this method only on bright, sunny days. The lens can come from binoculars, camera, telescopic sights, or magnifying glasses. Angle the lens to concentrate the sun's rays on the tinder. Hold the lens over the same spot until the tinder begins to smoulder. Gently blow or fan the tinder into flame, and apply it to the fire lay.

Metal Match (or Firesteel)

Place a flat, dry leaf under your tinder with a portion exposed. Place the tip of the metal match on the dry leaf, holding the metal match in one hand and a knife in the other. Scrape your knife against the metal match to produce sparks. The sparks will hit the tinder. When the tinder starts to smoulder, proceed as above.

Overhand Eye Knot

This method of creating a loop is quick and effective, but it can jam and be difficult to untie.

Flemish Eye Knot

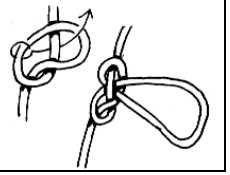
This loop is less likely to jam than the overhand eye knot

Crabbins Hitch

This eye knot is very sturdy. It doesn't have the tendency to cut itself or pull out.

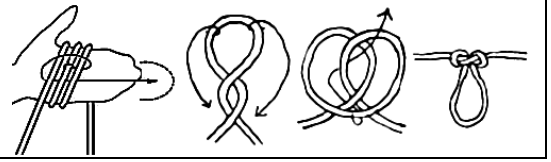
Manharness Knot

This is a useful knot for making a series of loops in a rope without needing a free end.



Butterfly Loop

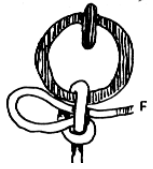
The butterfly loop is sturdier than the manharness loop. It is easier to untie and resists jamming. Two methods of tying it are shown. This knot is also useful for fishing line.



7.3.4 KNOTS FOR FASTENING ROPES

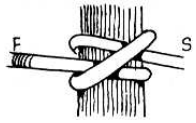
Slippery Hitch

Can be released quickly in an emergency. It holds secure as long as there is tension on the standing end.



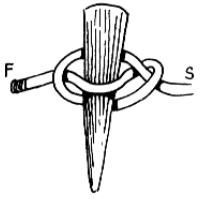
Clove Hitch

For securing a rope to a spar. If pulled taught this hitch will not slip on smooth surfaces. Useful for starting lashings.



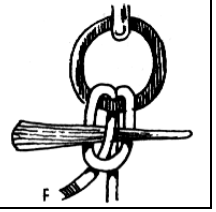
Boat Knot

This is a method of securing a rope to a pin or small piece of wood on a boat. It is quickly released.



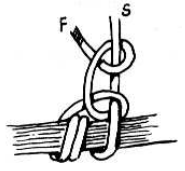
Double Boat Knot

A bight is passed through the ring and a spike. Removing the spike will release the knot.



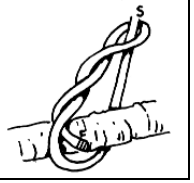
Rolling Hitch

To fasten a rope to a spar. This is a very secure hitch.



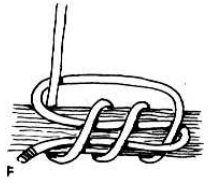
Timber Hitch

For securing a rope to square timber, round logs etc. A good starting knot for lashings.



Hallard Hitch

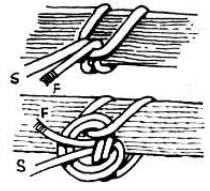
For fastening a rope to a spar. The sketch shows the hitch open. When pulled tight and the hitches closed it is a neat and secure fastening.



Noose Hitch

A quick and easy method of securing a rope to a beam.

Can be made more secure with an overhead knot.



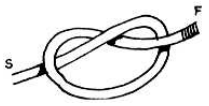
7.3 KNOTS

Knots and lashings can take the place of nails and screws in construction work. Knowing only a few knots would be adequate, but many more are included. Note in the diagrams the letter F stands for the 'free' or 'untied' end of the rope, and S stands for 'standing' or 'secured'.

7.3.1 KNOTS FOR THE ENDS OF A ROPE

Thumb Knot

Simple knot used for a stopper at the end of a rope or a grip.



Overhand Knot

Same use as the thumb knot. Makes a larger grip and is easy to untie.

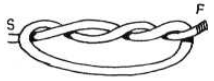
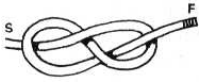


Figure Eight

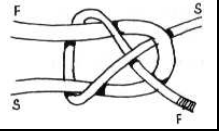
Same use as the thumb knot but more ornamental.



7.3.2 KNOTS FOR JOINING ROPES

Sheet Bend

This is used to join two ropes of unequal thickness. The thicker rope is the bend.



Double Sheet Bend

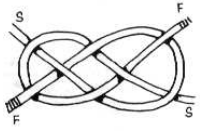
This is similar to the sheet bend but with greater security. It is useful for wet ropes.

Crossover Sheet Bend

This holds more securely than the single or double sheet bend. It is used in windy conditions where flapping may undo the bend.

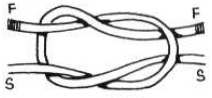
Carrick Bend

This is used for secure joining of two even ropes. It can be used on steel cables. It is easily undone and does not jam like other bends can.



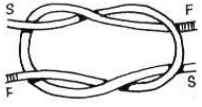
Reef Knot

Used to securely join two ropes of equal thickness together. Note the position of the free and standing ends. Also called a square knot.



Thief Knot

This knot is tied to appear like a reef knot. It was used to detect entry, as it would be retied as a reef knot.



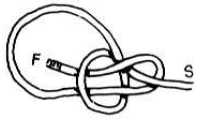
Stopper Hitch

This is used to fasten a rope to another rope (or bar) on which there is already strain. When the hitch is pulled tight the attached rope will not slip, and tension on the main rope can be taken on the attached rope. Can be useful for climbing.

7.3.3 KNOTS TO MAKE LOOPS IN ROPE

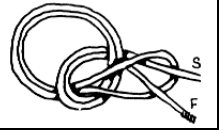
Bowline

This is used to form a loop that will not close in on itself.



Bowline on a Bight

Used to make a double loop that will not close in on itself.



Battery

Use a battery to generate a spark. Attach a wire to each terminal. Scrape the wires together near the tinder to create sparks.

Gunpowder

If you have ammunition, carefully extract the bullet from the shell casing, and use the gunpowder as tinder. A spark will ignite the powder. Be extremely careful when extracting the bullet from the case.

6.4.2 PRIMITIVE METHODS

The fire creating methods employed by our early ancestors are not beyond a survivor. However, they are exhaustive and require practice to work. This is why tools such as cigarette lighters should be carried, so primitive methods can be practised before these run out.

Flint and Steel

The direct spark method is the easiest of the primitive methods to use. The flint and steel method is the most reliable of the direct spark methods. Strike a flint or other hard, sharp-edged rock edge with a piece of carbon steel (stainless steel will not produce a good spark). This method requires a loose-jointed wrist and practice. When a spark has caught in the tinder, blow on it until spreads and bursts into flames.

Fire-Plow

The fire plow requires a straight base of softwood and a shaft of hardwood. To use this method, cut a straight groove in the base and plow the blunt tip of the shaft up and down the groove. The plowing action of the shaft pushes out small particles of wood fibres. Then, as you apply more pressure on each stroke, the friction ignites the wood particles.

Bow and Drill

The technique of starting a fire with a bow and drill is simple, but you must exert much effort and be persistent to produce a fire. You need the following items to use this method —

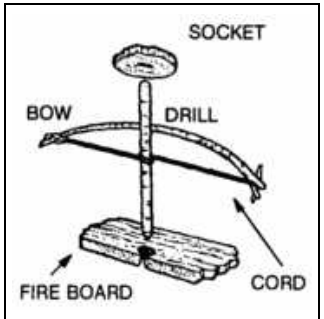
FIRE-PLOW

Socket	The socket is an easily grasped stone or piece of hardwood or bone with a slight depression in one side. Use it to hold the drill in place and to apply downward pressure.
Drill	The drill should be a straight, seasoned hardwood stick about 2 cm in diameter and 25 cm long. The top end is round and the low end blunt (to produce more friction).
Fire board	Its size is up to you. A seasoned softwood board about 2.5 cm thick and 10 cm wide is preferable. Cut a depression about 2 cm from the edge on one side of the board. On the underside, make a V-shaped cut from the edge of the board to the depression.
Bow	The bow is a resilient, green stick about 2.5 cm in diameter and a string. The type of wood is not important. The bowstring can be any type of cordage. You tie the bowstring from one end of the bow to the other, without any slack.

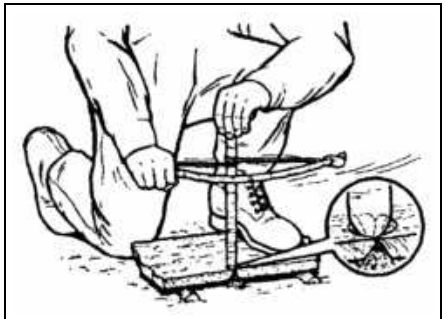
To use the bow and drill, first prepare the fire lay. Then place a bundle of tinder under the V-shaped cut in the fire board. Place one foot on the fire board.

Loop the bowstring over the drill and place the drill in the pre-cut depression on the fire board. Place the socket, held in one hand, on the top of the drill to hold it in position.

Press down on the drill and saw the bow back and forth to twirl the drill. Once you have established a smooth motion, apply more downward pressure and work the bow faster. This action will grind hot black powder into the tinder, causing a spark to catch. Blow on the tinder until it ignites.



FIRE DRILL CONSTRUCTION



USING THE DRILL

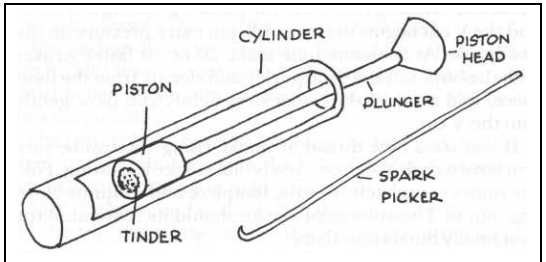
If there are problems with the cord from slipping on the drill, an alternative the Egyptians used involves a hole through the drill. The cord is slipped through the hole and one end is wrapped around the drill a few times. The cord will not slip as the drill turns.

Fire Piston

Used by many people in South-East Asia, a fire piston is a device that creates heat by rapid compression of air. When a piston is rammed into a cylinder, the air temperature rises quickly.

This temperature rise can be sufficient to light a piece of tinder placed on the piston.

These can be made from a cylinder of bone or hollow bamboo. The piston is made from wood or bone.



FIRE PISTON

To use the device –

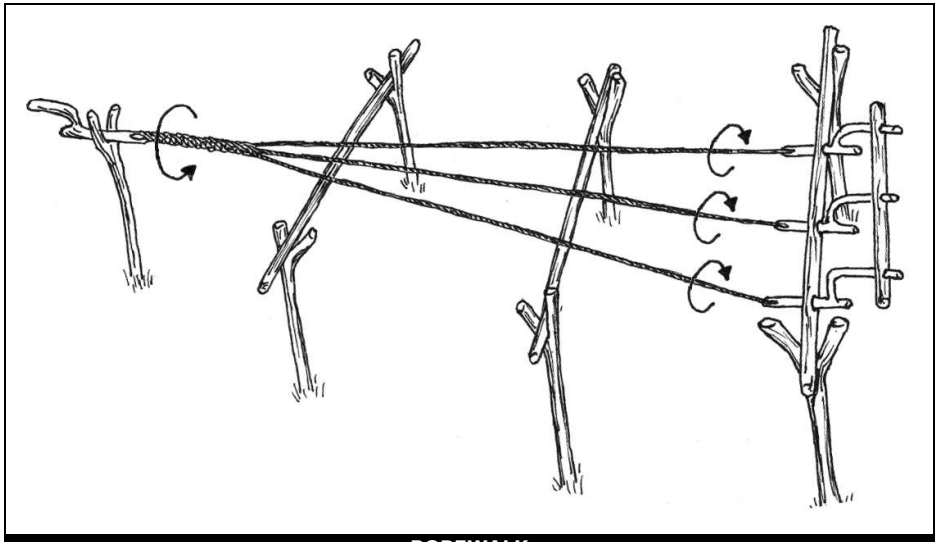
- Place a small piece of tinder on the end of the piston.
- Place the piston in the end of the cylinder.
- Ram the piston in **hard** and **fast** with the palm of your hand. It may be easier to place the cylinder on the ground or against something hard like a rock or tree.
- Pull the piston out and check the tinder. If the tinder is not lit, place the piston back cylinder **immediately** and try again. The initial strike may have heated the tinder to just below the point of lighting.
- You may need to use a picker to pull the lit tinder out of the cylinder.

The approximate dimensions of a fire piston are as follows —

Cylinder	Length	10 – 15 cm
	Outside diameter	2.5 cm
	Inside diameter	1 – 2 cm
Piston	Total length	10 – 15 cm
	Shaft length	8 – 10 cm
	Piston head length	2 – 2.5 cm

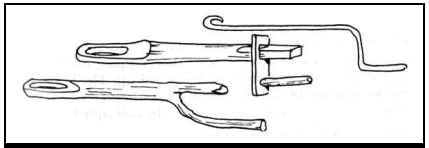
The piston head should be a snug fit inside the cylinder but allowed to move freely. If necessary a tighter seal may be made by wrapping a single layer of cotton thread a few mm wide around the piston head. Vaseline, oil or grease should be used to lubricate the cotton gasket.

If constructed properly, the piston should hit the bottom and spring back up slightly. It also should make a 'pop' noise when you pull it out.



ROPEWALK

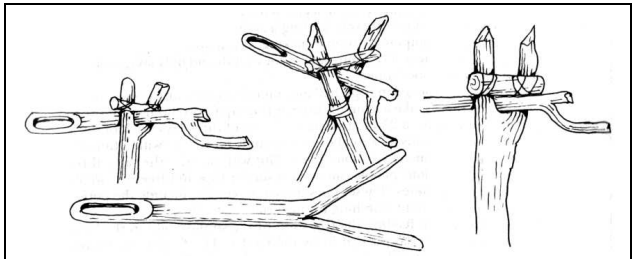
The spinners can be made from natural sticks, thick bent wire or constructed. A connecting bar at the spinning end allows one person to spin all cords simultaneously. This handle is turned in a reverse direction to the handle at the opposite end, to twist the strands together. These strands are laid by a feeder working down the rope.



SPINNERS

It is necessary for both ends to work together because the act of laying the strands will take some of the original twist out.

If the rope is well laid then the strands will lay lengthways across the rope.

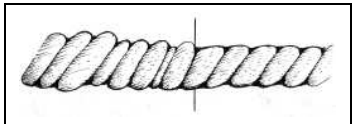


TYPES OF CRANK HOLDERS

If a rope is needed which is too long to be laid on a single ropewalk, sections of the complete rope are made one at a time. When a section is complete, coil it at the single crank end until the next section is complete. Then splice the two sections together and continue as needed. See **Rope Splices** (Page 7-10).

When a rope is complete, pass it quickly over a fire to remove loose fibres. This will make the rope smoother and more professional.

Do not attempt to rush rope making. The turners must turn evenly and smoothly while putting their weight on the rope as the layer advances up the rope laying the strands side by side. This takes a lot of practice to do quickly. A poorly spun rope will be bulgy, uneven and weak at points. Expect a three people team to take at least 2 hours to spin 20 metres of rope at first.

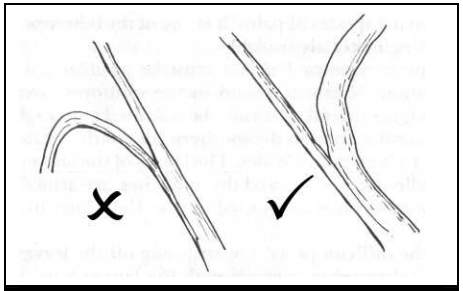


POOR VS GOOD ROPE LAY

Palm fibre in tropical or sub-tropical regions is an excellent material. It is found at the junction at the leaf and the trunk.

Many types of vines are also very strong, and can be extremely long in ideal conditions. In the case of most vines usually only the skin is especially strong. If used as a complete vine they should therefore be used unskinned (leave the skin on).

If the vine skin itself is used for its fibre to make rope, the correct way to remove the skin is to bend the main stalk away from the split, rather than trying to pull a strand off from the main stalk.



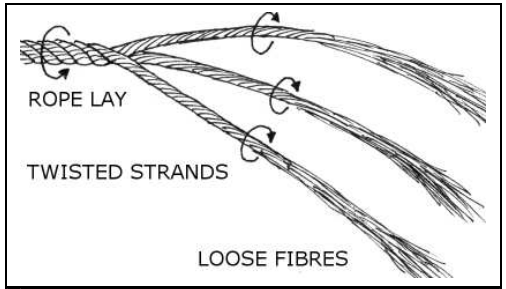
SPLITTING VINE SKIN

7.2 MAKING ROPE

Once suitable materials are identified and gathered in large enough quantities, rope can be made. Rope is made by creating cord from the fibres first, then combining three or more cords into rope in the same manner. This can be repeated to make even larger rope.

7.2.1 MAKING CORD WITH YOUR HANDS

Gather the fibres into loose strands of even thickness. Twist each of these strands clockwise. The twist will hold the fibres in the strand. As a rough rule, the strands should be about 1 mm with about 15 – 20 fibres per strand. Thicker strands will generally produce weaker cord.



THREE STRAND CORD LAY

Without letting the strands untwist, group two, three or four together and twist them together in an anti-clockwise direction. They will tend to twist together naturally so ensure they do so evenly.

Work down the length twisting the unlaid fibre bunches together clockwise, feeding in more fibre as you go, and twisting the strands together anti-clockwise. Make sure the strands are of an even thickness, with an even twist and even tension. This takes quite some practice so don't expect to get it right first go, especially when making fine strong cord.

Normally two or more people are required to spin and lay cord. It is a community effort, especially if a lot of rope is needed. It is possible for one person to make cord by twisting the strands by running a flat hand along the thigh, with the fibre between the hand and thigh. The other hand is free to feed in more fibre. This method can be slow and takes time to master.

7.2.2 SETTING UP A ROPEWALK

Cord can be made into rope by laying several cords together in the same manner as the cord was made. An easy way to do this is with a ropewalk.

When spinning ropes of 10 metres or more, it is necessary to support the length with crossbars every few metres. This prevents the cord sagging on the ground and getting snagged with twigs and dirt on the ground.

The crossbars should be smooth and free of twigs and loose bark that may interfere with the spinning of the cord.

A crank at the laying end is turned to lay the strands together. A connecting bar between the cranks at the spinning end allows one person to spin all cranks simultaneously. If the rope is correctly laid, the fibres should lay horizontally along the rope.

When you need to make a very long rope, it can be made in sections. The sections are made one at a time and placed aside until the last section is made. The strands are then spliced together. When splicing the sections, stagger the strands to ensure the join is smooth.

6.4.3 CHAR CLOTH

Char cloth is cotton that has been heated to become blackened, but not to the point of combustion. It is useful tinder in starting fires, especially with primitive methods such as spark methods, friction methods or a fire piston.

To create char cloth you need a small thin that is fairly air tight, such as a tobacco tin. Place a small hole in the top from 1 to 5 mm for gasses to escape. Cut the cloth into small squares and place them neatly inside. Do not pack them tightly. The cloth must be 100% cotton.

Place the tin on a small fire or glowing coals and soon it will start smoking. Wait until it is finished smoking and carefully remove it from the fire. Wait until the tin is cool before opening it because if oxygen rushes in it will ignite immediately.

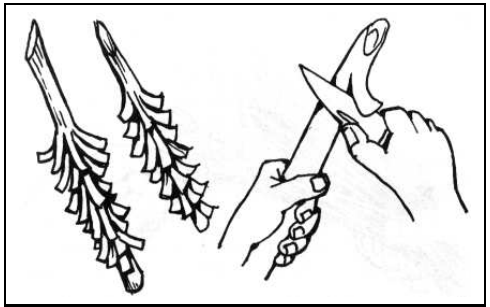
When finished it should be completely black, not brown, if not just put it back on the fire. If it is crumbly then it is overdone and useless. It should be fairly soft and not too fragile.

Carefully remove and store in a watertight container, or just leave in the tin for later.

6.4.4 FIRE WITH DAMP MATERIALS

Creating fire when all the available materials are wet is a difficult task, and all the more important when you are cold and soaking. It is not impossible however.

To gather kindling to start the fire, snap dead twigs from trees rather than collect them from the ground. A fuzz-stick can also be used. To create a fuzz-stick, take a dead branch about 1-2 cm in diameter that is relatively dry. Strip any bark off with a knife to further remove any moisture. Then start cutting curly slivers into the stick. The wood inside will be dry.



CREATING A FUZZ STICK

Once a small fire is burning, keep feeding it dry kindling and surround it with larger fuel to dry that. When that fuel is dry, feed it into the fire and continue until you have a suitable fire. Keep stacking damp wood around the fire to ensure you have fuel.

Friction Methods with Damp Materials

If you are trying to use friction to light a fire and your tools are damp, you face a very difficult challenge. If you have a dry cloth or towel, dry the equipment off as best as you can before you start.

You will not get it started in one go with the wet material but you can get it to start smoking by applying a lighter effort than usual. If you use too much pressure, the wood will be eaten away, rather than just the moisture being drawn out.

Once smoke is produced, rest for a few seconds until the smoke stops then repeat. Doing this will eventually draw moisture from the wood to a point where you can get an ember.

6.4.5 FIREWOOD TYPES

There are many things which make some woods burn hotter than others - rate of growth, resin content, age of tree, part of tree, structure of the wood itself. As a general rule, fire making woods that are good for making friction fires make bad firewood, since they are low density and resin-less.

The best woods include oak, hickory, madrone, manzanita, mesquite, and other dense hardwoods. The worst woods include pine sapwood and many other softwoods and willow, although these make good kindling.

Wet wood burns cooler than dry wood, but burns relatively longer. Heart wood burns hotter than sapwood in general. Rotten wood is good for producing smoke, but not heat or light.

Charcoal burns hotter than the wood it was made from as the volatile gases which produce flames burn at a relatively low temperature. So your coals are the hottest part of the fire, not the flames. Light comes from the burning gases.

6.5 HELPFUL HINTS

- Use non-aromatic seasoned hardwood for fuel, if possible.
- Collect kindling and tinder along the trail.
- Add insect repellent to the tinder.
- Keep the firewood dry.
- Dry damp firewood near the fire.
- One you have a fire going, dry some kindling to take with you for later.
- If you have firelighters, remember you don't need to use a whole firelighter for each fire.
- Bank the fire to keep the coals alive overnight.
- Carry lighted punk, when possible.
- Be sure the fire is out before leaving camp. It is better to bury it under sand or soil rather than to douse with water. The water will dry out and the fire will rekindle, as well as creating a lot of smoke.
- Do not select wood lying on the ground for friction methods. It may appear to be dry but generally doesn't provide enough friction.

7 Ropes and Knots

One of the most basic needs in a primitive living situation is the skilful use of ropes and lashings. From creating fishing line and nets, animal snares, building shelters to creating bridges, the uses are endless.

Although modern day rope is extremely cheap and strong, emergencies can arise. It is therefore important to know not only how to use ropes, but to make or improvise them.

7.1 SUITABLE MATERIALS

Almost any fibrous material can be spun into decent rope. Materials between 30 – 60 cm or more can be used. If a group of people are employed to the task, large ropes of up to 10 cm diameter, with breaking strains of over 1000 kg can be made.

Breaking Strains

Using a 3-lay, 3 cm diameter rope as a guide, the following list gives an idea of the strength of various materials. This is a general guide only, for safety in a critical application, test the ropes thoroughly beforehand.

Green grass	50 - 100 Kg
Bark fibre	200 - 700 Kg
Palm fibre	300 - 1000 Kg
Sedges	900 - 1000 Kg
Lianas (monkey vines)	250 - 300 Kg
Lawyer vine (*Calamus*) (10 mm unskinned)	- 500 Kg

MATERIAL STRENGTH GUIDE

7.1.1 SELECTING MATERIALS

The proper materials for making rope must have the following qualities —

- It must have reasonably long fibre
- It must be strong
- It must be pliable and not snap when bent
- It must have grip so the fibres will bite into each other

There are three simple tests that can be applied to determine the suitability of the material –

- First pull on the material to determine its strength. If you can easily break it, it is of no use
- Twist the fibres between your fingers and roll the fibres together. Make sure the material does not snap apart.
- Finally, tie a knot in the material and slowly pull it together. If it does not cut itself and can be pulled reasonably tight, it is suitable.

Many plants can be found with these qualities such as ground vines, most long grasses, water reeds, rushes and the inner bark of many trees and shrubs. Some fresh green material may be stiff, however if you pass them over hot flames for 30 seconds, often the sap will burst through some of the cell structures, making the material pliable.

Some seaweeds and members of the large aloe family may also be useful.

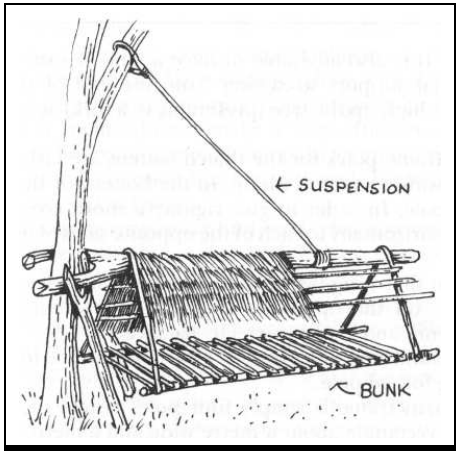
Gathering and Preparing Materials

Some plants may have high amounts of vegetable gum. Soaking these plants in water for several hours may remove this. A running stream is good if the material can be weighed down or contained. Boiling or drying thoroughly in the sun and teasing the fibres out can also work.

Some materials only have strength if used green. Such materials may include sedges, water rushes, grasses and liana vines. When harvesting, the plants should never be pulled out of the ground, but cut above ground level with a sharp knife or machete. Harvesting should only be done over a wide area. Never clear a site and only use the larger clumps to allow for regrowth.

In temperate areas fibre from the inner bark of some trees and shrubs is an excellent material to use. It is best to use when the tree is dead and the fibre dried out. If you absolutely must use material from a living tree, cut and test a small strip first. Then remove bark from branches only. Cut through to the sapwood, peel it off the tree and test the different layers. Unless it's oozing sap it is probably suitable, but should be soaked in water for a few hours then sun dried.

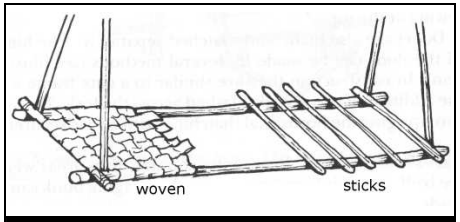
8.4.4 TREE SWING SHELTER



TREE SWING SHELTER

In areas that are swampy, or infested with snakes, a swinging bunk shelter can be made by a single person in a day.

The forked pole that supports the bunk must be very strong. The suspension line should be tied as high as practical, and preferably to the bottom of a fork.



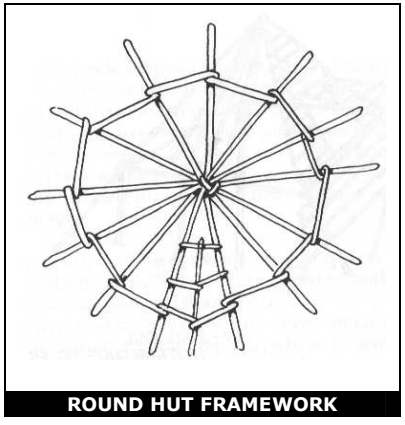
SWING SHELTER BUNK

The frame poles from the thatch battens are lashed separately, with a square lashing, to the forked frame pole. For extra strength, lash some short sticks to either end of the frame.

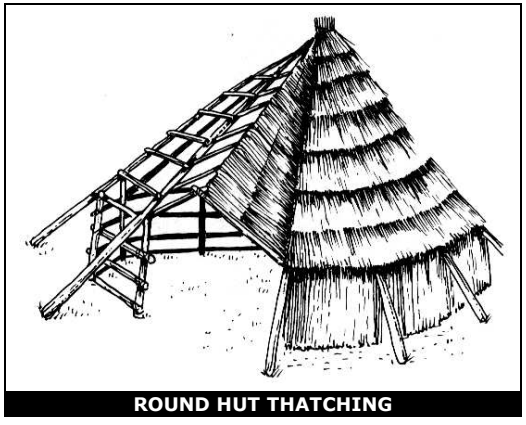
When thatching the frame, thatch one row on one side, then one row on the other. This will help strengthen the framework and keep it balanced.

The bunk is made separately and attached to the supporting forked pole. Its main frame is simply four frames lashed together. The centre of the bunk can be made with woven material or made with crossed sticks.

8.4.5 ROUND HUT



ROUND HUT FRAMEWORK



ROUND HUT THATCHING

To make a standard round thatched hut, cut or gather four poles each about 5 metres long and between 10 - 15 cm thick. They should be as straight as possible.

Lash these together in the shape of a tepee or pyramid. Dig holes in the ground at an angle to hold the poles in place as you form the structure. A depth of 30 – 50 cm is usually enough.

The distance between the diagonal poles should be about 6 metres to ensure a roof slope of about 45°. This is a good angle for shedding rainwater.

Another eight poles, which can be somewhat lighter, can be added to the initial pyramid. They should be spaced evenly around the circle. These should be lashed to the roof poles after being driven into the ground.

Square Lashing

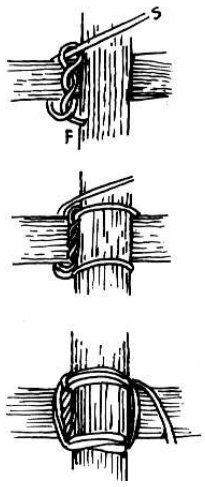
This is used to join poles at right angles.

Start with a timber hitch or clove hitch below the crossbar.

Lash tightly around upright and cross bar about four times.

Make about two or three frapping turns – these are turns that go around the lashing and pull it taut.

Secure the end of the frapping turns with clove hitches.



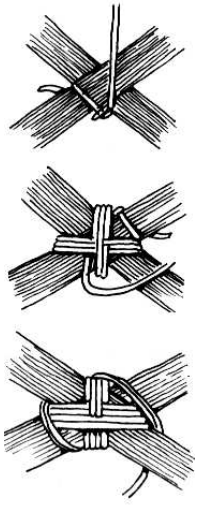
Diagonal Lashing

This is used for bracing or joining spars at irregular angles.

Start with a timber hitch or clove hitch and take about three or four full turns vertically.

Pass rope under top spar and make about four turns horizontally.

Make two or three frapping turns and secure by two clove hitches on the pole.



Sheer Lashing

(For increasing the length of a spar)

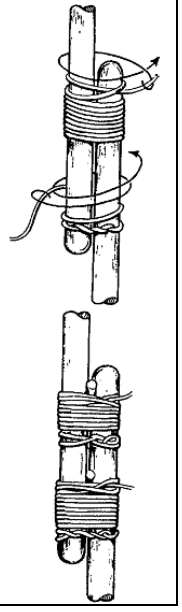
It is important to have a good overlap of a quarter to a third of the overall length.

Start with a clove hitch or timber hitch around both spars near the end of the overlap.

Continue with six to ten turns around both spars. Finish with a clove hitch around the second spar.

To tighten, insert small wedges inside the turns, or make three or four frapping turns around one side of the lashings to pull them in tight.

Add a second lashing to increase strength of the join.



Sheer Lashing

(For making 'sheer legs')

Line up the two butts of the spars.

Start with a timber hitch around one spar.

Continue with six to ten turns which are made firmly, but not too tight.

Make a couple of frapping turns between the two spars to tighten the lashings.

Finish with a clove hitch.

The sheer legs are opened out to tighten the lashings. It's possible to make the turns too tight so it may help to insert a small wedge between the spars before you start lashing.

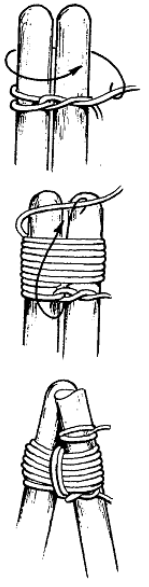
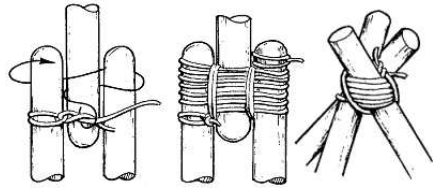


Figure of Eight Lashing

Lay three spars so that the centre spar goes in the opposite direction of the outer two. Start with a timber hitch or clove hitch on one of the outer spars.

Continue with six or seven turns which are taken loosely over and under the spars. Finish with loose frapping turns and a clove hitch.

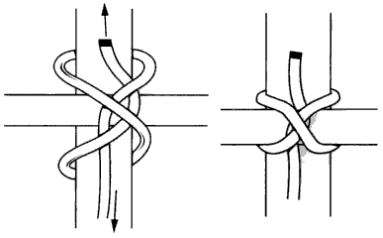


Wedges can be used before doing the lashing to enable even spacing.

Transom Knot

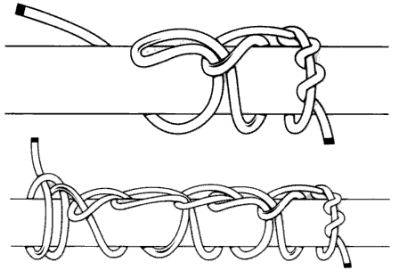
This is a good knot to tie two sticks at right angles when you don't want a bulky lashing.

You can cut the ends off close to the knot.



Chainstitch Lashing

This is a good lashing to use with awkwardly shaped bundles. Start with a timber hitch and make the chain as illustrated. Finish with two half hitches.



7.5 ROPE SPLICES

Splicing ropes together is sometimes preferable to knots or bends, especially when the rope needs to pass through a block and tackle or may otherwise get snagged. Splicing also looks a lot neater than a knot, no matter how well the knot is tied.

7.5.1 SHORT SPLICE

The simplest of all splices is known as the short splice.

To start this splice, unravel the strands of each rope a few inches. Wrap some twine around the ropes to prevent further unravelling. You should also seize the ends of the strands to help with splicing.

If you are using nylon rope, the strands can be seized with a flame.

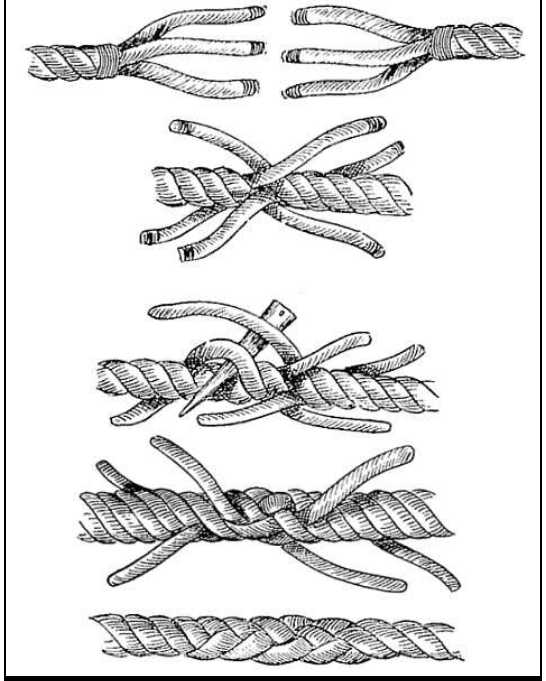
Butt the two ends of the ropes together as shown.

With a spike or short stick, work one of the strands up and feed a loose strand under it. The first strand must be run over the strand which it is next to, and under the next one.

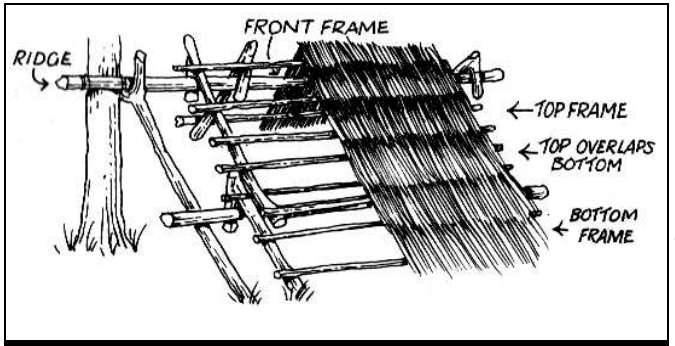
Continue with the other strands and for the other side of the rope. Trim the strands when complete.

If desired, the splice can be made to look neater by gradually thinning out the strands as you go, giving a taper to the splice.

In this way the splice will not be much larger than the original rope and will not snag easily.



SHORT SPLICE

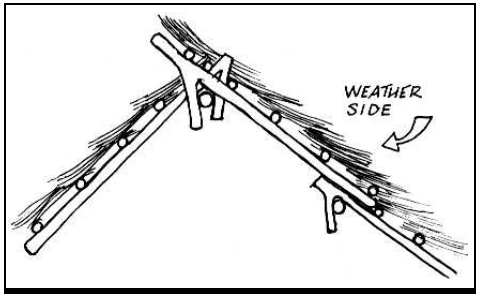


BATTENS AND THATCHING

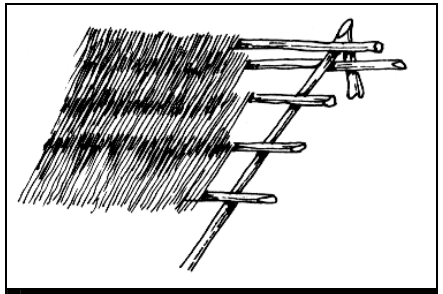
Hang these sticks from the ridgepole and crossbar as supports to lash horizontal battens for thatching.

Ensure the end of the top frame projects well beyond the fork and the ridge.

This protects the top frame and saves the work of ridge thatching.



PROTECTION FROM THE WEATHER



ANOTHER VIEW

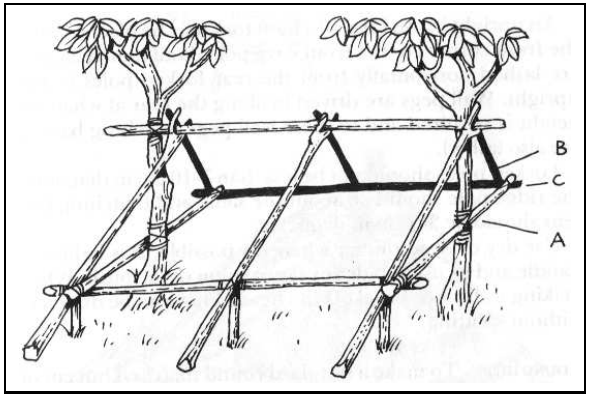
8.4.3 PERMANENT LEAN-TO HUT

The permanent lean-to hut using a tree for bracing is simple and quick to erect.

The ridge pole is raised against the tree by the means of the two forked poles to the required height of about 3 metres, depending on the width.

The end-forked poles should be at an angle of no less than 45°. If the length of the ridge is more than 4 metres it is a good idea to put in another one or two forked poles about halfway long.

On to the end-forked poles lash a crossbar (A) and lash it again to the upright tree.

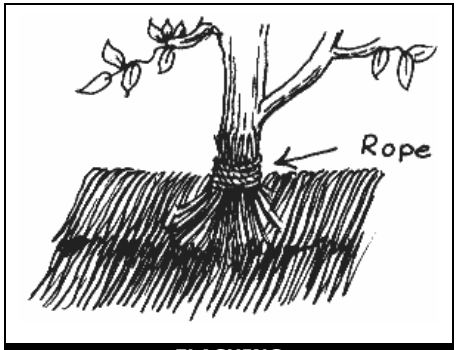


HUT FRAME SET UP BETWEEN TWO SAPLINGS

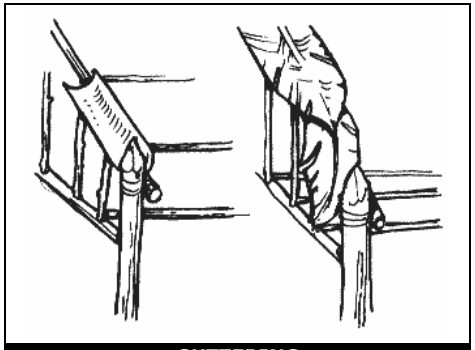
This crossbar is also lashed to pole (B) and pole (C). This crossbar has lashed to its front end pole (B), connecting and lashed to the ridge and also the front eaves, pole (C) and the front thatching battens.

Thatching battens are lashed onto the two rear forks. The distance apart depending on the thatching material used.

An upright may be placed under the front corners to the front eave. Thatch battens are lashed horizontally from the rear forked poles to this upright. Wall pegs are driven in along the rear at whatever height is required and to these the wall pegs thatching battens are also lashed.



FLASHING



GUTTERING

8.4 SEMI PERMANENT SHELTERS

If the situation permits, more advanced dwellings can be constructed. For a large building job, a group of people should be organised into smaller sub groups each with different tasks —

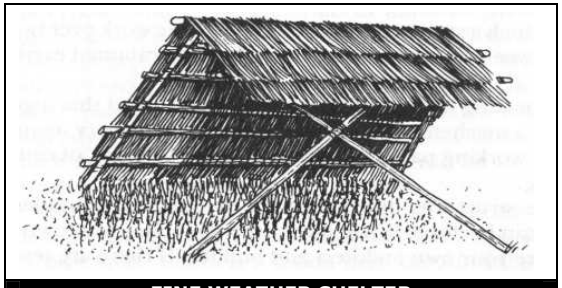
- The building site needs to be cleared, and levelled if necessary. If shovels aren't available digging tools can be improvised from bush timber.
- Poles need to be cut and carried to the build site.
- If cordage needs to be made, consider the time required.
- Material for thatching needs to be cut and gathered first as it usually needs time to dry out.

8.4.1 FINE-WEATHER SHELTER

If conditions are favourable, a simple 'fine weather' shelter can be constructed by one or two people in a couple of hours.

The supporting poles should be buried for extra stability. The thatched side faces the prevailing winds, while the overhang will keep out a light shower.

This shelter obviously provides little to no protection in extreme conditions.



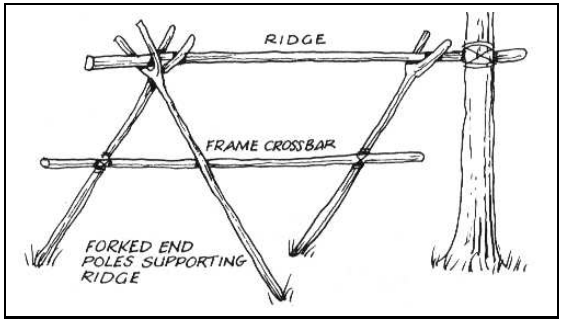
FINE WEATHER SHELTER

8.4.2 SECTIONAL LEAN-TO

Small one or two person huts can be constructed in an hour or two by making and thatching two or three frames from 2 metres in length by 1 metre high or larger as needed.

These frames are lashed onto two forked sticks and secured to a strong living tree by the ridgepole. The framework is simple to construct.

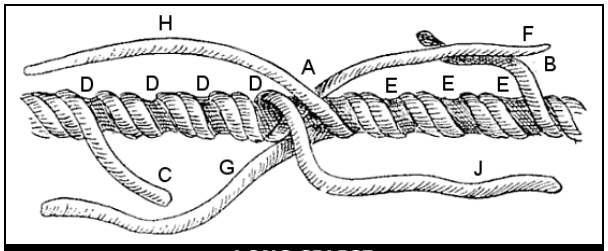
For the down pieces and the front eve, if you build one, select sticks with strong forks and cut to leave a hook at the end.



SECTIONAL LEAN-TO MAIN FRAME

7.5.2 LONG SPLICE

A better and stronger splice is the long splice, which will run through anything the original rope can. A well made long splice cannot be distinguished from the rope itself after a few days use.



LONG SPLICE

To make this splice, unlay the strands about 1 or 2 metres. Then unlay one strand in each rope half as much again.

Place the middle strands together as at A. Strands B and C will leave a groove from where they were unlaid at D and E.

Take the two central strands, F and G, and lay them into the grooves until they meet at B and C. Be sure to keep them twisted tightly as you do so.

Take the strands H and J, and cut out half the fibres in each. Tie an overhand knot in the end and tuck them into the next lays as in a short splice. Do the same for strands B, C and F, G.

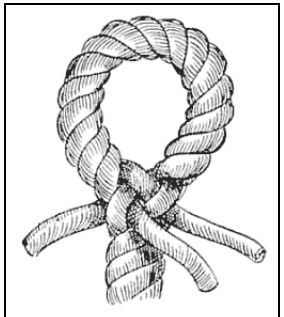
Finally stretch the rope tight, pull pound and roll the splice until smooth and round. Then trim off all the loose ends close to the rope.

7.5.3 EYE SPLICE

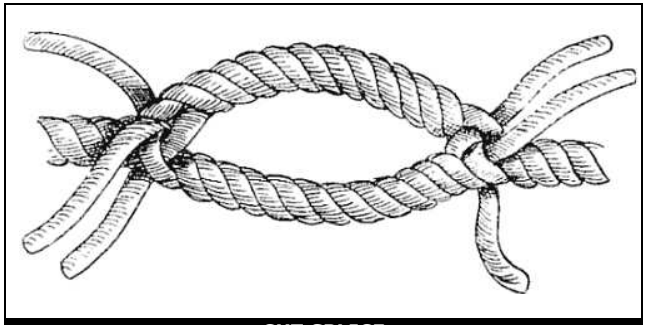
An eye splice is very easy to make and is handy in many ways. It is made the same way as the short splice, but the end of the rope is unlaid and then bent around and spliced into its own strands of the standing part.

7.5.4 CUT SPLICE

A cut splice is made in the same way as the short splice or eye splice. However each end of the rope is spliced into the centre of the standing rope to form a loop that closes shut when the rope is taut.



EYE SPLICE

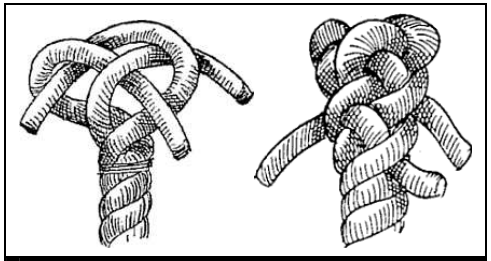


CUT SPLICE

7.5.5 CROWN SPLICE

A crown is useful for stopping the end of a frequently used rope from fraying. Start off as shown in the diagram then pull the ends tight to cinch it up. Then tuck the strands in as with a short splice to complete the crown.

Taper the strands as you work down if you want a neater appearance to the crown.



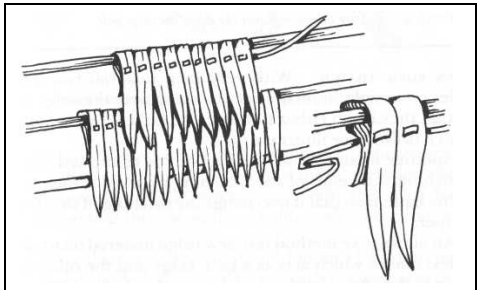
CROWN SPLICE

8.3.7 SEWN BATTEN THATCH

With long, broad leaves, they can be bent over the thatching battens and sewn in with lengths of split cane or other suitable material.

The battens can be thatched before attaching to the framework.

If green material is used, make sure it doesn't curl as it dries by testing in the sun.



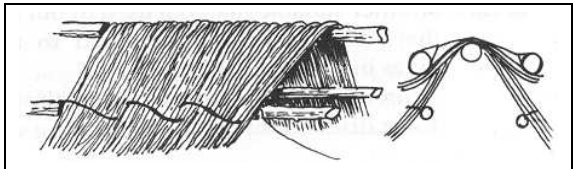
SEWN BATTEN THATCH

8.3.8 RIDGE THATCHING

In thatching, the ridge of any hut must have the topmost row of stitching covered. Otherwise the hut will leak along the ridgeline.

This cap must therefore curl completely around the ridge pole, or better yet – a false ridge pole.

Alternatively it may stand up from the ridge. If it is bound tightly this will make an efficient watershed. For pyramid and circular huts this is ideal.



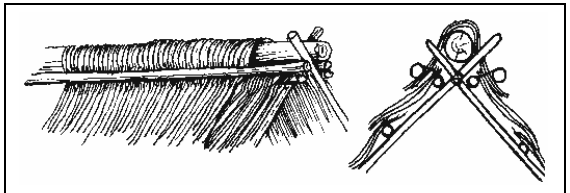
RIDGE THATCHING

8.3.9 SEWN RIDGE THATCH

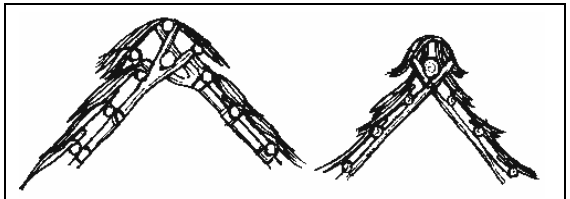
With very long material two poles or straight branches may be slung over the ridge pole so that they lie on either side of it and hold the edges of the thatch down.

Another method is to tie two battens to the last line of thatching. The ends of the thatching material are then sewn into the battens so that it overhangs the stitching of the thatch proper.

Another method is to sew ridge material on to three poles, one of each acts as a false ridge and the other two, sewn to the ends of the material, hang down about 50 cm on either side. This can be made on the ground and then hoisted up to cover the ridgepole.



SEWN RIDGE THATCH



CROWN RIDGE THATCHING

8.3.10 FLASHING AND GUTTERING

If a living tree is being used as support for a shelter, flashing may be required. This also applies if one or more of the structural poles extends above the thatch line of the roof. Use thin rope to bind extra thatching material around the tree or pole. Continue this lashing several centimetres above the extra thatching to ensure water doesn't run down the pole.

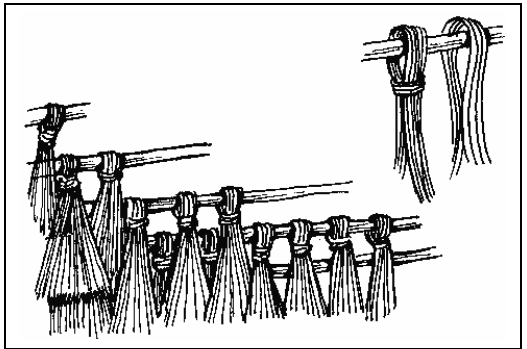
Under some conditions it may be necessary to create a gutter to channel heavy rainfall away from your shelter. Guttering can be made from wide sheets of bark. Very wide leaves of some palms may also be laid so they overlap each other.

A more robust, and laborious material is hollowed out palm tree trunks. Large bamboo cane halves can also be used if the mid-sections are carved or hammered out.

This thatch makes a very neat job from the inside. It is secure in strong weather and requires no tying material. If sedges or sharp sword grass is being used then protect your hands with socks to avoid cuts if gloves are not available.

It is important that the long, free ends of each tuft bundle overlap the two or three proceeding rows. Do not push the joining or knot end of these tufts up too tightly together.

There can be some space (say up to 2 cm) between the bent over ends on the battens. This space will be covered by the next row.

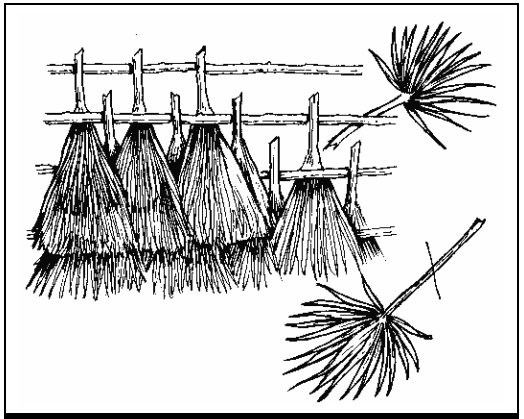


TUFT THATCHING

8.3.4 STALK THATCH

Any type of palm leaf, complete with stalk can be used for this type of thatching. It is both quick and efficient.

That stalks of the palms are woven through the thatch battens. The stalks are literally jammed between the battens and the pressure is sufficient to hold them in place.



STALK THATCH

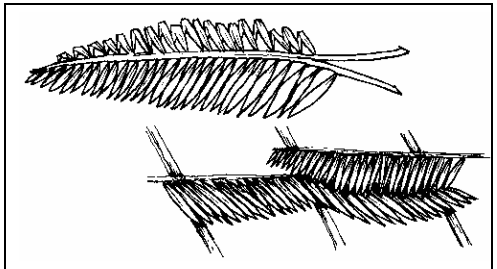
8.3.5 SPLIT STALK THATCH

This thatch is suitable for long pinnate leaves such as those found on date palms. The centre rib of each frond is split lengthways. The split ribs are tied together and secured to the ridge poles of the hut in an overlapping fashion. This eliminates the need for thatching battens unless extra strength is needed for the roof.

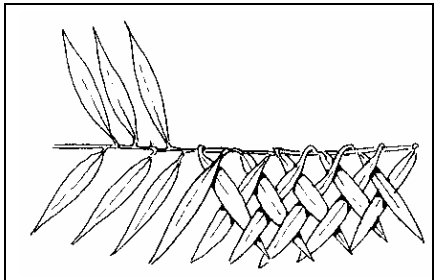
8.3.6 WOVEN THATCH

This is an alternative to the split stalk method if a lot of people are available and time is not a factor. The pinnate fronds are laid flat on the ground and the leaves from one side are laid over another and woven between the leaves opposite them.

The stalk is the tied onto the framework of the hut.



SPLIT STALK THATCH



WOVEN THATCH

8 Shelters

A shelter can protect you from the sun, insects, wind, rain, snow, hot or cold temperatures, and enemy observation. It can give you a feeling of well-being. It can help you maintain your will to survive.

In some areas, your need for shelter may take precedence over your need for food and possibly even your need for water.

The most common error in making a shelter is to make it too large. A shelter must be large enough to protect you. It must also be small enough to contain your body heat, especially in cold climates.

8.1 SHELTER SITE SELECTION

When you start looking for a site, you must consider whether the site —

- Contains material to make the type of shelter you need.
- Is large enough and level enough for you to lie down comfortably.
- Provides protection against wild animals and rocks and dead trees that might fall.
- Is free from insects, reptiles, and poisonous plants.

You must also remember the problems that could arise in your environment. For instance —

- Avoid flash flood areas in foothills.
- Avoid avalanche or rockslide areas in mountainous terrain.
- Avoid sites near bodies of water that are below the high water mark.

8.2 BASIC SHELTERS

When looking for a shelter site, keep in mind the type of shelter (protection) you need. However, you must also consider –

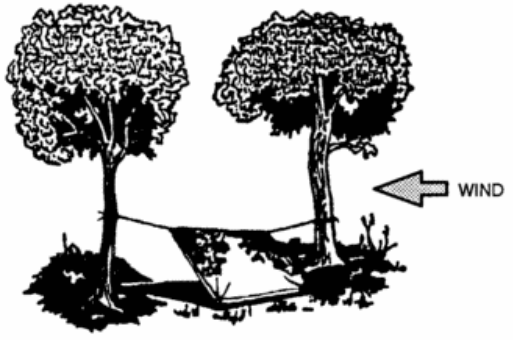
- How much time and effort you need to build the shelter.
- If the shelter will adequately protect you from the elements (sun, wind, rain, and snow).
- If you have the tools to build it. If not, can you make improvised tools?
- If you have the type and amount of materials needed to build it.

To answer these questions, you need to know how to make various types of shelters.

8.2.1 SIMPLE LEAN-TOS AND TENTS

It takes only a short time and minimal equipment to build this lean-to. You need material such as a canvas or poncho, 3 - 4 meters of rope, three stakes about 30 cm long, and two trees or poles 2 - 3 metres apart. Ensure that the back of your lean-to will be into the wind.

If you plan to use the lean-to for more than one night, or you expect rain, make a centre support for the lean-to. Make this support with a centre-pole, or a line attached to an overhanging branch.



ⓘ When at rest, you lose as much as 80 percent of your body heat to the ground. To reduce heat loss to the ground, place some type of insulating material, such as leaves, inside your shelter.

This tent protects you on two sides. To make this tent, you need a canvas or poncho, two 2 – 3 meter ropes, six stakes about 30 cm long, and two trees 2 - 3 meters apart.

Another method for supporting the centre is to use an external A-frame. Use two long sticks, one with a forked end, to form the A-frame.

This simple one-person shelter can be built with three poles, one for the centre brace and two to hold down the sides.

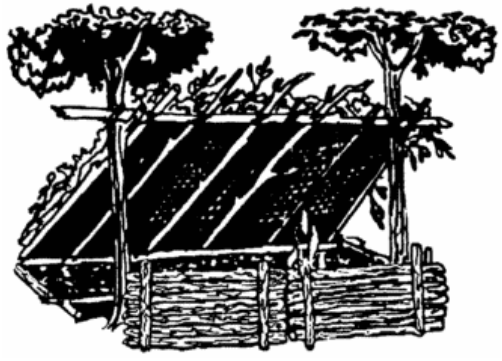
The centre brace can be lashed around a tree, hooked on a fork, or suspended from above.

Roll the sides of the material around the poles. Stake out or put a spreader between the poles to ensure they don't slide inwards.

An alternative is to dig trenches and bury the sides under dirt and rocks. This is especially effective in beach sand.

8.2.2 FIELD-EXPEDIENT LEAN-TO

If you are in a wooded area and have enough natural materials and time, you can make a field-expedient lean-to without the aid of tools or with only a knife.



You will need –

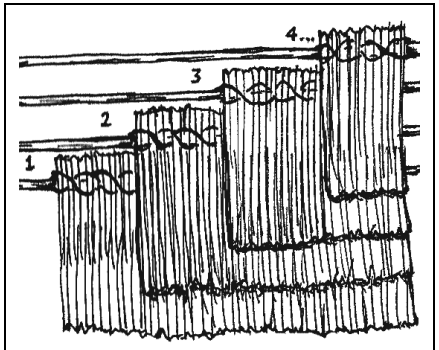
- Two trees (or upright poles) about 2 meters apart.
- One pole about 2 meters by 2.5 cm.
- Five to eight poles about 3 meters by 2.5 cm in diameter for beams.
- Cord or vines for securing the horizontal support to the trees.
- Other poles, saplings, or vines to criss-cross the beams.

To make this lean-to –

- Tie the 2-meter pole to the two trees at chest height. This is the horizontal support. If a standing tree is not available, construct a biped using Y-shaped sticks or two tripods.
- Place one end of the beams (3-meter poles) on one side of the horizontal support. As with all lean-to type shelters, be sure to place the lean-to's backside into the wind.
- Criss-cross saplings or vines on the beams.
- Cover the framework with brush, leaves, pine needles, or grass, starting at the bottom and working your way up like shingling.
- Place straw, leaves, pine needles, or grass inside the shelter for bedding.

8.3.1 SEWN THATCHING

Sewn thatching is started by stitching the first layer of thatch on the lowest thatching batten. The second layer must lie on top and completely cover the stitching below.



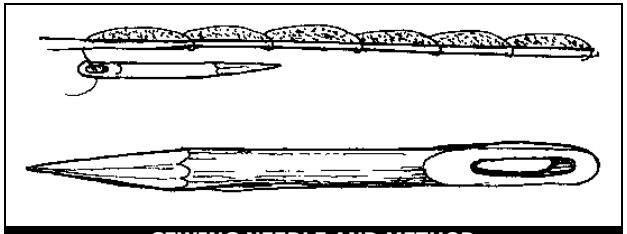
PROPERLY LAID SEWN THATCHING

To sew thatching, make a thatching needle by cutting a dead, straight-grained stick about 2 cm thick and about 15 cm long. Sharpen one end and rub it as smooth as possible on a stone. Narrow the other end until it is about 5mm thick. Before doing this, however, cut an eye in this end. If you cut the eye first, it will not split out when the end is paired down.

Lay the thatching material with the butts toward the roof and the lower end on the lowest batten. Secure one end of the sewing material to the batten.

Thread the other end through the eye of the needle and sew the material to the batten.

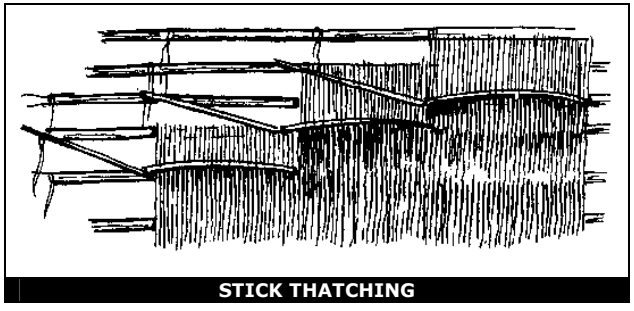
To avoid holes where the sewing may tend to bunch the thatching together, push the needle through the thatch at an acute angle. Then push the thatch over the crossing of the stiches.



SEWING NEEDLE AND METHOD

8.3.2 STICK THATCHING

With the stick thatch, ties about 60 cm apart are fastened onto the thatching batten. The thatching stick is tied down thus binding the material together.



STICK THATCHING

This method of securing thatching is useful when long lengths of material for sewing are not available.

As with sewn thatching, follow the principles of overlapping layers to cover the thatching stick. This will ensure a rainproof roof. This is not as secure (or windproof) as sewn thatching.

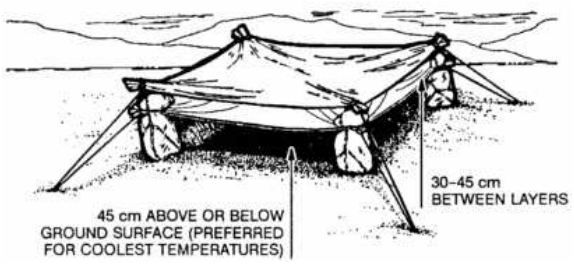
8.3.3 TUFT THATCHING

This is an excellent method if the material is fairly long (60 cm – 1 metre), and pliable. Reeds and sedges are very suitable.

- Gather the material into small sheaves about 3 mm or so thick.
- Bend the butt end over the thatching batten.
- Twist a few strands around the sheave a few times and push it through the bunched up material to hold it secure.
- The tuft is the slipped along the batten and the procedure continued until the batten is completed.

Another type of belowground shade shelter is of similar construction, except all sides are open to air currents and circulation.

For maximum protection, you need a minimum of two layers of material. White is the best colour to reflect heat; the innermost layer should be of darker material.



8.2.9 NATURAL SHELTERS

Do not overlook natural formations that provide shelter. Examples are caves, rocky crevices, clumps of bushes, small depressions, large rocks on leeward sides of hills, large trees with low-hanging limbs, and fallen trees with thick branches. However, when selecting a natural formation –

- Stay away from low ground such as ravines, narrow valleys, or creek beds. Low areas collect the heavy cold air at night and are therefore colder than the surrounding high ground. Thick, brushy, low ground also harbours more insects.
- Check for poisonous snakes, ticks, mites, scorpions, and stinging ants.
- Look for loose rocks, dead limbs, coconuts, or other natural growth than could fall on your shelter.
- Be aware of possible seismic activity in the area when exploring caves and rocky outcrops. Your shelter could become your tomb.

8.3 THATCHING

Materials suitable for thatching range from long grass, reeds, rushes, most of the long stalked ferns (such as bracken), palm leaves of all types and as a last resort, many pliant, leafy branches.

Long grass and reeds make a high quality roof when they are used dried rather than in their green state. It is advisable when using these materials to cut and stack them at the very start of your building project. This allows the material to dry out before being used.

If placed on the roof supports in their green state, grass and reeds will shrink and curl, allowing the rain to enter. All green materials will shrink and this will affect the lashings or stitches as well, causing them to become loose.

Green branches do not make a very efficient roof and should only be used in an emergency.

With most of the brackens it is advisable to use the material when it's green and sew it down tightly. This also applies if you are forced to use green branches.

Palm leaves are best for thatching when they are dead and dry. It is usual to find large amounts of them at the base of the tree. They are excellent material but can become brittle, especially in the summer heat.

The best time to collect palm leaves for shelter is early in the morning when the dead leaves have been softened by dew, or after rain. It is also advisable to soften the leaves with water before sewing them onto the thatching battens.

There are many times of thatching, each with their own peculiar advantages and application with certain types of material.

Principles of Watershed in Thatching

Thatch may be for shade or protection against rain. Thatching for shade is easy. Thatching for protection from wind and rain will be effective only if certain principles are observed. If the stitching interrupts the smooth, continuous course of the raindrops, the drops will travel along the stitching and the roof will of course leak. Thatch will never leak if the stitching is properly covered.

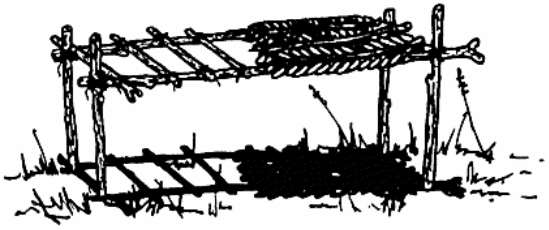
It is the quality of coverage, rather than the amount that makes a natural roof waterproof. Wind proofing however depends on the thickness and tightness of the thatch.

In cold weather, add to your comfort by building a fire reflector wall as shown. Drive four long stakes into the ground to support the wall. Stack green logs on top of one another between the support stakes.

You can also form two rows of stacked logs to create an inner space within the wall that you can fill with dirt. This will strengthen the wall and make it more heat reflective. Bind the top of the support stakes so that the green logs and dirt will stay in place.

8.2.3 SWAMP BED

In any area with standing water or continually wet ground, the swamp bed keeps you out of the water. When selecting such a site, consider the weather, wind, tides, and available materials.



To make a swamp bed –

- Cut four or six poles and drive them firmly into the ground so they form a rectangle. They should be far enough apart and strong enough to support your height and weight, to include equipment.
- Cut two poles that span the width of the rectangle.
- Secure these two poles to the upright poles. Be sure they are high enough above the ground or water to allow for tides and high water.
- Cut additional poles that span the rectangle's length. Lay them across the two side poles, and secure them.
- Cover the top of the bed frame with broad leaves or grass to form a soft sleeping surface.
- Build a fire pad by laying clay, silt, or mud on one comer and allow it to dry.

Another shelter designed to get you above and out of the water or wet ground uses the same rectangular configuration as the swamp bed. You very simply lay sticks and branches lengthwise on the inside of the upright poles until there is enough material to raise the sleeping surface above the water level.

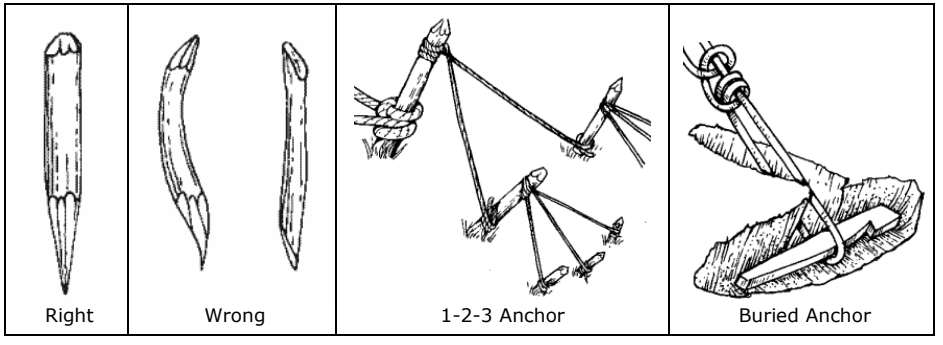
8.2.4 ANCHORS

Proper selection of stakes and anchors is important especially in areas of soft soil, sand or snow. Strong winds and stormy weather can also necessitate strong anchors.

In order for stakes to be strong and not split when they are driven into the ground, select straight wood and sharpen them all round, like you would a pencil. A bevel on the head of the stake will prevent splitting.

If trying to anchor in soft soil, or need extra strength, use the 1-2-3 anchor.

For sand or snow you will need to dig a trench about 30-50 cm deep (or more if stormy weather is expected). Tie the rope around the middle of a peg or log and fill the trench.

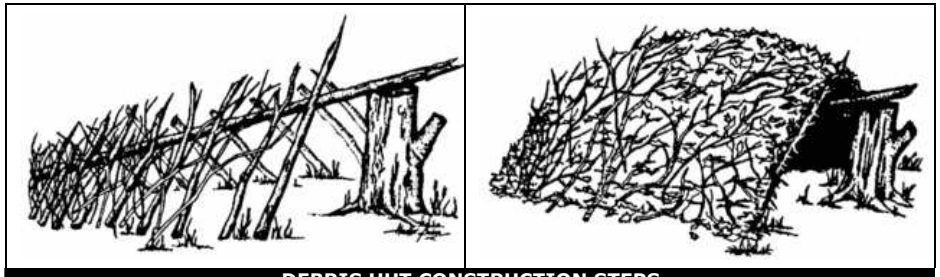


8.2.5 DEBRIS HUT

For warmth and ease of construction, this shelter is one of the best. When shelter is essential to survival, build this shelter.

To make a debris hut –

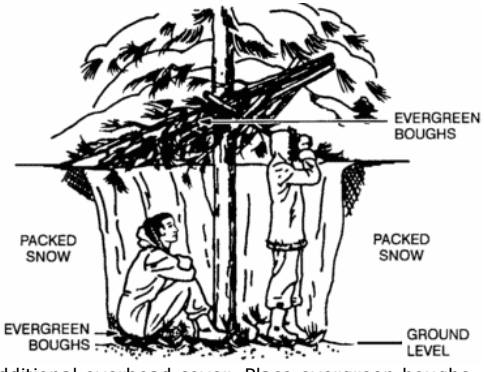
- Build it by making a tripod with two short stakes and a long ridgepole or by placing one end of a long ridgepole on top of a sturdy base, or by anchoring it to a tree at about waist height.
- Prop large sticks along both sides of the ridgepole to create 'ribs'. Ensure the ribbing is wide enough to accommodate your body and steep enough to shed water.
- Place finer sticks and brush cross-wise on the ribbing. These form a latticework that will keep the insulating material (grass, pine needles, leaves) from falling through the ribbing into the sleeping area.
- Add light, dry, soft debris over the ribbing until the insulation is at least 50cm thick.
- Place a thick layer of insulating material inside the shelter.
- As a final step, add shingling material or branches on top of the debris layer to prevent the insulation from blowing away.



DEBRIS HUT CONSTRUCTION STEPS

8.2.6 TREE-PIT SNOW SHELTER

If you are in a cold, snow-covered area where evergreen trees grow and you have a digging tool, you can make a tree-pit shelter.



To make this shelter –

- Find a tree with bushy branches that provides overhead cover.
- Dig out the snow around the tree trunk until you reach the depth and diameter you desire, or until you reach the ground.
- Pack the snow around the top and the inside of the hole to provide support.
- Find and cut evergreen boughs. Place them over the top of the pit to give you additional overhead cover. Place evergreen boughs in the bottom for insulation.

8.2.7 BEACH SHADE SHELTER

This shelter protects you from the sun, wind, rain, and heat. It is easy to make using natural materials.

To make this shelter –

- Collect driftwood or other natural material to use as support beams and as a digging tool.
- Select a site that is above the high water mark.

- Scrape or dig out a trench running north to south so that it receives the least amount of sunlight. Make the trench long and wide enough for you to lie down comfortably.
- Mound soil on three sides of the trench. The higher the mound, the more space inside the shelter.
- Lay support beams (driftwood or other natural material) that span the trench on top of the mound to form the framework for a roof.

- Enlarge the shelter's entrance by digging out more sand in front of it.
- Use natural materials such as grass or leaves to form a bed inside the shelter.

8.2.8 DESERT SHELTERS

In an arid environment, consider the time, effort, and material needed to make a shelter. If you have material such as a poncho or canvas, use it along with such terrain features as rock outcropping, mounds of sand, or a depression between dunes or rocks to make your shelter.

Using rock outcroppings –

- Anchor one end of your poncho (canvas, parachute, or other material) on the edge of the outcrop using rocks or other weights.
- Extend and anchor the other end of the poncho so it provides the best possible shade.

In a sandy area –

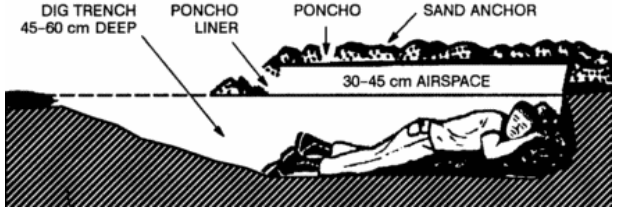
- Build a mound of sand or use the side of a sand dune for one side of the shelter.
- Anchor one end of the material on top of the mound using sand or other weights.
- Extend and anchor the other end of the material so it provides the best possible shade.

ⓘ If you have enough material, fold it in half and form a 30 - 45cm airspace between the two halves. This airspace will reduce the temperature under the shelter.

A belowground shelter can reduce the midday heat as much as 16 - 22°C (30 - 40°F). Building it, however, requires more time and effort than for other shelters. Since your physical effort will make you sweat more and increase dehydration, construct it before the heat of the day.

To make this shelter –

- Find a low spot or depression between dunes or rocks. If necessary, dig a trench 45 - 60 cm deep and long and wide enough for you to lie in comfortably.
- Pile the sand you take from the trench to form a mound around three sides.
- On the open end of the trench, dig out more sand so you can get in and out of your shelter easily.
- Cover the trench with your material.
- Secure the material in place using sand, rocks, or other weights.



If you have extra material, you can further decrease the midday temperature in the trench by securing the material 30 - 45 cm above the other cover. This layering of the material will reduce the inside temperature 11 - 22°C (20 - 40°F).

9.5 LASHING AND CORDAGE

Many materials are strong enough for use as lashing and cordage. A number of natural and man-made materials are available in a survival situation. For example, you can make a cotton web belt much more useful by unravelling it. You can then use the string for other purposes (fishing line, thread for sewing, and lashing).

This subject is discussed in detail in **Making Ropes and Cords** (Page 7-1).

9.5.1 NATURAL CORDAGE SELECTION

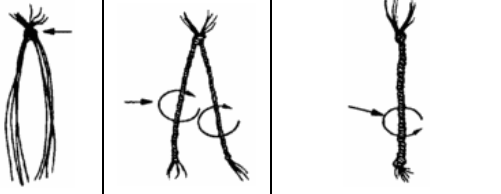
Before making cordage, there are tests you can do to determine your materials suitability. First, pull on a length of the material to test for strength. Next, twist it between your fingers and roll the fibres together. If it withstands this and does not snap apart, tie an overhand knot with the fibres and gently tighten. If the knot does not break, the material is usable.

Sinew

An excellent natural material for lashing small objects is sinew. You can make sinew from the tendons of large game, such as deer. Remove the tendons from the game and dry them completely. Smash the dried tendons so that they separate into fibres. Moisten the fibres and twist them into a continuous strand. If you need stronger material, you can braid the strands. When you use sinew for small lashings, you do not need knots as the moistened sinew is sticky and it hardens when dry.

Plant Fibres

You can shred and braid plant fibres from the inner bark of some trees to make cord. You can use the linden, elm, hickory, white oak, mulberry, chestnut, and red and white cedar trees. After you make the cord, test it to be sure it is strong enough for your purpose. You can make these materials stronger by braiding several strands together.



MAKING CORD FROM PLANT FIBRES

Rawhide

You can use rawhide for larger lashing jobs. Make rawhide from the skins of medium or large game. After skinning the animal, remove any excess fat and any pieces of meat from the skin. Dry the skin completely. You do not need to stretch it as long as there are no folds to trap moisture. You do not have to remove the hair from the skin. Cut the skin while it is dry. Make cuts about 6 mm wide. Start from the centre of the hide and make one continuous circular cut, working clockwise to the hide's outer edge. Soak the rawhide for 2 to 4 hours or until it is soft. Use it wet, stretching it as much as possible while applying it. It will be strong and durable when it dries.

9.6 CLOTHING AND INSULATION

You can use many materials for clothing and insulation. Both man-made materials and natural materials, such as skins and plant materials, are available and offer significant protection.

Animal Skins

The selection of animal skins in a survival situation will most often be limited to what you manage to trap or hunt. However, if there is an abundance of wildlife, select the hides of larger animals with heavier coats and large fat content. Do not use the skins of infected or diseased animals if at all possible. Since they live in the wild, animals are carriers of pests such as ticks, lice, and fleas. Because of these pests, use water to thoroughly clean any skin obtained from any animal. If water is not available, then at least shake out the skin thoroughly. As with rawhide, lay out the skin, and remove all fat and meat. Dry the skin completely. Use the hind quarter joint areas to make shoes and mittens or socks. Wear the hide with the fur to the inside for its insulating factor.

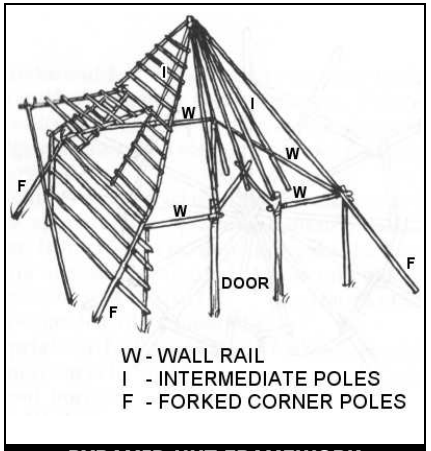
See **Tanning Animal Hides** (Page 9-8) for details on preparing animal hides.

These main structure poles should then be strengthened by cross battens and the inside wall supports constructed within the circle.

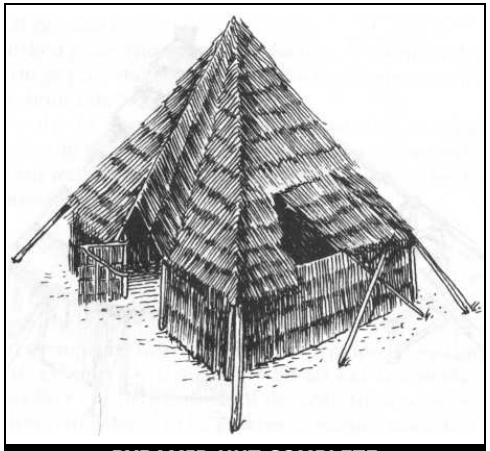
Use dry dead timber wherever possible. It is stronger and lighter to handle.

8.4.6 PYRAMIDAL HUTS

With a square base, this hut allows a lot of useable wall and floor space. This is an excellent cold weather hut, but takes at least three days to complete. The construction technique is similar to the round hut.



PYRAMID HUT FRAMEWORK



PYRAMID HUT COMPLETE

8.4.7 USEFUL HINTS

Materials for Lashing

Although in building larger structures, manufactured items such as rope, twine, special tools etc will be used. Some or all of these items may have to be improvised.

For lashings, sewing and tying, any ground or tree vine which has length, strength and pliability will serve. They should be tested for strength and pliability by tying a thumb knot in the vine and gently pull it tight. If it snaps or cuts itself it is useless.

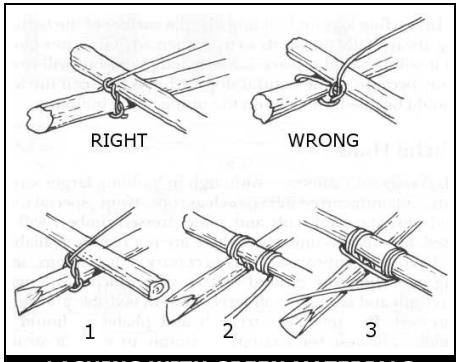
In addition to vines, the outer skin of long leaves of most palms can be used for ties. The inner bark of many shrubs and trees, alive or dead, also makes excellent lashing material. Strip down to the required thickness but watch for weak spots where it is likely to fray away.

Special Knots

Many of the sedges have length and strength and may be used for lashing and sewing work. Nearly all the bulrushes can serve as lashings.

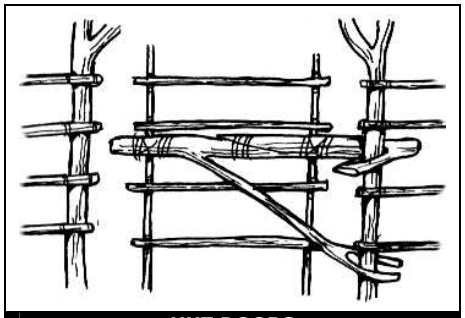
Green materials require special knots. The usual start of a square lashing is with a clove hitch, but such a hitch on green material is useless. The natural springiness will cause the knot to open.

Always start a lashing with a timber hitch. See that the free end passes straight through the eye and does not come back against it. If it does, it will probably cut through itself.



LASHING WITH GREEN MATERIALS

8.4.8 DOORS AND WINDOWS



HUT DOORS

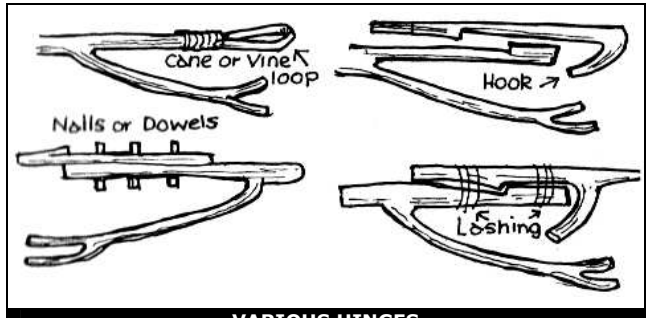
Fixtures such as doors and windows are easily added with very little extra work.

Windows can simply be two or three forked sticks cut off short before the fork with the long end protruding. Thatch battens are lashed to these forked sticks and the framework is lifted up and hung on one of these battens of the hut itself.

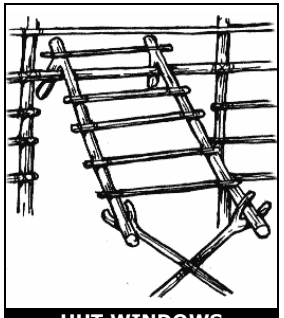
In the general thatching of a hut this window space is left clear. The window frame is thatched as a separate unit.

It is best to make the window frame wider than the window opening. There should be at least a 10 cm overlap of the frame and the window. The loose ends of the thatching above the window frames should be allowed to come on to the window's own thatch and should completely cover the sewing at the top.

Doors are also made and thatched separately. The hinge of the door can be made by several methods. In construction they are similar to a gate frame with the addition of two uprights lashed across the fork. To these two uprights, the horizontal thatching battens are secured.



VARIOUS HINGES



HUT WINDOWS

8.5 CAMPCRAFT

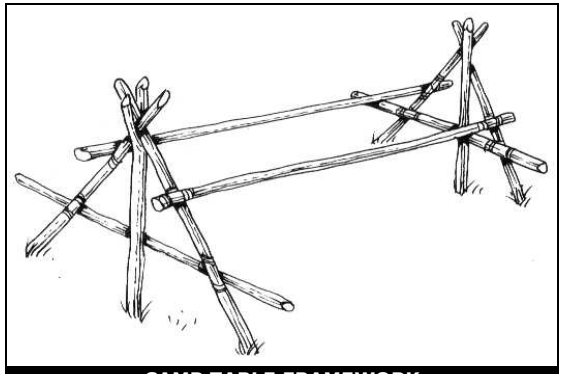
In a long term camp situation, life can become more comfortable and efficient by constructing some simple furniture, such as tables and chairs. It's time consuming, but good for morale.

8.5.1 TABLES

This type of camp table, with integrated seating, has been used for so long that the basic design has been incorporated into commercial patio and park furniture.

To start the framework, select two forked sticks about 8-10 cm diameter. The length of the stake will depend on how hard you need to drive them into the ground to be secure.

Sharpen and drive the stakes into the ground so the prong of the fork is pointing outwards.



CAMP TABLE FRAMEWORK

Experiment with different materials to make a bow. Some of the most recommended bow woods are relatively dense and heavy. Light woods are generally not recommended.

Traditionally, nocks are cut near the tips of each end to hold the bow string. Instead of using cut nocks, the bow string can be stopped from slipping down the bow by applying a tight wrapping of cord or leather strapping around the end of the limb.

9.4.1 ARROWS

Select arrows from the straightest dry sticks available. The arrows should be about half as long as the bow. Scrape each shaft smooth all around. You will probably have to straighten the shaft. You can bend an arrow straight by heating the shaft over hot coals. Do not allow the shaft to scorch or bum. Hold the shaft straight until it cools.

You must notch the ends of the arrows for the bowstring. Cut or file the notch; do not split it. Fletching (adding feathers to the notched end of an arrow) improves the arrow's flight characteristics, but is not necessary on a field-expedient arrow.

9.4.2 ARROW POINTS

To make an arrow point, use the same procedures for making a stone knife blade. Chert, flint, and shell-type stones are best for arrow points. You can fashion bone like stone – by flaking. You can make an efficient arrow point using broken glass.

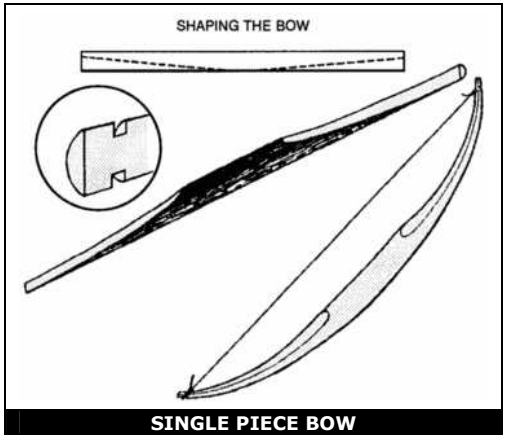
You can make arrowheads from bone, glass, metal, or pieces of rock. You can also sharpen and fire harden the end of the shaft. To fire harden wood, hold it over hot coals, being careful not to bum or scorch the wood.

9.4.3 SINGLE PIECE BOW

A good bow is the result of many hours of work. You can construct a suitable short-term bow fairly easily. When it breaks or loses its spring, you can replace it.

Select a hardwood stick about one meter long that is free of knots or limbs. Carefully scrape the large end down until it has the same pull as the small end. Careful examination will show the natural curve of the stick. Always scrape from the side that faces you, or the bow will break the first time you pull it.

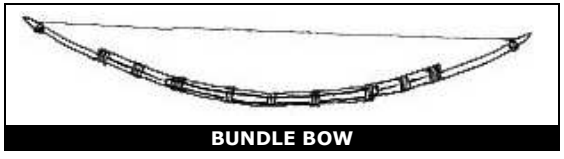
Dead, dry wood is preferable to green wood. To increase the pull, lash a second bow to the first, front to front, forming an "X" when viewed from the side. Link the tips of the bows with cordage and only use a bowstring on one bow.



SINGLE PIECE BOW

9.4.4 BUNDLE BOW

A bundle bow is made up of sticks that are tied together in such a way to achieve a similar taper to a carved bow.



BUNDLE BOW

Three or more sticks of a similar diameter and fairly uniform thickness are bundled together to make a bow. The shortest stick should be around half the length of the longest one. The middle-sized stick should be about three-quarters the length of the longest one. Experiment to find the best direction for the pull of the bow.

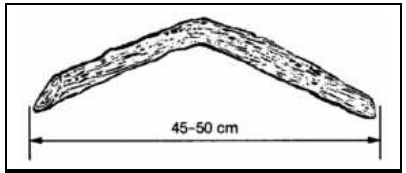
Small saplings can be cut and seasoned or a suitable seasoned bamboo may perform a little better because of its comparatively low weight. Some varieties of bamboo seem to be quite unsuitable for this purpose. Old fibreglass or carbon fibre fishing rods can also be used.

9.3 OTHER EXPEDIENT WEAPONS

You can make other weapons such as the throwing stick, archery equipment, and the bola.

9.3.1 THROWING STICK

The throwing stick, commonly known as the rabbit stick, is very effective against small game. The rabbit stick itself is a blunt stick, naturally curved at about a 45-degree angle. Select a stick with the desired angle from heavy hardwood such as oak. Shave off two opposite sides so that the stick is flat like a boomerang. You must practice the throwing technique for accuracy and speed. First, align the target by extending the non-throwing arm in line with the mid to lower section of the target.



THROWING STICK

Slowly and repeatedly raise the throwing arm up and back until the throwing stick crosses the back at about a 45-degree angle or is in line with the non-throwing hip. Bring the throwing arm forward until it is just slightly above and parallel to the non-throwing arm. This will be the throwing stick's release point. Practice slowly and repeatedly to attain accuracy.

JOIN THREE 60cm CORDS

TIE WEIGHTS SECURELY TO THE END OF THE CORDS

HOLD BY CENTRE KNOT AND TWIRL THE BOLA OVER YOUR HEAD. RELEASE TOWARD TARGET

BOLA

9.3.2 BOLA

The bola is weapon that is easy to make. It is especially effective for capturing running game or low-flying fowl in a flock.

To use the bola, hold it by the centre knot and twirl it above your head.

Release the knot so that the bola flies toward your target. When you release the bola, the weighted cords will separate. These cords will wrap around and immobilize the fowl or animal that you hit.

9.3.3 SLING

You can make a sling by tying two pieces of cordage, about 60 cm long, at opposite ends of a palm-sized piece of leather or cloth. Place a rock in the cloth and wrap one cord around the middle finger and hold in your palm. Hold the other cord between the forefinger and thumb. To throw the rock, spin the sling several times in a circle and release the cord between the thumb and forefinger. You will need practice to gain proficiency. The sling is very effective against small game.

9.4 ARCHERY EQUIPMENT

While it may be relatively simple to make a bow and arrow, it is not easy to use one. You must practice using it a long time to be sure that you will hit your target. Also, a field-expedient bow will not last very long before you have to make a new one. For the time and effort involved, you may well decide to use another type of field-expedient weapon.

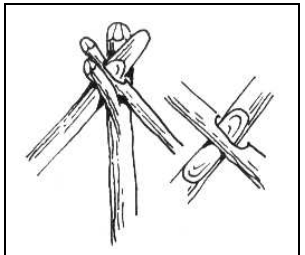
It is often recommended that a bow should be longer than twice your draw length. A shorter bow may shoot a little faster and be more convenient to carry than a longer bow, but it may be more likely to fail. A longer bow may help you shoot more accurately, has a greater potential pull and will probably be a bit more durable.

Find and cut four strong, straight poles and place them into the crotch of the fork at a 45° angle to the uprights. Shave these cross-braces as shown so they fit neatly into the crotch.

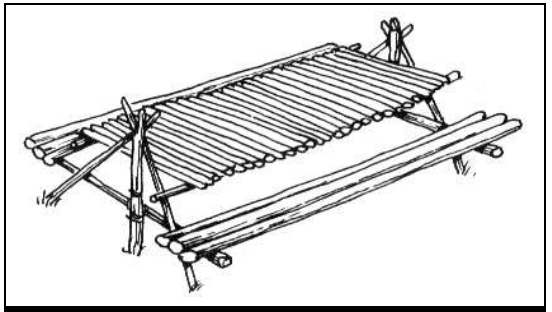
Tightly lash the table and seat supports as shown, at a comfortable height. The framework is now complete.

To finish the table, find many straight long poles for the table and seat surfaces and lash them as shown. The surface poles can be squared off with a drawknife and plane, or can be split down the middle with a wedge, otherwise just accept a rounded, bumpy surface.

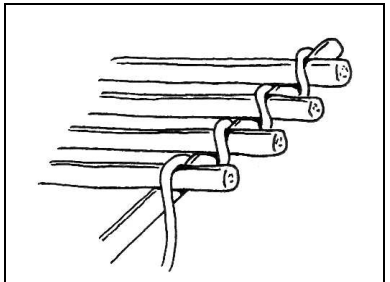
If the seats show signs of sagging, construct a 'H' frame for support in the middle.



CROSS BRACES



COMPLETED TABLE



LASHING THE SURFACE POLES

Bracing in Soft Ground

If the ground is soft or sandy, additional bracing may be needed to stop the table from wobbling. Any wobble will lead to the table's premature destruction and you will have to reconstruct it.

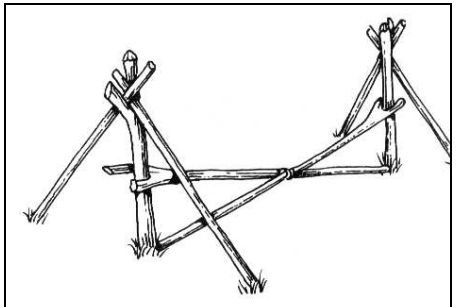
Portable Table

If you don't want a table that is permanently fixed in one position, some extra bracing will eliminate the need for driving poles into the ground. The table can then be moved as needed.

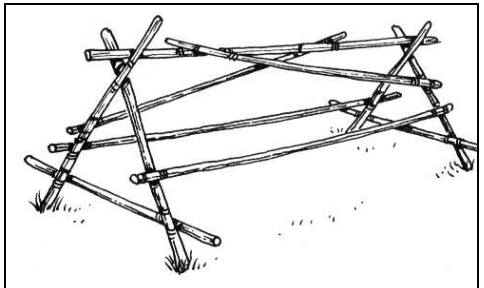
Keeping Things Level

If you don't have a spirit level, it is easy to construct shelters and benches that are level by using a plum. A plum is simply a piece of string with a weight attached. When the string is held the weight will, of course, point toward the centre of the Earth. This will provide a perfectly accurate vertical reference point.

To find the horizontal level line, it is simply a matter of determining the 90° angle from the vertical. Almost any commercially made item, such as a container, book, Gameboy, piece of paper etc will have 90° angles somewhere. There are eight down there ↓ If you are truly struggling for 90°, the human eye is very efficient at determining this angle.



BRACING IN SOFT GROUND

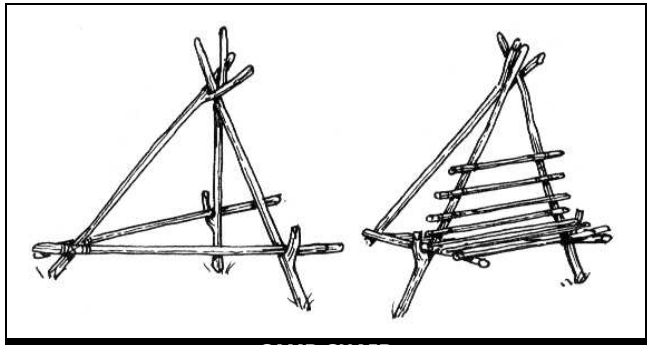


BRACING A PORATABLE TABLE

8.5.2 CHAIRS

In the bush, any raised object becomes a seat but if you get tired of sitting on rocks and logs, you can make comfortable furniture with a little time and imagination.

At right is one design for a bush chair, remember to make it tall enough so you don't have the fork sticking in the back of your head.



CAMP CHAIR

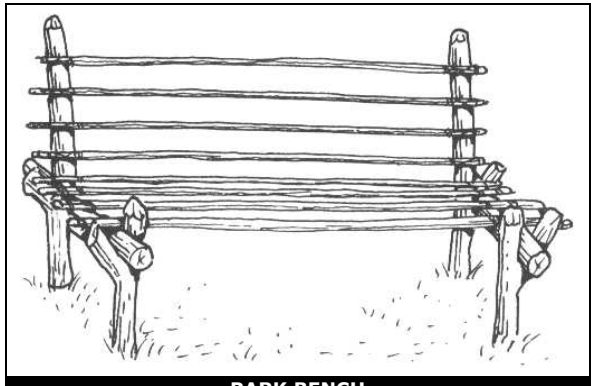
When selecting the poles for the seat and backing, position the wood so you don't have uncomfortable knots sticking into your backside, unless you like that sort of thing.

Park Bench

This illustration of a simple park bench needs little explanation.

Drive the vertical poles deep enough into the ground to ensure stability, or add diagonal cross bracing.

If the bracing is strong enough, the bench could be made to be portable.



PARK BENCH

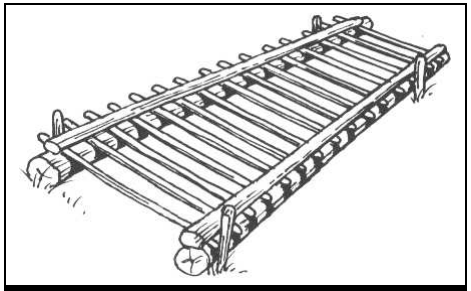
8.5.3 BEDS

An hour of hard work is worth a good nights rest. Sleeping directly on the ground is not ideal and will drain heat out of your body very quickly.

A raised bed will eliminate the thermal coupling between your body and the ground and will also reduce the amount of small creatures crawling on you.

This design shows the basic framework for a raised camp bed. Select two large straight poles for the footing and peg them so they don't roll around.

The cross-poles can either be lashed directly to the bottom logs, or lashed to the two thinner poles, forming a moveable frame.



SIMPLE CAMP BED FRAMEWORK

Bedding Material

As comfortable as sleeping on a grill of gnarly knot-ridden sticks would be, to complete the bed you need an ample layer of soft material, and a covering mat to hold it all together.

Just about any material can be used for the 'down' as long as it is soft and large enough so it doesn't slip through the grill. Dried grass, ferns, green leaves etc. Make sure this layer is thick enough to support your body weight and provide a soft, springy bed.

Next construct a mat out of reeds or long grass bundled and woven together with some cordage. This will prevent the loose material from being displaced during your sleep.

razor sharp edge. Use the flaking tool along the entire length of the edge you need to sharpen. Eventually, you will have a very sharp cutting edge that you can use as a knife.

Lash the blade to some type of hilt.

> ⓘ Stone will make an excellent puncturing tool and a good chopping tool but will not hold a fine edge. Some stones such as chert or flint can have very fine edges, but will break easily.

Bone

You can also use bone as an effective edged weapon. First, select a suitable bone. The larger bones, such as the leg bone of a deer or another medium-sized animal, are best. Lay the bone upon another hard object. Shatter the bone by hitting it with a rock. From the pieces, select a suitable pointed splinter. You can further shape and sharpen this splinter by rubbing it on a rough-surfaced rock. If the piece is too small to handle, you can still use it by adding a handle to it. Select a suitable piece of hardwood for a handle and lash the bone splinter securely to it.

> ⓘ Use the bone knife only to puncture. It will not hold an edge and it may flake or break if used differently.

Wood

You can make edged weapons from wood. Use these only to puncture. To make a knife using wood, first select a straight-grained piece of hardwood that is about 30 cm long and 2.5 cm in diameter. Fashion the blade about 15 cm long. Shave it down to a point. Use only the straight-grained portions of the wood. Do not use the core or pith, as it would make a weak point.

Harden the point by a process known as fire hardening. Dry the blade portion over the fire slowly until lightly charred. The drier the wood, the harder the point. After lightly charring the blade portion, sharpen it on a coarse stone. If using bamboo and after fashioning the blade, remove any other wood to make the blade thinner from the inside portion of the bamboo. Removal is done this way because bamboo's hardest part is its outer layer. Keep as much of this layer as possible to ensure the hardest blade possible. When charring bamboo over a fire, char only the inside wood; do not char the outside.

Metal

Metal is the best material to make field-expedient edged weapons. First, select a suitable piece of metal, one that most resembles the desired end product. Depending on the size and original shape, you can obtain a point and cutting edge by rubbing the metal on a rough-surfaced stone. If the metal is soft enough, you can hammer out one edge while the metal is cold. Use a suitable flat, hard surface as an anvil and a smaller, harder object of stone or metal as a hammer to hammer out the edge. Make a knife handle from wood, bone, or other material that will protect your hand.

Other Materials

You can use other materials to produce edged weapons. Glass is a good alternative to an edged weapon or tool. Obtain a suitable piece in the same manner as described for bone. Glass has a natural edge but is less durable for heavy work. You can also sharpen plastic – if it is thick enough or hard enough – into a durable point for puncturing.

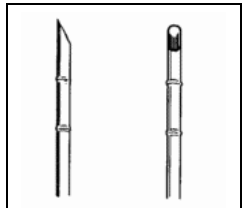
9.2.2 SPEARS

Use the same procedures to make a spear blade as a knife blade. Select a shaft (a straight sapling) 1.2 - 1.5 metres long. The length should allow you to handle the spear easily and effectively.

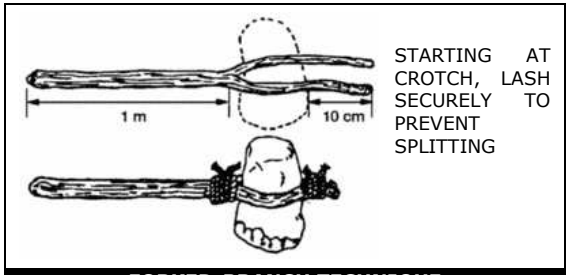
To attach the blade to the shaft, split the handle, insert the blade, then lash it tightly.

You can use other materials without adding a blade. Select a long straight hardwood shaft and shave one end to a point. If possible, fire-harden the point.

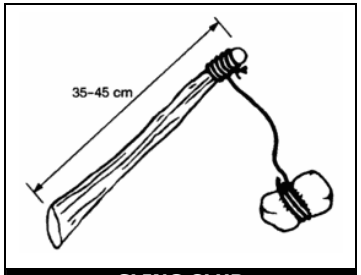
Bamboo also makes an excellent spear. Starting 8 - 10 cm back from the end used as the point, shave down the end at a 45° angle. Remember, to sharpen the edges, shave only the inner portion.



BAMBOO SPEAR



FORKED-BRANCH TECHNIQUE



SLING CLUB

9.2 EDGED WEAPONS

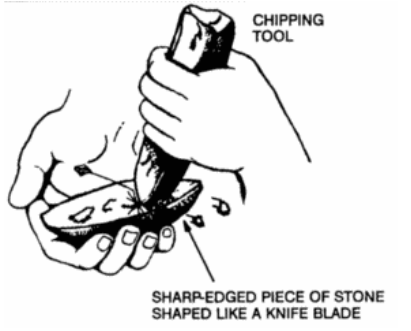
Knives, spear blades, and arrow points fall under the category of edged weapons. The following paragraphs will discuss the making of such weapons.

9.2.1 KNIVES

A knife is an invaluable tool used to construct other survival items. You may find yourself without a knife or you may need another type knife or a spear. To improvise you can use stone, bone, wood, or metal to make a knife or spear blade.

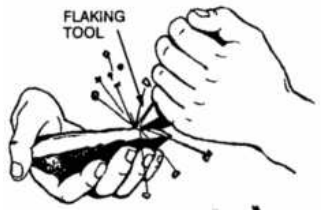
Stone

To make a stone knife, you will need a sharp-edged piece of stone, a chipping tool, and a flaking tool. A chipping tool is a light, blunt-edged tool used to break off small pieces of stone. A flaking tool is a pointed tool used to break off thin pieces of stone. You can make a chipping tool from wood, bone, or metal, and a flaking tool from bone, antler tines, or soft iron.



1. SHAPE BLADE –

STRIKE GLANCING BLOWS NEAR EDGE TO GET EDGE THIN ENOUGH TO SHARPEN

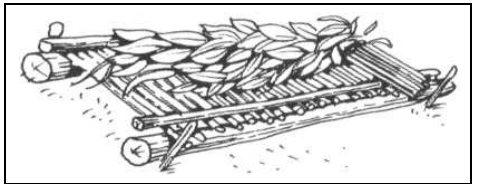


2. SHARPEN BLADE –

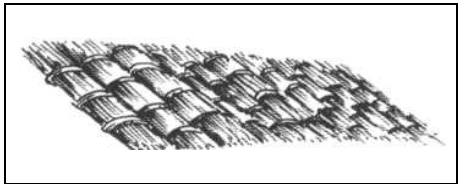
PRESS DOWNWARD WITH FLAKING TOOL AT STONE EDGE OR PUSH FLAKING TOOL ALONG EDGE

MAKING A STONE KNIFE

Start making the knife by roughing out the desired shape on your sharp piece of stone, using the chipping tool. Try to make the knife fairly thin. Then, using the flaking tool, press it against the edges. This action will cause flakes to come off the opposite side of the edge, leaving a



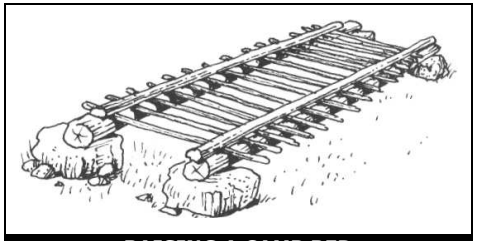
BEDDING MATERIAL



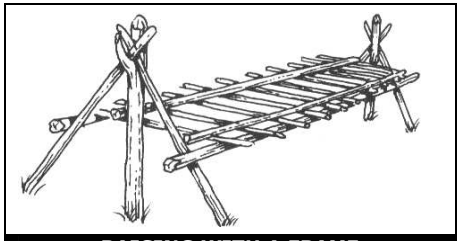
COVER MAT

Above Ground Camp Beds

Rocks or large logs can be used to raise a camp bed off the ground. Another method is to construct some A-frames, similar to those used for the camp table, and lash the bed framework to that.

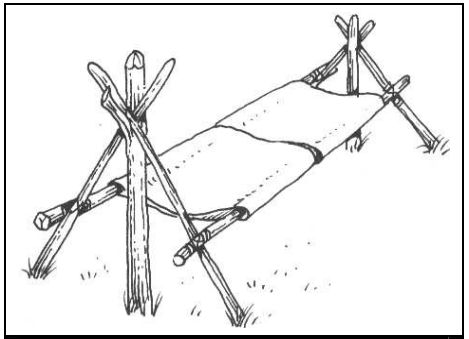


RAISING A CAMP BED

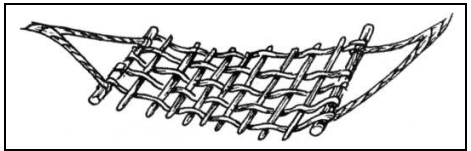


RAISING WITH A FRAME

If you have some strong material such as canvas, the design can be greatly simplified by constructing a stretcher type bed. Canvas bags can be simply looped around the side supports.



STRETCHER BED



BUSH HAMMOCK

If you need to stitch the material, use a back-stitch (rather than a straight stitch) and double or triple them.

If you have enough spare rope, a hammock can be woven. Using sticks for the cross supports reduces the amount of rope needed. This design is both comfortable and strong.

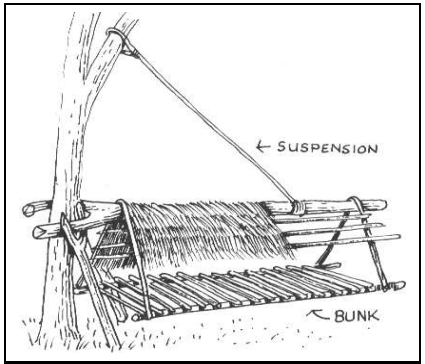
Tree-Swing Shelter

A shelter and a bed can be incorporated into one design. Find or cut a large log with a fork and suspend it to a suitable tree as shown. The forked end may need to be lashed to the tree to prevent it from slipping upwards.

Next, construct the bunk in the same manner as a camp bed and suspend it to the large main pole with some strong rope.

Now horizontal beams can be lashed to the A-frame rope supports, and these can be thatched to provide a waterproof shelter.

This design is useful in swampy territory or areas that are prone to snakes. Be sure to make the shelter large enough so it is not difficult to enter.



TREE SWING SHELTER

8.6 LONG TERM SHELTERS

If the situation requires, and permits, you may consider building a larger, more robust shelter. Many options are available from the popular log-cabin to mud-brick, rammed earth and others.

Before commencing construction, the site should be well prepared and the materials should be collected and stored in advance.

STONE FOUNDATION

8.6.1 FOUNDATIONS

Buildings such as rammed earth or mudbrick houses should be set on a solid foundation. This foundation does not need to cover the entire floor, only to bear the weight of the walls.

A trench 60 cm deep by 30 cm wide, lined all over with 4 cm of clay is enough to bear the weight. Large stones are then set into this clay and the footing continued with more clay and stones until a packed wall has been made that stands about 20 cm above ground level. The wall is raised to prevent water from damaging the walls. If you are in an area that is subject to flooding, a higher foundation may be required.

Clay is a good material to use because it is fairly resistant to moisture once tramped in and the building will require no damp course. Concrete can be used if available, but a damp course (water-proof barrier) will be required underneath.

8.6.2 RAMMED EARTH CONSTRUCTION

Earth buildings can either be constructed by making forms to contain the material, or by ramming it in blocks, forming bricks, and laying these in courses.

The material required for construction is earth, mixed with a proportion of clay, sand or other gritty particles. It should be free of organic materials such as tree roots.

Soil Properties

Any heavy loamy soil is suitable for rammed earth construction. The soil must have the right moisture content. To test the moisture content, roll some into a golf-ball sized lump and drop it from 30 cm. If it breaks up on contact, it is too dry and will need moisture to be added before ramming.

If it holds together after being dropped, apply a second test. Drop the ball from above your head. If it still holds together, it is too wet and will need to be dried out.

The soil should be tested for its clay-silt-sand ratio. There should be between 30% - 70% sand and 30% - 70% clay and silt. The ideal proportions are 50/50. You should take samples from various areas and test. You may combine soils from different areas to obtain the correct mix.

Testing Soil

To test soil, take a clear container about 10 cm high. Dry some of the test earth, crumble it and fill the container to the top. Then empty the container into another dish, and wash thoroughly in slowly running water until all the clay and silt washes over the rim.

Dry what remains and place back into the container. This will provide the sand ratio of the soil. Soil with too much clay will crack, but if the clay content is too low, the block will crumble. Soil that is heavy in clay however is suitable for mudbricks.

Strengthening Agents

The walls can be made with earth only, but adding binding agents such as dried grass or straw will increase the strength considerably. If bricks are to be made in molds, the binding agent should be cut in lengths to fit in the molds. If long walls are to be made, any reasonable length will do, but shorter lengths will mix better with the clay-sand material.

9 Weapons, Tools & Equipment

A knife is your most valuable tool in a survival situation. You must always keep it sharp and ready to use. Imagine being in a survival situation without any weapons, tools, or equipment except your knife. You would probably feel helpless, but with the proper knowledge and skills, you can easily improvise needed items.

In survival situations, you may have to fashion any number and type of field-expedient tools and equipment to survive. Examples of tools and equipment that could make your life much easier are ropes, rucksacks, clothes, nets, and so on.

Weapons serve a dual purpose. You use them to obtain and prepare food and to provide self-defence. A weapon can also give you a feeling of security and provide you with the ability to hunt on the move.

9.1 CLUBS

You hold clubs, you do not throw them. As a field-expedient weapon, the club does not protect you from enemies. It can, however, extend your area of defence beyond your fingertips. It also serves to increase the force of a blow without injuring yourself. There are three basic types of clubs. They are the simple, weighted, and sling club.

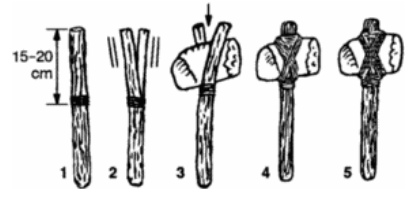
Simple Club

A simple club is a staff or branch. It must be short enough for you to swing easily, but long enough and strong enough for you to damage whatever you hit. Its diameter should fit comfortably in your palm, but it should not be so thin as to allow the club to break easily upon impact. A straight-grained hardwood is best if you can find it.

Weighted Club

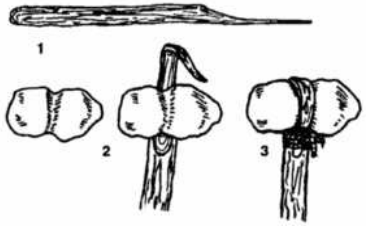
A weighted club is any simple club with a weight on one end. The weight may be a natural weight, such as a knot on the wood, or something added, such as a stone lashed to the club.

To make a weighted club, first find a stone that has a shape that will allow you to lash it securely to the club. If you cannot find a suitably shaped stone, you must fashion a groove or channel into the stone by a technique known as pecking. By repeatedly rapping the club stone with a smaller hard stone, you can get the desired shape.



1. WRAP LASHING
2. SPLIT END TO LASHING
3. INSERT STONE
4. LASH SECURELY ABOVE, BELOW AND ACROSS STONE
5. BIND SPLIT END TIGHTLY TO SECURE STONE

SPLIT-HANDLE TECHNIQUE



1. TAKE HARDWOOD 1m LONG AND 2.5cm IN DIAMETER AND SHAVE END TO ABOUT HALF THE DIAMETER
2. TAKE ABOUT A 1.8kg STONE WITH A GROOVE. OR MAKE A GROOVE
3. WRAP THE SHAVED END AROUND THE STONE
4. LASH SECURELY

WRAPPED-HANDLE TECHNIQUE

Small stones and river gravel can also be used. If using either straw or gravel, test blocks should be made, seasoned, and tested for strength and cracking before beginning construction. Make note of the materials and proportions used in each test block.

Forms and Molds

Forms can be made from a series of boards which are bolted together to allow the rammed earth wall to be built directly onto the buildings footing.

Alternatively, molds can be made and the earth rammed into them to make large blocks. After drying, these blocks can be laid in the same way as bricks.

If forms are used, the most convenient size for filling is about 1 metre high and 2 metres long.

At the first level clamp the forms to the footings by driving poles into the earth and securing at the top of the forms.

Ramming Technique

When ramming, shovel about 10 cm of earth along the entire form and ram it down until it 'rings'. The ringing sound is distinctly different from the initial 'thuds' when starting to ram. When the first layer is 'ringing' throughout its entire length, the process is repeated.

Separate right-angle forms are needed for the corners and the earth should be rammed particularly hard in these sections. Each level of the wall should be allowed to cure for several days before the forms are removed and the next layer is started.

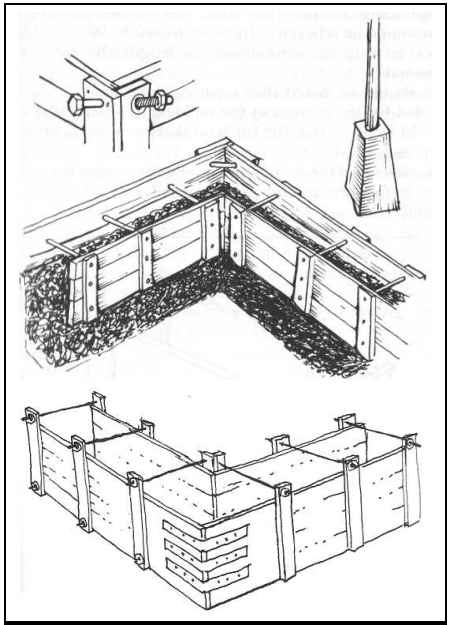
Rammers generally weigh between 4 - 8 kg and have a large flat hardwood head. The handle should be about 1.5 metres long. For a wall 2.5 - 3 metres tall, 30 cm thick is sufficient. Higher walls should be 40 cm thick.

Incorporating pieces of wood into the structure during building will make it easier to attach fixtures such as doors and windows.

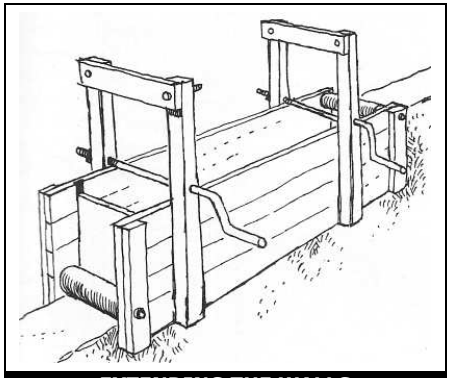
If molds are used to form bricks, they can be designed to break apart once a brick has been made. The bricks can cure without support.

The roof can be thatched or shingled, or can be made by laying a bed of logs which is then chinked with clay and covered with soil and sod. The angle should be at least 15° to allow for proper water shedding.

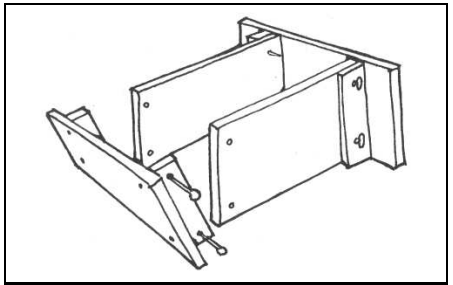
Once the structure has been constructed and roofed, extra protection on the outside walls from rain can be applied. This can be a whitewash, lime-wash, a cow dung-mud render mix, bituminous paint or a cement render made from one part cement to two parts sand in a highly liquid form.



RAMMED EARTH FORMS



EXTENDING THE WALLS



BREAK-APART MOLD

8.6.3 SIMPLE LOG CABIN

If timber is plentiful and termites are not a problem, a log cabin can be built as a permanent shelter. Any type of log can be used as long as it is fairly straight and about 20 – 25 cm in diameter, and only minor tapering. A taper of 5 cm over a 5 meter log is acceptable. Two logs should be larger and heavier than the rest for use as bed logs.

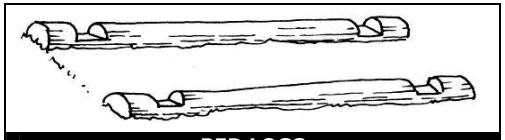
Seasoning the Timber

If possible, cut down trees in early winter. The cooler temperatures allow for longer drying times, which reduces cracking and splitting. To season the logs, stack them on the ground with thinner logs as spacers between the courses to keep the main logs off the ground and provide the most airflow.

The bark should be partially peeled off with a drawknife if you have one. This will increase drying speed with only minimum splitting cracking. Season for at least 1 – 2 years.

Construction

Find a clear flat area, or clear and level one, in a suitable area. The area should not be susceptible to flooding or landslides and be out of view from possible intruders.

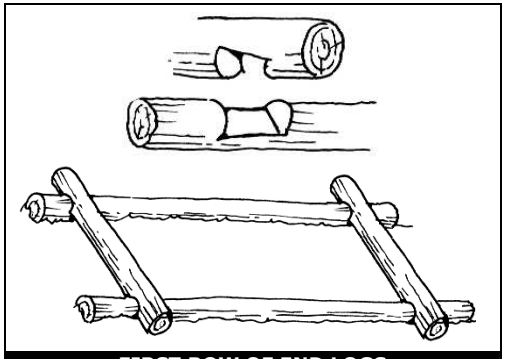


BED LOGS

Lay the bed logs in the required position, ensuring they are square. If you measure diagonally from corner to corner, both measurements should be even.

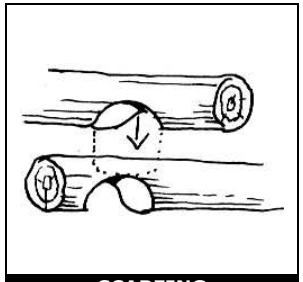
Cut square notches in the bed logs quarter way through. Next select two logs for the first course of end logs and cut them to length if necessary. Cut two square notches a quarter way through so they slot into the bed logs.

The remaining logs are 'scarfed' into the lower rows by cutting round grooves half way through. This method of scarfing underneath the logs ensures water will automatically run down and not get trapped in the grooves.



FIRST ROW OF END LOGS

Continue building in this manner to build up the walls. Alternate each row so the tapered end sits on the fat end of the previous row. Once the walls reach about waist height, cut the openings for doors and windows. The loose ends can be braced by cutting a vertical groove into the ends of the logs and inserting a thin pole to hold them in place.



SCARFING

COMPLETED CABIN

Once the walls are high enough, form the apex for the roof by using shorter and shorter end logs. You can then finish with a thatched, shingled or sod roof. When complete, chink the cabin from the inside, using a clay/soil mixture. This will need to be reapplied from time to time.

8.6.4 OTHER CONSTRUCTION TECHNIQUES

There are many ways to build strong shelters and entire books have been written on each of the methods presented in this chapter. Choose a method that best suits your resources and requirements, even if that means combining two or more techniques.

It is best not to start too large, but rather build the minimum you require to improve your immediate situation and expand later on as your situation permits.

Adobe

Adobe is basically soil that has been moistened, formed into shape, and allowed to dry. Often chopped straw or other fibres are added for strength. The best adobe soil will have between 15% to 30% clay, with the rest of the mixture being sand or larger aggregate.

Too much clay will cause shrinkage and cracking when drying, too little will not be enough to bind the material properly. Adobe can be stabilised with a small amount of cement or asphalt emulsion to keep it intact when subject to excessive weather.

Sometimes adobe is shaped into uniform blocks that can be stacked like bricks to form walls, but more often is simply piled up over time to create a solid structure. It can be shaped into blocks by pouring into molds and rammed or simply left to dry. The walls should be about 50 cm (20 in) thick.

Occasional re-plastering will be required as the weather deteriorates the walls. Large eaves to protect the walls from the weather and a foundation to raise it off the ground will greatly reduce the need for maintenance.

Due to the high earth content, adobe has a large thermal mass and will hold heat or cold for a long time. Insulation can be provided with a second internal wall of light cob, described below.

Cob

Cob is similar to adobe, but there is a much higher percentage of long straw fibres mixed in and the clay content is between 10% to 20%. The mixture of clay, soil, coarse sand, straw and water is thoroughly mixed and beaten together. The stiff mud is then built up into walls while still wet, without the use of formwork or ramming.

The mixture is applied in courses, each of which is 'sewn' or 'woven' into the lower course while it is still pliable. As the walls are formed, frames for doors and windows and other fixtures such as wooden anchors benches are incorporated along the way.

Because of the weight of the material, the bottom courses must be allowed to dry before a new course can be added. This makes it hard to add more than about 30 cm (1 ft) per day. The walls should be about 50 cm (20 in) thick.

Due to the lack of mortar joints and the high percentage of fibres, cob houses are usually more resistant to earthquakes than their close cousin, adobe. They also have higher insulation, as opposed to thermal mass (holds heat or cold), because of the amount air trapped in the fibres.

Cob houses, like adobe, must be protected from the weather with generous eaves and a foundation. They should never be constructed in flood plains, well nothing should really.

Light Cob

A variation of cob is to use long straw fibres and coat them with enough clay mixture so that they stick together, but does not form a solid mass.

This material is then tamped into form and left to set before removing the formwork. This is useful for making interior walls that do not bear any weight. These walls offer a lot more insulation than traditional cob or adobe.

External walls can be made from this way if they are made thick enough, but some sort of frame would be needed as the light cob is not load bearing.

The walls can be rendered with a clay mixture once they are set.

Straw Substitute

If you don't have straw, many other natural materials can be substituted, such as dried reeds. Basically any material that is suitable for rope making will add the strength necessary if they are long enough, and abundant. See **Selecting Materials** (Page 7-1) for details.

If you are going to collect such materials, then your fist task should be gathering a large supply before you start construction as this will be time consuming.

11.2 ENVIRONMENTAL FACTORS

Surviving and evading the enemy in an arid area depends on what you know and how prepared you are for the environmental conditions you will face. Determine what equipment you will need, the tactics you will use, and the environment's impact on them and you.

In a desert area there are seven environmental factors that you must consider —

- Low rainfall
- Intense sunlight and heat
- Wide temperature range
- Sparse vegetation
- High mineral content near ground surface
- Sandstorms
- Mirages

Low Rainfall

Some areas receive less than 10 cm of rain annually, and this rain comes in brief torrents that quickly run off the ground. You cannot survive long without water in high desert temperatures. You must first consider "How much water do I have?" and "Where are other water sources?"

Intense Sunlight and Heat

Air temperature can rise as high as 60°C (140°F) during the day. Heat gain results from direct sunlight, hot blowing winds, reflective heat (the sun's rays bouncing off the sand), and conductive heat from direct contact with the desert sand and rock.

The temperature of desert sand and rock averages 16 - 22°C (30 - 40°F) more than the air.

Intense sunlight and heat increase the body's need for water. To conserve your body fluids and energy, you will need a shelter to reduce your exposure to the heat of the day. Travel at night to lessen your use of water.

Radios and sensitive items of equipment exposed to direct intense sunlight may malfunction.

Wide Temperature Range

Temperatures in arid areas may get as high as 55°C during the day and as low as -10°C during the night. The drop in temperature at night occurs rapidly and will chill a person who lacks warm clothing. The cool evenings and nights are the best times to work or travel. For the night you will find a wool sweater, long underwear, and a wool stocking cap extremely helpful.

Sparse Vegetation

Vegetation is sparse in arid areas. You will therefore have trouble finding shelter and camouflaging your movements. During daylight hours large areas of terrain are visible and easily controlled by a small opposing force.

If travelling in hostile territory, follow the principles of desert camouflage —

- Hide or seek shelter in dry washes (wadis) with thicker growths of vegetation and cover from oblique observation.
- Use the shadows cast from brush, rocks, or outcropping. The temperature in shaded areas will be 11 - 17°C cooler than the air temperature.
- Cover objects that will reflect the light from the sun.

Before moving, survey the area for sites that provide cover. You will have trouble estimating distance. The emptiness of desert terrain causes most people to underestimate distance by a factor of three: What appears to be 1 km away is really 3 km away.

High Mineral Content

All arid regions have areas where the surface soil has a high mineral content (borax, salt, alkali, and lime). Material in contact with this soil wears out quickly, and water in these areas is extremely hard and undrinkable. Wetting your uniform in such water to cool off may cause a skin rash. The Great Salt Lake area is an example of this type of mineral-laden water and soil. There is little or no plant life; there-fore, shelter is hard to find. Avoid these areas if possible.

Sandstorms

Sandstorms occur frequently in most deserts. The greatest danger is getting lost in a swirling wall of sand. Wear goggles and cover your mouth and nose with cloth. If natural shelter is unavailable, mark your direction of travel, lie down, and sit out the storm.

Plant Fibres

Several plants are sources of insulation from cold. Cattail is a marshland plant found along lakes, ponds, and the backwaters of rivers. The fuzz on the tops of the stalks forms dead air spaces and makes a good down-like insulation when placed between two pieces of material. Milkweed has pollen like seeds that act as good insulation. The husk fibres from coconuts are very good for weaving ropes and, when dried, make excellent tinder and insulation.

9.7 COOKING AND EATING UTENSILS

Many materials may be used to make equipment for the cooking, eating, and storing of food.

Bowls

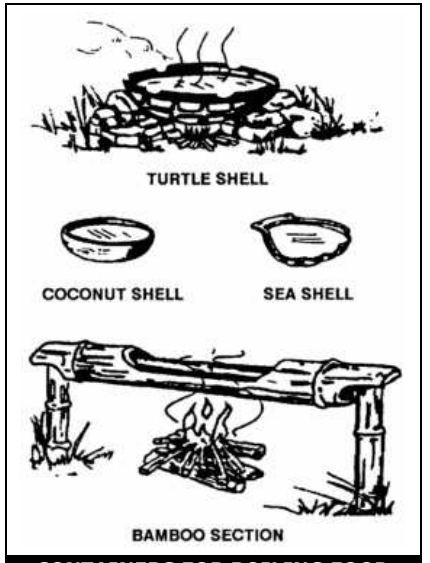
Use wood, bone, horn, bark, or other similar material to make bowls. To make wooden bowls, use a hollowed out piece of wood that will hold your food and enough water to cook it in. Hang the wooden container over the fire and add hot rocks to the water and food. Remove the rocks as they cool and add more hot rocks until your food is cooked.

> ! **CAUTION –** Rocks with air pockets, such as limestone and sandstone may explode while heating in the fire.

You can also use this method with containers made of bark or leaves. However, these containers will burn above the waterline unless you keep them moist or keep the fire low.

A section of bamboo works very well, if you cut out a section between two sealed joints.

> ! **CAUTION –** A sealed section of bamboo will explode if heated.



CONTAINERS FOR BOILING FOOD

Forks, Knives, and Spoons

Carve forks, knives, and spoons from non-resinous woods so that you do not get a wood resin aftertaste or do not taint the food. Non-resinous woods include oak, birch, and other hardwood trees.

> ⓘ Do not use trees that secrete a syrup or resin-like liquid on the bark or when cut.

Pots

You can make pots from turtle shells or wood. As described with bowls, using hot rocks in a hollowed out piece of wood is very effective. Bamboo is the best wood for making cooking containers.

To use turtle shells, first thoroughly boil the upper portion of the shell. Then use it to heat food and water over a flame.

Water Bottles

Make water bottles from the stomachs of larger animals. Thoroughly scrape out and flush the stomach out with water, then tie off the bottom. Leave the top open, with some means of fastening it closed.

9.8 TANNING ANIMAL HIDES

Tanning a hide will make it soft and suitable for clothing and many useful items. Start with a freshly-skinned hide from the animal. You will also need the brain for the tanning solution. An interesting quirk is that every animal has enough brains to tan its own hide.

9.8.1 SIMPLE TANNING

Fleshing the Hide

If the hide is not fresh, and the meat seems dry and stuck to the hide, soak it in water overnight. It will tend to float so weigh it down. Let it drip dry the next day.

Spread the hide fur side down on a flat log or other surface if available. If possible, stretch it taut and tack it down. Another method is to use a horizontal beam about naval height (a pole lashed between two trees). Lay the hide with the neck over the beam so you can hold it in place with body weight.

Take a dull scraping tool and begin scraping the muscle and fat tissue away until you see the pores of the skin. Be sure to scrape every square inch of the hide, including the edges.

De-hairing the Hide

If you chose to remove the hair from the hide, fill a large container with enough water to completely cover the hide. Mix up one cup of ashes with two cups cold water and stir it well. Stir this lye solution into the water then submerge the entire hide.

Keep it submerged until the hair begins to pull out easily. Stir the mixture and let the hide soak for a while longer until you can take scrape a blunt scraping tool gently across the skin a few times and remove a strip of hair. At this point you can scrape all the hair off.

Once all the hair is removed, trim the hide so there are no thin edges.

Braining the Hide

Mix the animal brain with a small amount of water and mash into a smooth consistency. Once blended, mix about 0.5 kg (1 pound) of brains to 15 litres (4 gallons) of water. Another way to measure is about a large walnut size of brain to 1 1/2 cups water.

The water should be very warm, but not too warm to put your hands in, otherwise it will slow cook the hide and weaken it. Divide this mixture into two equal portions.

Begin to dip the hide in the warm solution. Wet the hide thoroughly and work with your hands. All parts of the hide should feel very slimy and smooth. If there are parts that do not feel slimy, gently pull on that part and let it absorb the brain solution.

Leave this to soak in the brain solution overnight, completely submerged and weighed down.

The next day, hang the hide up to dry. If it is a hot sunny day, do not leave it hanging too long once dry or it will be difficult to work later.

Once the hide is dry, place it in a container of clean water and let soak overnight again.

Softening

Begin to stretch your hide. Pull it side to side and head to tail over a beam. The back of an old chair works well. Stretch and buff it over the entire length of the hide. Continue doing this until dry. If the pelt dries tough in one some spots, reapply some brain solution, let it soak in and stretch until dry.

For larger pelts you can make a frame to stretch the hide over. This can be made with four poles lashed together, or two horizontal poles lashed between two trees. Cut slits in the edge of the hide about 2 cm in from the edge and about 1 cm long to lace the hide to the frame. Pull the hide as taut as you can in the frame.

Smoking

Smoke the hide for a few hours using a tepee setup. This will help reduce oxygen to the fire. Use old rotting wood that contains a lot of punkwood. Dampen the wood if necessary and check often for flare-ups. Don't use bark to create the smoke, the bark doesn't contain the oils necessary.

It shouldn't get too hot in the smoker or the hide will bake. Once smoking is complete trim the edges of the hide.

11 Desert Survival

To survive and evade in arid or desert areas, you must understand and prepare for the environment you will face. You must determine your equipment needs, the tactics you will use, and how the environment will affect you and your tactics. Your survival will depend upon your knowledge of the terrain, basic climatic elements, your ability to cope with these elements, and your will to survive.

11.1 TERRAIN

Most arid areas have several types of terrain. The five basic desert terrain types are –

- Mountainous (High Altitude).
- Rocky plateau.
- Sand dunes.
- Salt marshes.
- Broken, dissected terrain ("gebel" or "wadi").

Desert terrain makes movement difficult and demanding. Land navigation will be extremely difficult as there may be very few landmarks.

Cover and concealment may be very limited; therefore, the threat of exposure to the enemy remains constant.

Mountain Deserts

Scattered ranges or areas of barren hills or mountains separated by dry, flat basins characterize mountain deserts. High ground may rise gradually or abruptly from flat areas to several thousand meters above sea level. Most of the infrequent rainfall occurs on high ground and runs off rapidly in the form of flash floods. These floodwaters erode deep gullies and ravines and deposit sand and gravel around the edges of the basins. Water rapidly evaporates, leaving the land as barren as before, although there may be short-lived vegetation. If enough water enters the basin to compensate for the rate of evaporation, shallow lakes may develop, such as the Great Salt Lake in Utah. Most of these lakes have a high salt content.

Rocky Plateau Deserts

Rocky plateau deserts have relatively slight relief interspersed with extensive flat areas with quantities of solid or broken rock at or near the surface. There may be steep-walled, eroded valleys, known as wadis in the Middle East and arroyos or canyons in the United States and Mexico. Although their flat bottoms may be superficially attractive as assembly areas, the narrower valleys can be extremely dangerous to men and material due to flash flooding after rains. The Golan Heights is an example of a rocky plateau desert.

Sandy or Dune Deserts

Sandy or dune deserts are extensive flat areas covered with sand or gravel. "Flat" is a relative term, as some areas may contain sand dunes that are over 300 meters high and 16 - 24 km long. Traffic ability in such terrain will depend on the windward slope of the dunes and the texture of the sand. Other areas, however, may be flat for 3 kilometres or more. Plant life may vary from none to scrub over 2 meters high. Examples of this type of desert include the edges of the Sahara, areas of California and New Mexico, and the Kalahari in South Africa.

Salt Marshes

Salt marshes are flat, desolate areas, sometimes studded with clumps of grass but devoid of other vegetation. They occur in arid areas where rainwater has collected, evaporated, and left large deposits of alkali salts and water with a high salt concentration. The water is so salty it is undrinkable. A crust that may be 2.5 - 30 cm thick forms over the saltwater.

In arid areas there are huge salt marshes. These areas usually support many biting insects. Avoid salt marshes. This type of terrain is highly corrosive to boots, clothing, and skin.

Broken Terrain

All arid areas contain broken terrain. Rainstorms that erode soft sand and carve out canyons form this terrain. A wadi may range from 3 meters wide and 2 meters deep to several hundred meters wide and deep. The direction it takes varies as much as its width and depth. It twists and turns and forms a mazelike pattern. A wadi will give you good cover and concealment, but do not try to move through it because it is very difficult terrain to negotiate.

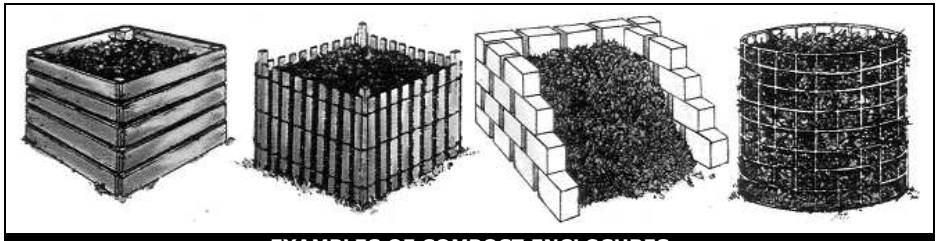
Compost Pit

A pit is ideal for composting materials consisting of mostly food scraps. Dig a hole in the ground, add the materials and mix with soil. Refill the hole with at least 20 cm (8 in) of soil.

Holding Bins

Bins help to contain the pile, keep animals out and aid in turning. They can be made from concrete blocks, bricks, stones, wire mesh or wood. The bin should be made bottomless to allow organisms such as worms to come up through the soil. If the bin is moveable, the heap can be turned by removing the bin, placing next to the heap and simply shovel the heap back into the bin.

If several bins are lined in a row, the turning can be done by shovelling the compost into the next bin down the line. Usually by the third or fourth monthly turning, the compost is done.



EXAMPLES OF COMPOST ENCLOSURES

10.6.4 COMPOST PROCESS

Accumulate enough material for a 1 x 1 x 1 metre heap. Shred or chop the materials to 5 cm or less to expose more surface area for decomposition. Start the pile with 10-15 cm of carbon-rich materials. Moisten and add 5-10 cm of nitrogen-rich materials and food scraps. Continue this layering and moistening process until about 1 metre high. Cover with a tarp.

Test the moisture content by feeling a handful and squeezing it. It should feel moist but not yield more than a few drops. If too wet, turn to allow air in and improve drainage. If too dry, water and turn it.

Periodically check the temperature in the piles centre. It should be very warm to the touch. When the temperature begins to drop, turn the pile and move material from the outside to the inside. The pile is being aerated in the process. Add water if the pile seems to be dry.

The process is complete when the pile does not generate any more heat. When the pile is cool and the compost has aged for another month, it should be finished. The pile should be much smaller than the original pile. The compost should be dark, loose and without a strong or unpleasant odour.

Use the compost to mix into the soil or to make compost tea for watering crops and seedlings.

10.6.5 TROUBLESHOOTING

SYMPTOMS	LIKELY CAUSE	SOLUTIONS
Offensive odour	Insufficient aeration	Turn and loosen pile
Ammonia odour	Too much nitrogen	Add carbon-rich materials
Pile doesn't heap up	Insufficient nitrogen	Add nitrogen-rich materials
	Pile too wet	Turn, add carbon sources and protect from rain
	Pile too dry	Turn and sprinkle with water
	Pile too small	Add more materials
Pile attracts flies and animals	Inappropriate materials	Don't use meats or oils. Remove such materials or rotate them to the centre of the pile and cover with carbon-rich materials.

9.8.2 ADVANCED TANNING

This is a more involved process but will produce excellent quality leather. This method is very suitable for using large hides for clothing.

To start, flesh, de-hair and brain the hide in the same manner as above.

Pre-Stretching

This is the most important step. It should be done out of the sun and wind if possible as the stretching is best done when wet. You will need a frame to stretch the hide on. This can be made by lashing two horizontal poles between two trees. Make sure the frame is large enough to accommodate the hide as well as about 25 cm (10 in) of lacing on each side.

Cut slits in the pelt about 2 cm in from the edge and 1 cm long and lace the hide to the frame making sure it is taut. First lace from side to side (not neck to butt) pulling the lacing snug. Then lace it neck to butt, not tight but just enough to take out the slack. Make sure the hide is centred as best you can.

Work the hide from side to side (not neck to butt) with a flat rounded stick or paddle to stretch it out. The hide will whiten as you stretch it. Make sure you work the edges well before the rest of the hide as they tend to dry out first. If the edges become dry before being stretched, it will be harder to stretch the centre and the lacing holes may break and need to be recut.

As soon as the hide starts to become baggy, tighten the lacing making sure it's even. Make sure you tighten it as much as possible to prevent it from shrinking again. Work both sides of the hide. The hair side doesn't whiten as easily as the flesh side so work it really well.

Continue working the hide and pulling in the lacing until the hide won't stretch any further. Then start to really work the neck, the hips and along the back. The hide is thicker in these places and will still be wet.

Once the hide is dry it will be stiff and hard and sound hard when tapped. It can be stored in this state indefinitely as long as it is kept dry. Because of stretching in one direction only, the hide will be fatter and shorter. This will be rectified in the final stage.

Smoking

Smoke the hide for a few hours as above. Then you will need the second half of the brain solution you produced previously.

It is important to take the hide directly from the smoker into the brain solution. Warm the brain solution up and take the hide from the smoker into the brain solution. Submerge and soak this for an hour or so.

Woking the Hide

This step involves a long metal edge to scrape along the hide. The thin metal strips that bind palettes and large appliance packages works well. Use a length about 1.2 metres (4 feet) and nail each end to a vertical pole like a tall straight tree. Let the band bow out about 20 cm (8 in) so there is room to pull the hide through.

Place the hide container under the band so the solution runs into it. Pull the hide through the band back and hold by each end. Pull the hide back and forth to work out any rubbery feeling parts of the hide. Pay attention to the neck, hips and along the back. It should feel like a soft, thick wet towel.

This step makes sure the pores are open and accept as much brain solution as possible. It should take about 5 to 10 minutes if it was stretched properly. Once complete, place the hide back in the brain solution and let soak overnight.

Softening

Remove the hide from the solution and wring out as well as you can over a horizontal beam (do not scrunch it). Lace up and work the hide in the same manner as the pre-stretching. This time however, lace it up from neck to butt first tightly, then from side to side but only enough to take out the slack. You will not need to lace it up as tightly as in pre-stretching.

When you work it, work from neck to butt to restore the original shape of the hide. You should not need to work it as much as before if the pre-stretching was done well.

Leave this overnight, then work it again just to relax it a bit and remove it from the frame.

The hide is ready for use, but you may smoke it again for colour.

9.8.3 MAKING RAWHIDE

You don't need brains to make rawhide. Basically the same as tanning but without the brain solution and usually the hair is removed. Whereas tanning is meant to keep the hide soft and flexible for use in clothing and crafts, rawhide is meant for toughness and strength.

The hide is fleshed and de-haired and usually cut into a rectangular shape. This can be stretched to soften the leather or made even tougher. For extra toughness soak in water and dry over a smoky fire and repeat several times. This can then be cut into patches, straps or any desirable shape.

9.9 NATURAL GLUES

Many glues can be found in nature that can be excellent bonding agents.

Glue from Animal Fat

Make glue by placing hide scrapings and hooves into a pot with only enough water to cover them. Simmer for a few hours until thick and gluggy. Cover and/or add liquid as it boils away to prevent the mixture from burning. Stir occasionally. To create a finer consistency, skim of the scum that bubbles to the surface.

Pine Pitch

Resin can be collected from the wounds of pine trees. A wound can be created with a knife or axe and the orange resin can be collected a few days later.

- Grind down some charcoal between stones, or a stone and a flattened stick, like a cudgel.
- Place a flat rock onto a fire to warm it. Once warmed, place pieces of resin on the stone.
- When the resin starts to melt, scrape it into a heap. Add some beeswax if you have it. This will help keep the pitch pliable when cooled. The more beeswax, the more pliable it will be.
- Scrape any impurities to the side.
- Add some powdered charcoal to the resin and mix in.

You can use this immediately to bond things such as arrow heads to arrows, or you can let it cool and store for later.

Ice Glue

If it is below freezing and you need a temporary glue, to fix barbs to a spear for example, glue can be made from a mixture of ice and sawdust.

Mix up a paste of liquid water and sawdust and glob it around the objects to be joined. Once this mixture freezes, the glue is remarkably strong. It is easy to rework if necessary simply by wetting it, or applying fresh animal dung.

This glue is obviously useless if the ambient temperature rises above freezing point.

10.6 COMPOSTING

A balance of five essential ingredients – moisture, air, carbon, nitrogen and decomposing organisms such as insects, worms and bacteria – are the key to rapid composting. A well managed pile can produce compost in about 3 months.

Water	Water is required by all living organisms including decomposers. The pile should be moist but not too wet. A bad odour may indicate that excess moisture is inhibiting decomposition.
Oxygen	Oxygen is essential. The compost pile should not be too high, tight or wet.
Carbon	Carbon is abundant in most organic materials and is broken down by decomposers to create food energy. However, other ingredients are needed for carbon to be readily eaten. Wood and paper are examples that are high in carbon, but deficient in other nutrients and are slow to decompose.
Nitrogen	Nitrogen is required by decomposers in relatively large amounts. It is a major ingredient in protein. Without sufficient nitrogen, decomposition is slow.
Decomposing Organisms	These organisms produce heat by their activity. This heat speeds the process and also helps to kill disease organisms and weed seeds. The speed varies but at some point the centre of the heap should feel hot or very warm. More mass, water, air or nitrogen may be needed to get the process going.

10.6.1 COMPOST MATERIALS

DESIRABLE MATERIALS	UNDESIRABLE MATERIALS
Nitrogen-Rich Materials: • Grass Clippings • Green leaves and garden trimmings. • Seaweed and aquatic plants (wash to remove salt) • Food scraps like fruit and vegetable scraps, egg shells, leftover bread. **Carbon Sources:** • Woodchips and sawdust • Small branches/twigs from trees and shrubs (broken into pieces) • Stems of fibrous grasses	**May contribute weeds and plant diseases when inadequately composted:** • Weedy, persistent plants • Diseased plants **Human Health Hazard:** • Dog or cat faeces • Other animal manure is OK to use **May Attract Flies, Rats, Animals:** • Oils • Dairy products • Meat or bones, poultry, fish

10.6.2 GETTING STARTED

The best location is a shady area protected from the wind to prevent it drying out. Place in an area that can't be flooded. The dimensions of a pile should be roughly 1 metre high, 1 metre wide. There is no limit to the length. Protect the pile from rain by covering with a tarp or build it under a roof.

Have a protected area to store the compost if you aren't going to use it immediately. Do not mix undecomposed materials with finished compost.

10.6.3 COMPOSTING METHODS

Basic Compost Heap

Simply pile and mix the compost materials on the ground. Cover when it rains to prevent it getting too wet or losing nutrients to leaching. Turn the heap every week or so. To aid in aeration, build the pile over scrap pipes drilled with holes. This reduces the need for turning.

PLANT	FRIENDS	FUNCTION	FOES
Potato	Beans, Cabbage, Marigold, Horseradish, Eggplant, Sweet Alyssum.	Alyssum attracts beneficial wasps and acts as a living ground cover	Pumpkin, Squash, Cucumber, Sunflower, Tomato, Raspberry
Pumpkin	Corn		Potato
Pyrethrum		Will repel bugs if grown around the vegetable garden	
Radish	Peas, Nasturtium, Lettuce, Cucumbers, Spinach	Radish attracts leaf minor away from spinach	
Raspberry	Most vegetables		Blackberries, Tomatoes, Potato
Rosemary	Cabbage, Beans, Carrots, Sage	Deters cabbage moth, bean beetles and carrot fly	
Roses	Garlic, Chives, Parsley, Mignonette Lettuce		
Rue		Keeps animals off garden beds if planted round the borders	
Sage	Rosemary, Cabbage, Carrots	Deters cabbage moth and carrot fly	
Spinach	Strawberries		
Squash	Nasturtium Corn		
Strawberries	Bush bean, Spinach, Borage, Lettuce		Cabbage
Sunflower	Cucumbers		Potato
Sweet Corn	Potatoes, Peas, Beans, Cucumbers, Pumpkin, Squash	Corn acts as a trellis for beans which attract predators of corn pests.	
Tansy	Fruit trees, Roses and Raspberries	Repels moths, flies and ants. Tansy leaves assist compost fermentation.	
Thyme	Here and there in the garden	Protects Cabbages, improves growth of vegetables, general insect repellent	
Tomatoes	Asparagus, Parsley, Chives, onion, Broccoli, Sweet Basil, Marigold, Carrots, Parsley.		Kohlrabi, Potato, Fennel, Cabbage
Turnip	Peas, Nasturtium, Lettuce, Cucumbers		
Wormwood		Although it can inhibit the growth of plants near it, wormwood repels moths, flies and fleas and keeps animals off the garden.	
Yarrow	Near aromatic herbs and vegetables	Plant along borders and paths. Enhances essential oil production and flavour	

10 Sustainable Gardening

A food producing garden will greatly enhance the wellbeing of a single survivor, or a group. Not only will it reduce the energy expended to hunt and forage for wild foods, a diverse garden will add to your overall health.

If you can't start a garden before disaster because of your current location, you may be able to start one later – either from seeds that you carry or propagated from wild plants in the area.

10.1 PLANNING A GARDEN

Before jamming all your seed in the ground, plan your garden and prepare the soil properly. A little forethought and preparation will go a long way towards a successful harvest.

10.1.1 CLIMATE CHANGE

First of all, do not presume the seasons in your area will remain unchanged. Many disaster scenarios such as asteroid strike, pole shift or global warming will bring with them drastic changes in the climate. Therefore it is suggested that you test before planting large crops.

For any given plant, sow a few seeds to determine the viability. If seed refuses to germinate, does not grow well or produces no seed, save your seeds and try again later. Stock a variety of seeds, even if they do not grow well or at all in your area now. Experiment cautiously – you may be surprised.

10.1.2 SECURITY

Your garden needs to be secure from intruders, of the four and two-legged variety. As always, choose a location that is out of view. A simple fence if made strong will keep most animals out of your plot, but may still attract wildlife.

If you are attracting unwanted wildlife and fear damage to your fence, a possible solution is a 'honey-pot'. Use the produce they are targeting as bait and position outside the fence – an easy target. Then set a suitable trap or snare. Consider this for two-legged intruders as well.

If you are being overrun by vermin or crawling insects, consider a small moat. If you are having a problem with flying insects, a smoky fire will keep these at bay, but may also give away your location. Birds are more difficult to keep out and will require netting, or a few cats. Perhaps a better solution is to provide something tastier, away from your crop.

10.1.3 SEEDS

The seeds you need to be stocking should be the heirloom variety. Commercial seeds are usually hybrids. Seed produced from hybrids may not come true. Seeds saved from commercial produce, are almost always hybrids. On seed packets, the 'F1' or 'T1' designator will indicate hybrid seeds. These seeds will not produce seed-producing plants, or plants at all, and you will not be able to produce any more food until you acquire more seeds.

10.1.4 PREPARING THE LOCATION

Vegetables grow best in an open, level area where the soil is loose, rich and well drained. If the soil is poor, mix in 10 cm of topsoil, peat moss, manure, seaweed, compost or leaf litter. Mix in some fertilizer to get you started if you have some. The more organic matter or topsoil you add, the better the soil will be. See **Composting** (Page 10-9).

Avoid heavy clays, sandy soils and shaded areas. Most vegetables require at least 6 hours of direct sunlight a day.

10.1.5 GARDEN LAYOUT

Keep the early vegetables such as lettuce, radishes and onions together. Tall-growing crops like sweet corn and tomatoes should be place further from the equator to prevent shading the smaller plants. (North in the Northern hemisphere, South in the Southern).

Plants that are self pollinated (like corn) should be planted in blocks of several short rows, rather than one long row. To stretch out the growing season, plant the same vegetables at intervals, rather than one large single planting.

10.1.6 PLANTING A GARDEN

When the first warm days of spring appear, allow for the sunshine and warmth to dry out the soil before trying to work it. You should be able to crumble a ball of dirt with your fingers. If it clings together it is still too wet and new roots will have a hard time pushing through the soil.

Prepare the soil at least 15 cm (6 in) deep, making sure all sod is turned over. Do this with a spade or plow. Shatter and slice each shovelful to break up the soil. Remove all weeds as you go to prevent them from competing with the vegetables. Finish by levelling smooth.

Planting the Seeds

Make a furrow for the seed using a stick for fine seeds, or hoe blade for larger seeds. Small seeds should be barely covered and large seeds should have no more than 2.5 cm (1 in) of soil. If the seeds are planted too deep they may not come up.

10.2 VEGETABLE GROWING GUIDE

This is a general guide only. Sowing times will vary greatly between different regions and climates. It also does not take into account the effects of climate change.

When direct planting with small seeds (eg carrots), bulk them out first by mixing with sand. You can help them pre-germinate by keeping them in moist sand for 2-4 days. When planting large seeds (eg peas, corn), soak them overnight. A weak seaweed solution or diluted worm water is good for this.

Try not to water directly on the leaves of plants susceptible to fungal diseases (tomatoes, cucumbers, pumpkins, zucchinis etc). If using overhead sprinklers, water in the early morning so water can evaporate during the day.

Summer Crops

In summer you should mulch your garden beds to keep the soil cool and moist. A 5 cm (2 in) layer of mulch will reduce the evaporation by over 70%. Don't lay down thick layers of material such as lawn clippings or sawdust that will pack down and form a barrier to water.

In days of extreme heat it may be necessary to physically protect the plants with some shade.

Winter Crops

Winter is usually the time to plant or prune soft fruits including strawberries, berries, currants etc. If your winter is mild you might start a number of crops in late winter rather than early spring. Such crops include artichokes, beetroot, cabbage, carrots, potatoes and radish.

Frost

If frost is an issue in your region, frost-sensitive vegetables such as capsicum, eggplant and tomatoes may need a glasshouse or warm spot to germinate and will usually need protection when planted out.

An alternative to a glasshouse can be improvised with a glass jar or clear plastic bottle with the top cut off and placed over the seedlings.

10.2.1 GENERAL PLANTING AND ROTATION GUIDE

Below is a simple guide for planting times which also describes a 5 year crop rotation scheme. See **Crop Rotation** (Page 10-5) for more information on this practice.

Plant	Spring	Summer	Autumn	Winter	Rotate*
Asparagus	ST			S ST	- - 3 - -
Beans	S S S	S S			1 - - - -
Beetroot	S S S	S S S			- - - 4 -
Broad Beans			S S	S	1 - - - -
Broccoli	S	ST ST T	T		- - - - 5
Brussel Sprouts	S ST	ST ST T	T		- - - - 5
Cabbage	ST ST ST	ST ST T	T		- - - - 5
Capsicum	S S S				- - 3 - -

PLANT	FRIENDS	FUNCTION	FOES
Chives	Carrots	Deters aphids. Spray will deter downy and powdery mildew	
Citrus	Bracken fern, Grape vines	Repels stink beetles	
Comfrey	Avocados and most Fruit trees	Compost activator, medicinal, foliage spray, nutrient miner. Useful to all gardens	
Cucumbers	Beans, Corn, Peas, Radish, Sunflowers		Potatoes, Aromatic herbs
Dill	Brassicas	Dill attracts predator wasp for cabbage moth	
Elderberry		General insecticide. The leaves help compost fermentation, the flowers and berries make lovely wine!	
Fennel		Repels flies, fleas and ants	Most plants dislike it
French Marigold	Tomatoes, Most vegetables	Root secretions kill nematodes in the soil. Will repel white fly	
Fruit trees	Nettles, Garlic, Chives, Tansy, Southernwood and Horseradish		
Garlic	Roses, Raspberry	Repels aphids from roses and raspberries. Repels cabbage butterfly and vampires	Peas, Beans
Geranium		Strong aroma - deters insects and encourages bees	
Grapes	Hyssop, Tansy and Sage		
Leek	Onion, Celery, Carrot		
Lettuce	Tall flowers, Carrots, Radish, Onion family	Flowers offer light shade for lettuce	
Marigolds	Tomatoes, Most vegetables	Kills couch and nematodes	
Melon	Radish		
Mint	Cabbage, Tomatoes	Deters white cabbage moth, ants, fleas and clothes moths	
Nasturtium	Radishes, Cabbages, Zucchini, Cucurbits (melons), Fruit trees	Secretes a mustard oil, which many insects find attractive. The flowers repel aphids and the cucumber beetle	
Nettle		Beneficial anywhere. Increases aroma of other herbs	
Onion and Garlic	Beets, Summer savoury, Tomatoes, Lettuce, Strawberries, Camomile		
Parsley	Tomato, Asparagus, Roses	Deters rose beetle, improves tomato and asparagus	
Peas	Carrots, Turnips, Corn, Beans, Radishes, Cucumbers, Most Vegetables and Herbs		Onions, Garlic Gladiolas, Potatoes

10.4.2 COVER CROPS

Cover crops are grown to protect and rebuild the soil between crops. Bare soil is susceptible to erosion, and may develop weeds which are time consuming to remove and take nutrients from the soil.

A cover crop will prevent this and when destroyed and worked back into the soil, will provide for the next crop.

Types of Cover Crops

Legume crops fix atmospheric nitrogen into a form that plants and micro-organisms can use. Other species recycle existing soil nitrogen and can reduce leaching losses.

Legumes	Non-Legumes
Clovers	Rye
Hairy Vetch	Oats
Field Peas	Wheats
Annual Medic	Forage Turnips
Alfalfa	Oilseed Radish
Soybean	Buckwheat

TYPES OF COVER CROPS

10.5 COMPANION PLANTING

Many problems associated with growing food, such as pest and vermin control, can be solved simply by growing the right plants together.

PLANT	FRIENDS	FUNCTION	FOES
Apple	Nasturtium	Climbs tree and repels codling moth	
Asparagus	Tomatoes, Parsley, Basil		
Balm	Tomatoes	Improves growth and flavour, attracts bees	
Basil	Tomatoes	Helps repel flies and mosquitoes	Rue
Beans	Potatoes, Carrots, Cucumber, Cauliflower, Summer savoury, most Vegetables and Herbs		Onions, Garlic, Gladiolus
Beetroot	Onions, Lettuce, Cabbage, Silver beet, Kohlrabi		
Birch		Dead leaves encourage compost fermentation	
Borage	Tomatoes, Squash and Strawberries	Deters tomato worm, improves growth and flavour	
Cabbage, Cauliflower, Broccoli	Sage, Dill, Camomile, Beets, Peppermint, Rosemary, Beans, Celery, Onions, Potatoes	Dill attracts a wasp to control cabbage moth. Zinnias attract lady bugs to protect plants	Strawberries, Tomatoes
Broad beans	Potatoes, Peas, Beans		
Caraway		Helps breakdown heavy soils	
Carrots	Lettuce, Peas, Leeks, Chives, Onions, Cucumbers, Beans, Tomatoes, Wormwood, Sage, Rosemary		Dill in flower, storage with apples
Catnip		Repels fleas, ants and rodents	
Cauliflower	Celery		
Celery & Celeriac	Chives, Leeks, Tomatoes, Dwarf Beans, Brassicas		
Chamomile	Cabbages, Onions	Deters flies and mosquitoes. Gives strength to any plant growing nearby	

Plant	Spring			Summer			Autumn			Winter			Rotate*
Carrots	S	S	S	S	S	S							- - - 4 -
Cauliflower			S	ST	ST	T	T						- - - - 5
Celery	S	ST	ST	T	T	S							- - - 4 -
Chicory				S	S	S	ST	T					-any-
Chilli	S	S	ST	T									- - 3 - -
Chives	S	S	S	S	S	S	ST	T	T				- 2 - - -
Chinese Cabbage				S	S	ST	T						- - - - 5
Coriander	S	S	ST	ST	T								- - - 4 -
Corn		S	ST	ST	T								-any-
Cucumber	S	S	ST	ST	T								-any-
Dill	S	ST	T	T									- - - 4 -
Eggplant	S	T	T										-any-
Endive			S	S	S	S	ST	T					-any-
Fennel	S	ST	T										-any-
Garlic								S	S	S			- 2 - - -
Kohlrabi				ST	ST	ST	ST	T					- - - - 5
Leeks	S	S	ST	ST	ST	T	T					S	- 2 - - -
Lentils	S	S	ST	T									1 - - - -
Lettuce	ST	ST	ST	ST	ST	ST	ST	ST				S	-any-
Melons	S	S	S										-any-
Onions	ST	T						S	S	S	ST	ST	- 2 - - -
Parsley	S	S	S	ST	ST	T	T	T					- - - 4 -
Parsnips	S	S	S	S	S	S							- - - 4 -
Peas	S	S	S	S	S	S						S	1 - - - -
Potatoes	S	S	S	S	S								- - 3 - -
Pumpkins	S	S	S										-any-
Radish	S	S	S	S	S	S							- - - - 5
Shallots	T					S	S	S	ST	ST	T	T	- 2 - - -
Silverbeet	S	S	ST	ST	ST	T						S	- - - 4 -
Spinach	S	S										S	- - - 4 -
Squash	S	S	ST	ST									-any-
Swede		S	ST	ST	T								- - - - 5
Tomatoes	S	ST	ST	T	T								- - 3 - -
Turnips	S	S	S	ST	ST	T	T	T					- - - - 5

S Sow

T Transplant

***** The rotate column refers to the order in which crops should be planted in a plot. For example, plants marked with **1** should be placed in one bed, then next year use the same soil for plants marked **2**.

Plants designated **–any–** can be planted anywhere in the rotation**.**

VEGETABLE GROWING GUIDE

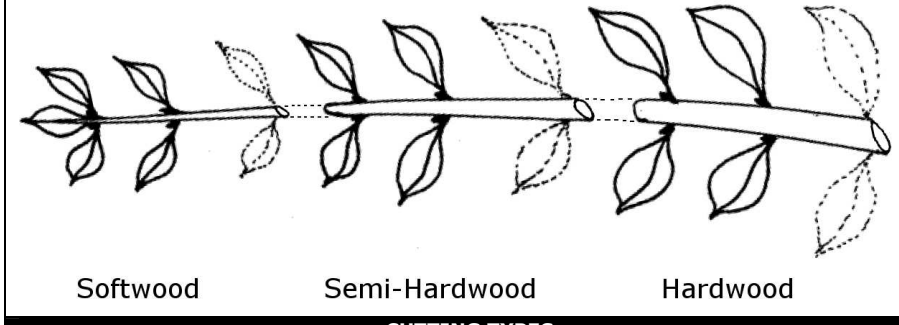
10.3 PROPAGATION FROM CUTTINGS

Plants propagated from cuttings are genetically identical to the original plant. If you discover a wild plant that is edible or otherwise useful, propagation in this way may be preferable to growing from seed. Note that not all plants can be propagated from cuttings, so experiment.

Cuttings should be taken from firm, current season growth. Hard, woody material and soft 'floppy' growth are likely to be unsuccessful. Bend the stem 60 – 90° and if it springs back to its original position it is suitable. Although there are exceptions to this rule and less than ideal specimens may take root.

10.3.1 PREPARING THE CUTTINGS

There are three general types of cutting that vary from the lower hardwood to the softwood tip. The most suitable cutting will depend on the plant being propagated so experimenting may be necessary. Generally, the tip will take root faster than the hardwood.



CUTTING TYPES

Collect cuttings in the early morning and ensure they are kept cool and moist. Wrap cuttings in moist paper or other material and keep shaded until planting. Cut at a length that leaves 3 to 4 nodes on the stem.

The diameter of a cutting should be from the size of a small finger to the size of a thumb.

Make the cut directly below a node and at an angle – this exposes more surface area for better absorption of nutrients and root formation. If you are not taking the tip, make a straight cut at the top to minimise water loss. Use a clean sharp blade or pruner to make the cut to ensure you don't crush the tissue. Strip to leave a maximum of two nodes with foliage (some plant cuttings can be stripped bare).

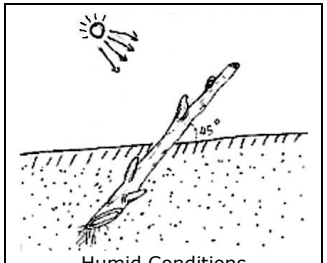
10.3.2 PLANTING THE CUTTINGS

Place the cutting at a 45° angle in the soil with at least one node facing the sunlight. In dry areas or seasons, cover all but one node with soil. Use a well drained medium, such as sand mixed with soil to aid in root growth.

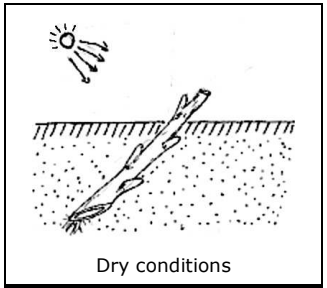
The soil should be free from diseases and competing weeds. To sterilise soil it can be heated in a pot. Heat and stir it long enough to ensure the soil reaches at least 80°C (175°F). Do this before adding any nutrients such as compost, manure or worm water.

Cuttings should be kept moist until they start to take root. Misting with a spray bottle and keeping in part shade will help this. Cuttings need to be watered at least twice daily.

If propagation is successful, the cuttings will start to sprout in 3 to 4 weeks.



Humid Conditions



Dry conditions

PLANTING CUTTINGS

10.4 CROP ROTATION

Crop rotation is important for organic gardening and provides many benefits. Pests and diseases tend to attack specific plant families, so rotation breaks the life cycles and build-up is reduced. Some crops, such as potatoes and squashes, can suppress weeds and minimise problems for following crops.

By planting the same crop in the same soil every year, the soil becomes depleted of the particular nutrients the plant needs, while others go to waste. It can also allow the build up of pests and diseases to unmanageable levels.

Different crops have different soil requirements and benefits. Rotating each year allows the soil to replenish and minimises deficiencies. Alternating between deep-rooted and fibrous-rooted crops improves soil structure.

Family	Examples	Soil Requirements	Soil Benefits
Brassicas	broccoli, brussel sprouts, cabbage, cauliflower, kohlrabi, mustard seed, oilseed rape, radish, swede, turnips	Leafy crops need nitrogen-rich soil	
Legumes	beans, lentils, lupins, peanuts, peas	Well-drained but moisture-retentive. Not nitrogen rich	Fix atmospheric nitrogen in roots for future crops
Alliaceae (Onions)	chives, garlic, leek, onion, shallots	High organic matter	
Solanaceae (Potato family)	capsicum, chilli eggplant, paprika, potato tobacco, tomato	High organic matter and nitrogen	Suppresses weeds, breaks up soil structure
Umbellifers	beets, caraway, carrot, celery, coriander, cumin, dill, fennel, parsley, parsnip	Root crops need stone-free soil. Not freshly manured	Root crops break up soil structure

PLANT TYPES AND BENEFITS

Some plants have so few soil-dwelling pests or disease that they can be fitted in anywhere in the rotation, such as chicory, courgettes, cucumbers, eggplant, endive, fennel, french beans, lettuces, marrows, peppers, pumpkins, radish, runner beans, squashes and sweet corn.

10.4.1 ROTATION SCHEMES

There are many types of rotation schemes in use. Rotation should be on at least a four year cycle and thus is one of the most popular methods. Below is a 5 year rotation which is mirrored in **General Planting and Rotation Guide** (Page 10-2).

	Bed 1	Bed 2	Bed 3	Bed 4	Bed 5
Year 1	Legumes	Onions	Potato Family	Umbellifers	Brassicas
Year 2	Onions	Potato Family	Umbellifers	Brassicas	Legumes
Year 3	Potato Family	Umbellifers	Brassicas	Legumes	Onions
Year 4	Umbellifers	Brassicas	Legumes	Onions	Potato Family
Year 5	Brassicas	Legumes	Onions	Potato Family	Umbellifers

5 YEAR ROTATION SCHEME

Do not travel in "whiteout" conditions. The lack of contrasting colours makes it impossible to judge the nature of the terrain.

Always cross a snow bridge at right angles to the obstacle it crosses. Find the strongest part of the bridge by poking ahead of you with a pole or ice axe. Distribute your weight by crawling or by wearing snowshoes or skis.

Make camp early so that you have plenty of time to build a shelter.

Consider frozen or unfrozen rivers as avenues of travel. However, some rivers that appear frozen may have soft, open areas that make travel very difficult or may not allow walking, skiing, or sledding.

Use snowshoes if you are travelling over snow-covered terrain. Snow 30 or more cm deep makes travelling difficult. If you do not have snowshoes, make a pair using willow, strips of cloth, leather, or other suitable material.

It is almost impossible to travel in deep snow without snowshoes or skis. Travelling by foot leaves a well-marked trail for any pursuers to follow. If you must travel in deep snow, avoid snow-covered streams. The snow, which acts as an insulator, may have prevented ice from forming over the water. In hilly terrain, avoid areas where avalanches appear possible. Travel in the early morning in areas where there is danger of avalanches. On ridges, snow gathers on the lee side in overhanging piles called cornices. These often extend far out from the ridge and may break loose if stepped on.

13.12 WEATHER SIGNS

There are several good indicators of climatic changes —

Wind

You can determine wind direction by dropping a few leaves or grass or by watching the treetops. Once you determine the wind direction, you can predict the type of weather that is imminent. Rapidly shifting winds indicate an unsettled atmosphere and a likely change in the weather.

Clouds

Clouds come in a variety of shapes and patterns. A general knowledge of clouds and the atmospheric conditions they indicate can help you predict the weather. See Appendix G for details.

Smoke

Smoke rising in a thin vertical column indicates fair weather. Low rising or "flattened out" smoke indicates stormy weather.

Birds and Insects

Birds and insects fly lower to the ground than normal in heavy, moisture-laden air. Such flight indicates that rain is likely. Most insect activity increases before a storm, but bee activity increases before fair weather.

Low Pressure Front

Slow-moving or imperceptible winds and heavy, humid air often indicate a low-pressure front. Such a front promises bad weather that will probably linger for several days. You can "smell" and "hear" this front. The sluggish, humid air makes wilderness odors more pronounced than during high-pressure conditions. In addition, sounds are sharper and carry farther in low-pressure than high-pressure conditions.

Mirages

Mirages occur in the interior of the desert about 10 km from the coast. They make objects that are 1.5 km or more away appear to move. This mirage effect makes it difficult for you to identify an object from a distance. It also blurs distant range contours so much that you feel surrounded by a sheet of water from which elevations stand out as "islands."

Light levels in desert areas are more intense than in other geographic areas. Moonlit nights are usually crystal clear, winds die down, haze and glare disappear, and visibility is excellent. You can see lights at great distances. Sound carries very far. Conversely, during nights with little moonlight, visibility is extremely poor. Travelling is extremely hazardous.

11.3 NEED FOR WATER

The subject of man and water in the desert has generated considerable interest and confusion since the early days of World War II when the U. S. Army was preparing to fight in North Africa. At one time the U. S. Army thought it could condition men to do with less water by progressively reducing their water supplies during training. They called it water discipline. It caused hundreds of heat casualties.

The body requires a certain amount of water for a certain level of activity at a certain temperature. For example, a person performing hard work in the sun at 43°C (104°F) requires 19 litres of water daily. Lack of the required amount of water causes a rapid decline in an individual's ability to make decisions and to perform tasks efficiently.

Your body's normal temperature is 36.9°C (98.6°F). Your body gets rid of excess heat (cools off) by sweating. The warmer your body becomes – whether caused by work, exercise, or air temperature — the more you sweat. The more you sweat, the more moisture you lose. Sweating is the principal cause of water loss. If a person stops sweating during periods of high air temperature and heavy work or exercise, they will quickly develop heat stroke. This is an emergency that requires immediate medical attention.

Understanding how the air temperature and your physical activity affect your water requirements allows you to take measures to get the most from your water supply. These measures are —

- **Find shade!** Get out of the sun!
- Place something between you and the hot ground.
- **Limit your movements!**
- **Conserve your sweat.** Wear your complete uniform to include T-shirt. Roll the sleeves down, cover your head, and protect your neck with a scarf or similar item. These steps will protect your body from hot-blowing winds and the direct rays of the sun. Your clothing will absorb your sweat, keeping it against your skin so that you gain its full cooling effect. By staying in the shade quietly, fully clothed, not talking, keeping your mouth closed, and breathing through your nose, your water requirement for survival drops dramatically.
- If water is scarce, **do not eat.** Food requires water for digestion; therefore, eating food will use water that you need for cooling.

Thirst is not a reliable guide for your need for water. A person who uses thirst as a guide will drink only two-thirds of their daily water requirement. To prevent this "voluntary" dehydration, use the following guide —

- At temperatures below 38 degrees C, drink 0.5 litre of water every hour.
- At temperatures above 38 degrees C, drink 1 litre of water every hour.

Drinking water at regular intervals helps your body remain cool and decreases sweating. Even when your water supply is low, sipping water constantly will keep your body cooler and reduce water loss through sweating. Conserve your fluids by reducing activity during the heat of day. Do not ration your water! If you try to ration water, you stand a good chance of becoming a heat casualty.

11.4 HEAT CASUALTIES

Your chances of becoming a heat casualty as a survivor are great, due to injury, stress, and lack of critical items of equipment. Following are the major types of heat casualties and their treatment when little water and no medical help are available.

Heat Cramps

The loss of salt due to excessive sweating causes heat cramps. Symptoms are moderate to severe muscle cramps in legs, arms, or abdomen. These symptoms may start as a mild muscular discomfort. You should then stop all activity, get in the shade, and drink water. If you fail to recognize the early symptoms and continue your physical activity, you will have severe muscle cramps and pain. Treat as for heat exhaustion, below.

Heat Exhaustion

A large loss of body water and salt causes heat exhaustion. Symptoms are headache, mental confusion, irritability, excessive sweating, weakness, dizziness, cramps, and pale, clammy skin. Immediately get the patient under shade. Make them lie on a stretcher or similar item about 45 cm off the ground. Loosen their clothing. Sprinkle them with water and fan them. Have them drink small amounts of water every 3 minutes. Ensure they stay quiet and rest.

Heat Stroke

Heat stroke is a severe injury caused by extreme loss of water and salt and the body's inability to cool itself. The patient may die if not cooled immediately. Symptoms are the lack of sweat, hot and dry skin, headache, dizziness, fast pulse, nausea and vomiting, and mental confusion leading to unconsciousness. Immediately get the person to shade. Lay them on a stretcher or similar item about 45 cm off the ground. Loosen their clothing. Pour water on them (it does not matter if the water is polluted or brackish) and fan them. Massage their arms, legs, and body. If they regain consciousness, let them drink small amounts of water every 3 minutes.

11.5 PRECAUTIONS

In a desert survival and evasion situation, it is unlikely that you will have a medic or medical supplies with you to treat heat injuries. Therefore, take extra care to avoid heat injuries. Rest during the day, work during the cool evenings and nights. Use a buddy system to watch for heat injury, and observe the following guidelines —

- Make sure you tell someone where you are going and when you will return.
- Watch for signs of heat injury. If someone complains of tiredness or wanders away from the group, they may be a heat casualty.
- Drink water at least once an hour.
- Get in the shade when resting; do not lie directly on the ground.
- Do not take off your shirt and work during the day.
- Check the colour of your urine. A light colour means you are drinking enough water, a dark colour means you need to drink more.

11.6 DESERT HAZARDS

There are several hazards unique to desert survival. These include insects, snakes, thorned plants and cacti, contaminated water, sunburn, eye irritation, and climatic stress.

Insects of almost every type abound in the desert. Man, as a source of water and food, attracts lice, mites, wasps, and flies. They are extremely unpleasant and may carry diseases. Old buildings, ruins, and caves are favourite habitats of spiders, scorpions, centipedes, lice, and mites. These areas provide protection from the elements and also attract other wild-life.

Wear gloves at all times in the desert. Do not place your hands anywhere without first looking to see what is there. Visually inspect an area before sitting or lying down. When you get up, shake out and inspect your boots and clothing. All desert areas have snakes. They inhabit ruins, native villages, garbage dumps, caves, and natural rock outcroppings that offer shade. Never go barefoot or walk through these areas without carefully inspecting them for snakes. Pay attention to where you place your feet and hands. Most snakebites result from stepping on or handling snakes. Avoid them. Once you see a snake, give it a wide berth.

13.10 FOOD

There are several sources of food in the arctic and subarctic regions. The type of food – fish, animal, fowl, or plant – and the ease in obtaining it depend on the time of the year and your location.

13.10.1 FISH

During the summer months, you can easily get fish and other water life from coastal waters, streams, rivers, and lakes. Use the techniques described in Chapter 5 to catch fish.

The North Atlantic and North Pacific coastal waters are rich in seafood. You can easily find crawfish, snails, clams, oysters, and king crab. In areas where there is a great difference between the high and low tide water levels, you can easily find shellfish at low tide. Dig in the sand on the tidal flats. Look in tidal pools and on offshore reefs. In areas where there is a small difference between the high and low tide water levels, storm waves often wash shellfish onto the beaches.

Most northern fish and fish eggs are edible. Exceptions are the meat of the arctic shark and the eggs of the sculpins.

The bivalves, such as clams and mussels, are usually more palatable than spiral-shelled seafood, such as snails.

WARNING!!!

The black mussel, a common mollusc of the far north, may be poisonous in any season. Toxins sometimes found in the mussel's tissue are as dangerous as strychnine.

The sea cucumber is another edible sea animal. Inside its body are five long white muscles that taste much like clam meat.

You can often find herring eggs on the seaweed in midsummer. Kelp, the long ribbon like seaweed, and other smaller seaweed that grow among offshore rocks are also edible.

13.10.2 SEA ICE ANIMALS

You find polar bears in practically all arctic coastal regions, but rarely inland. Avoid them if possible. They are the most dangerous of all bears. They are tireless, clever hunters with good sight and an extraordinary sense of smell. If you must kill one for food, approach it cautiously. Aim for the brain; a bullet elsewhere will rarely kill one. Always cook polar bear meat before eating it.

WARNING!!!

Do not eat polar bear liver! It contains a **toxic** concentration of vitamin A.

Skin and Butcher Game (Page 4-19) while it is still warm. If you do not have time to skin the game, at least remove its entrails, musk glands, and genitals before storing. If time allows, cut the meat into usable pieces and freeze each separately so that you can use the pieces as needed. Leave the fat on all animals except seals. During the winter, game freezes quickly if left in the open. During the summer, you can store it in underground ice holes.

13.11 TRAVEL

As a survivor in an arctic region, you will face many obstacles.

Avoid travelling during a blizzard.

Take care when crossing thin ice. Distribute your weight by lying flat and crawling.

Cross streams when the water level is lowest. Normal freezing and thawing action may cause a stream level to vary as much as 2 - 2.5 meters per day. This variance may occur any time during the day, depending on the distance from a glacier, the temperature, and the terrain. Consider this variation in water level when selecting a campsite near a stream.

Consider the clear arctic air. It makes estimating distance difficult. You more frequently underestimate than overestimate distances.

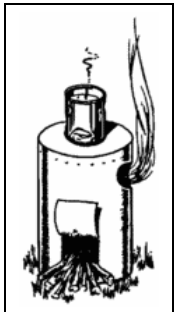
- A person trying to get warm or to dry clothes may become careless and burn or scorch their clothing and equipment.
- Melting overhead snow may get you wet, bury you and your equipment, and possibly extinguish your fire.

In general, a small fire and some type of stove is the best combination for cooking purposes.

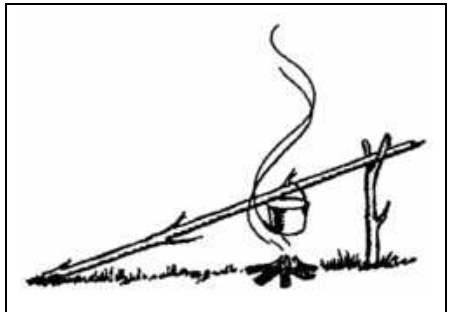
A hobo stove is particularly suitable to the arctic. It is easy to make out of a tin can, and it conserves fuel.

A bed of hot coals provides the best cooking heat.

Coals from a crisscross fire will settle uniformly. Make this type of fire by crisscrossing the firewood.



HOBO STOVE



CRANE HOLDING POT

For heating purposes, a single candle provides enough heat to warm an enclosed shelter. A small fire about the size of a man's hand is ideal for use in enemy territory. It requires very little fuel, yet it generates considerable warmth and is hot enough to warm liquids.

13.9 WATER

There are many sources of water in the arctic and subarctic. Your location, the apparent season and any recent disasters will determine where and how you obtain water.

Always purify the water before drinking it. During the warmer months, the best natural sources of water are freshwater lakes, streams, ponds, rivers, and springs. Water from ponds or lakes may be slightly stagnant, but still usable. Running water in streams, rivers, and bubbling springs is usually fresh and suitable for drinking.

The brownish surface water found in a tundra during the summer is a good source of water. However, you may have to filter the water before purifying it.

You can melt freshwater ice and snow for water. Completely melt before putting them in your mouth. Trying to melt ice or snow in your mouth takes away body heat and may cause internal cold injuries. If on or near pack ice in the sea, you can use old sea ice to melt for water. In time, sea ice loses its salinity. You can identify this ice by its rounded corners and bluish colour.

You can use body heat to melt snow. Place the snow in a water bag and place the bag between your layers of clothing. This is a slow process, but you can use it on the move or when you have no fire.

ⓘ Do not waste fuel to melt ice or snow when drinkable water is available from other sources.

When ice is available, melt it, rather than snow. One cup of ice yields more water than one cup of snow. Ice also takes less time to melt. You can melt ice or snow in a water bag, MRE ration bag, tin can, or improvised container by placing the container near a fire. Begin with a small amount of ice or snow in the container and, as it turns to water, add more ice or snow.

Another way to melt ice or snow is by putting it in a bag made from porous material and suspending the bag near the fire. Place a container under the bag to catch the water.

During cold weather, avoid drinking a lot of liquid before going to bed. Crawling out of a warm sleeping bag at night to relieve yourself means less rest and more exposure to the cold.

Once you have water, keep it next to you to prevent refreezing. Also, do not fill your canteen completely. Allowing the water to slosh around will help keep it from freezing.

12 Tropical Survival

Knowledge of field skills, the ability to improvise, and the application of the principles of survival will increase the prospects of survival. Do not be afraid of being alone in the jungle; fear will lead to panic. Panic will lead to exhaustion and decrease your chance of survival.

Everything in the jungle thrives, including disease germs and parasites. Nature will provide water, food, and plenty of materials to build shelters.

Indigenous peoples have lived for millennia by hunting and gathering. However, it will take an outsider some time to get used to the conditions and the non-stop activity of tropical survival.

12.1 TROPICAL WEATHER

High temperatures, heavy rainfall, and oppressive humidity characterize equatorial and subtropical regions, except at high altitudes. At low altitudes, temperature variation is seldom less than 10°C and is often more than 35°C. At altitudes over 1,500 meters, ice often forms at night. The rain has a cooling effect, but when it stops, the temperature soars.

Rainfall is heavy, often with thunder and lightning. Sudden rain beats on the tree canopy, turning trickles into raging torrents and causing rivers to rise. Just as suddenly, the rain stops. Violent storms may occur, usually toward the end of the summer months.

Hurricanes, cyclones, and typhoons develop over the sea and rush inland, causing tidal waves and devastation ashore. In choosing campsites, make sure you are above any potential flooding. Prevailing winds vary between winter and summer. The dry season has rain once a day and the monsoon has continuous rain. In Southeast Asia, winds from the Indian Ocean bring the monsoon, but it is dry when the wind blows from the landmass of China.

Tropical day and night are of equal length. Darkness falls quickly and daybreak is just as sudden.

12.2 JUNGLE TYPES

There is no standard jungle. The tropical area may be any of the following —

- Rain forests.
- Secondary jungles.
- Semi-evergreen seasonal and monsoon forests.
- Scrub and thorn forests.
- Savannas.
- Saltwater swamps.
- Freshwater swamps.

Tropical Rain Forests

The climate varies little in rain forests. You find these forests across the equator in the Amazon and Congo basins, parts of Indonesia, and several Pacific islands. Up to 3.5 meters of rain fall evenly throughout the year. Temperatures range from about 35°C in the day to 20°C at night.

There are five layers of vegetation in this jungle. Where untouched by man, jungle trees rise from buttress roots to heights of 60 meters. Below them, smaller trees produce a canopy so thick that little light reaches the jungle floor. Seedlings struggle beneath them to reach light, and masses of vines and lianas twine up to the sun. Ferns, mosses, and herbaceous plants push through a thick carpet of leaves, and a great variety of fungi grow on leaves and fallen tree trunks.

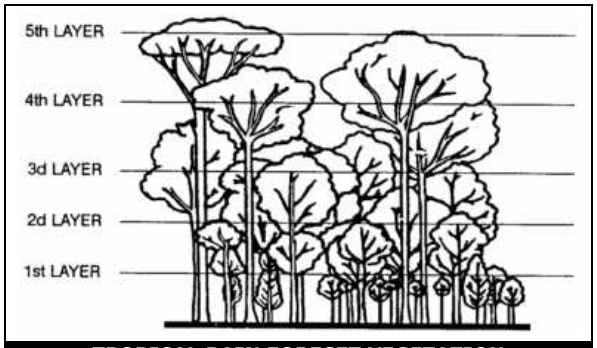
Because of the lack of light on the jungle floor, there is little undergrowth to hamper movement, but dense growth limits visibility to about 50 meters. You can easily lose your sense of direction in this jungle. It is extremely hard for aircraft to see you, which can be an advantage.

Secondary Jungles

Secondary jungle is very similar to rain forest. Prolific growth, where sunlight penetrates to the jungle floor, typifies this type of forest.

Such growth happens mainly along river banks, on jungle fringes, and where man has cleared rain forest.

When abandoned, tangled masses of vegetation quickly reclaim these cultivated areas. You can often find cultivated food plants among this vegetation.



TROPICAL RAIN FORESET VEGETATION

Semi-evergreen Seasonal and Monsoon Forests

The characteristics of the American and African semi-evergreen seasonal forests correspond with those of the Asian monsoon forests. These characteristics are —

- Their trees fall into two stories of tree strata. Those in the upper story average 18 to 24 meters; those in the lower story average 7 to 13 meters.
- The diameter of the trees averages 0.5 meter.
- Their leaves fall during a seasonal drought.

Except for the sago, nipa, and coconut palms, the same edible plants grow in these areas as in the tropical rain forests.

Tropical Scrub and Thorn Forests

The chief characteristics of tropical scrub and thorn forests are —

- There is a definite dry season.
- Trees are leafless during the dry season.
- The ground is bare except for a few tufted plants in bunches; grasses are uncommon.
- Plants with thorns predominate.
- Fires occur frequently.

Within the tropical scrub and thorn forest areas, you will find it hard to obtain food plants during the dry season. During the rainy season, plants are considerably more abundant.

Tropical Savannas

General characteristics of the savannah are —

- It is found within the tropical zones in South America and Africa.
- It looks like a broad, grassy meadow, with trees spaced at wide intervals.
- It frequently has red soil.
- It grows scattered trees that usually appear stunted and gnarled like apple trees. Palms also occur on savannas.

Saltwater Swamps

Saltwater swamps are common in coastal areas subject to tidal flooding. Mangrove trees thrive in these swamps. Mangrove trees can reach heights of 12 meters, and their tangled roots are an obstacle to movement. Visibility in this type of swamp is poor, and movement is extremely difficult. Sometimes, streams that you can raft form channels, but you usually must travel on foot through this swamp.

Everything in a saltwater swamp may appear hostile to you, from leeches and insects to crocodiles and caimans.

Avoid the dangerous animals in this swamp, avoid this swamp altogether if you can. If there are water channels through it, you may be able to use a raft to escape.

13.7.5 LEAN-TO SHELTER

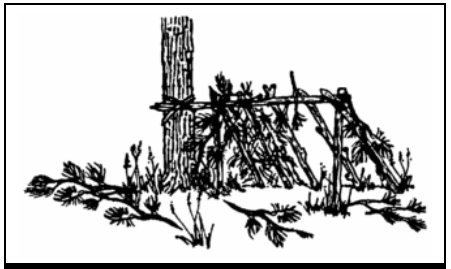
Construct this shelter in the same manner as for other environments; however, pile snow around the sides for insulation.

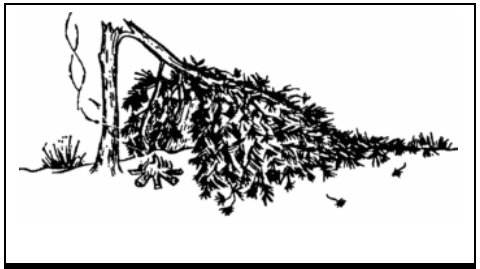
13.7.6 FALLEN TREE SHELTER

To build this shelter, find a fallen tree and dig out the snow underneath it. The snow will not be deep under the tree. If you must remove branches from the inside, use them to line the floor.

13.7.7 TREE-PIT SHELTER

Dig snow out from under a suitable large tree. It will not be as deep near the base of the tree. Use the cut branches to line the shelter. Use a ground sheet as overhead cover to prevent snow from falling off the tree into the shelter. If built properly, you can have 360-degree visibility. See **Tree Pit Snow Shelter** (Page 8-4).


LEAN-TO SHELTER


FALLEN TREE SHELTER

13.8 FIRE

Fire is especially important in cold weather. It not only provides a means to prepare food, but also to get warm and to melt snow or ice for water.

All wood will burn, but some types of wood create more smoke than others. For instance, coniferous trees that contain resin and tar create more and darker smoke than deciduous trees.

There are few materials to use for fuel in the high mountainous regions of the arctic. You may find some grasses and moss, but very little. The lower the elevation, the more fuel available. You may find some scrub willow and small, stunted spruce trees above the tree line. On sea ice, fuels are seemingly nonexistent. Driftwood or fats may be the only fuels available to a survivor on the barren coastlines in the arctic and subarctic regions.

If fuel or oil is available from a wrecked vehicle or downed aircraft, use it for fuel. Leave the fuel in the tank for storage, drawing on the supply only as you need it. Oil congeals in extremely cold temperatures, therefore, drain it from the vehicle or aircraft while still warm if there is no danger of explosion or fire. If you have no container, let the oil drain onto the snow or ice. Scoop up the fuel as you need it.

! **CAUTION –** Do not expose flesh to petroleum, oil, and lubricants in extremely cold temperatures. The liquid state of these products is deceptive in that it can cause frostbite.

Some plastic products, such as drink bottles, plastic bags, and foam rubber will ignite quickly from a burning match. They will also burn long enough to help start a fire. For example, a plastic spoon will burn for about 5 minutes.

In cold weather regions, there are some hazards in using fires, whether to keep warm or to cook. For example –

- Fires have been known to burn underground, resurfacing nearby. Therefore, do not build a fire too close to a shelter.
- In snow shelters, excessive heat will melt the insulating layer of snow that may also be your camouflage.
- A fire inside a shelter lacking adequate ventilation can result in carbon monoxide poisoning.

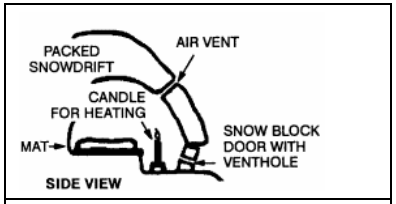
13.7.1 SNOW CAVE SHELTER

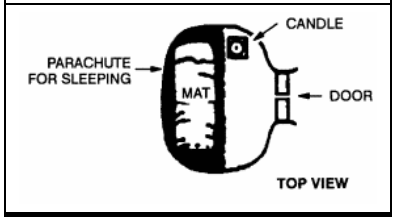
The snow cave shelter is an effective shelter because of the insulating qualities of snow. Remember that it takes time and energy to build and that you will get wet while building it.

First, you need to find a drift about 3 meters deep into which you can dig. While building this shelter, keep the roof arched for strength and to allow melted snow to drain down the sides.

Build the sleeping platform higher than the entrance. Separate the platform from the snow cave's walls or dig a small trench between the platform and the wall. This will prevent the melting snow from wetting you and your equipment.

This construction is especially important if you have a good source of heat in the snow cave. Ensure the roof is high enough so that you can sit up. Block the entrance with a snow block or other material and use the lower entrance area for cooking.



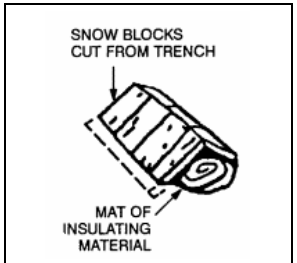


SNOW CAVE SHELTER

The walls and ceiling should be at least 30 cm thick. Install a ventilation shaft. If you do not have a drift large enough to build a snow cave, you can make a variation of it by piling snow into a mound large enough to dig out.

13.7.2 SNOW TRENCH SHELTER

The idea behind this shelter is to get you below the snow and wind level and use the snow's insulating qualities. If you are in an area of compacted snow, cut snow blocks and use them as overhead cover. If not, you can use a poncho or other material. Build only one entrance and use a snow block or rucksack as a door.



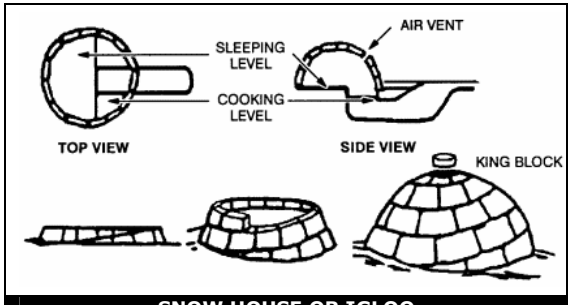
SNOW TRENCH SHELTER

13.7.3 SNOW BLOCK AND PARACHUTE SHELTER

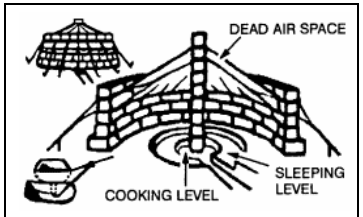
Use snow blocks for the sides and parachute material for overhead cover. If snowfall is heavy, you will have to clear snow from the top at regular intervals to prevent the collapse of the parachute material.

13.7.4 SNOW HOUSE OR IGLOO

In certain areas, the natives frequently use this type of shelter as hunting and fishing shelters. They are efficient shelters but require some practice to make them properly. Also, you must be in an area that is suitable for cutting snow blocks and have the equipment to cut them (snow saw or knife).



SNOW HOUSE OR IGLOO



Line tie-downs go through hole, are watered down and freeze in place

SNOW BLOCK AND PARACHUTE SHELTER

Freshwater Swamps

You find freshwater swamps in low-lying inland areas. Their characteristics are masses of thorny undergrowth, reeds, grasses, and occasional short palms that reduce visibility and make travel difficult. There are often islands that dot these swamps, allowing you to get out of the water. Wildlife is abundant in these swamps.

12.3 TRAVEL THROUGH JUNGLE AREAS

With practice, movement through thick undergrowth and jungle can be done efficiently. Always wear long sleeves to avoid cuts and scratches.

To move easily, you must develop "jungle eye," that is, you should not concentrate on the pattern of bushes and trees to your immediate front. Focus on the jungle further out and find natural breaks in the foliage. Look through the jungle, not at it. Stop and stoop down occasionally to look along the jungle floor. This may reveal game trails that you can follow.

Stay alert and move slowly and steadily through dense forest. Stop periodically to listen and take your bearings. Use a machete to cut through dense vegetation, but do not cut unnecessarily or you will quickly wear yourself out.

If using a machete, stroke upward when cutting vines to reduce noise because sound carries long distances in the jungle. Use a stick to part the vegetation. Using a stick will also help dislodge biting ants, spiders, or snakes. Do not grasp at brush or vines when climbing slopes; they may have irritating spines or sharp thorns.

Many jungle and forest animals follow game trails. These trails wind and cross, but frequently lead to water or clearings. Use these trails if they lead in your desired direction of travel.

In many countries, electric and telephone lines run for miles through sparsely inhabited areas. Usually, the right-of-way is clear enough to allow easy travel. When travelling along these lines, be careful as you approach transformer and relay stations. In enemy territory, they may be guarded.

Travel Tips

- Pinpoint your initial location as accurately as possible to determine a general line of travel to safety. If you do not have a compass, use a field-expedient direction finding method.
- Take stock of water supplies and equipment.
- Move in one direction, but not necessarily in a straight line. Avoid obstacles. In enemy territory, take advantage of natural cover and concealment.
- Move smoothly through the jungle. Do not blunder through it since you will get many cuts and scratches. Turn your shoulders, shift your hips, bend your body, and shorten or lengthen your stride as necessary to slide between the undergrowth.

Immediate Considerations

- Take shelter from tropical rain, sun, and insects. Malaria-carrying mosquitoes and other insects are immediate dangers, so protect yourself against bites.
- In the tropics, even the smallest scratch can quickly become dangerously infected. Promptly treat any wound, no matter how minor.

12.4 WATER PROCUREMENT

Even though water is abundant in most tropical environments, you may, as a survivor, have trouble finding it. If you do find water, it may not be safe to drink. Some of the many sources are vines, roots, palm trees, and condensation. You can sometimes follow animals to water.

Often you can get nearly clear water from muddy streams or lakes by digging a hole in sandy soil about 1 meter from the bank. Water will seep into the hole. You must purify any water obtained in this manner.

12.4.1 ANIMALS AS SIGNS OF WATER

Animals can often lead you to water. Most animals require water regularly. Grazing animals such as deer are usually never far from water and usually drink at dawn and dusk. Converging game trails often lead to water. Carnivores (meat eaters) are not reliable indicators of water. They get moisture from the animals they eat and can go without water for long periods.

Birds can sometimes also lead you to water. Grain eaters, such as finches and pigeons, are never far from water. They drink at dawn and dusk. When they fly straight and low, they are heading for water. When returning from water, they are full and will fly from tree to tree, resting frequently. Do not rely on water birds to lead you to water. They fly long distances without stopping. Hawks, eagles, and other birds of prey get liquids from their victims; you cannot use them as a water indicator.

Insects can be good indicators of water, especially bees. Bees seldom range more than 6 km from their nests or hives. They usually will have a water source in this range. Ants need water. A column of ants marching up a tree is going to a small reservoir of trapped water. You find such reservoirs even in arid areas. Most flies stay within 100 meters of water, especially the European mason fly, easily recognized by its iridescent green body.

Human tracks will usually lead to a well, bore hole, or soak. Scrub or rocks may cover it to reduce evaporation. Replace the cover after use.

12.4.2 WATER FROM PLANTS

Plants such as vines, roots, and palm trees are good sources of water.

Vines

Vines with rough bark and shoots about 5 cm thick can be a useful source of water. You must learn by experience which are the water-bearing vines, because not all have drinkable water. Some may even have a poisonous sap. The poisonous ones yield a sticky, milky sap when cut. Non-poisonous vines will give a clear fluid. Some vines cause a skin irritation on contact; therefore let the liquid drip into your mouth, rather than put your mouth to the vine. Preferably, use some type of container. See **Water From Vegetable Sources** (Page 3-2) to obtain water from a vine.

Roots

In Australia, the water tree, desert oak, and bloodwood have roots near the surface. Pry these roots out of the ground and cut them into 30-centimeter lengths. Remove the bark and suck out the moisture, or shave the root to a pulp and squeeze it over your mouth.

Palm Trees

The buri, coconut, and nipa palms all contain a sugary fluid that is very good to drink. To obtain the liquid, bend a flowering stalk of one of these palms downward, and cut off its tip. If you cut a thin slice off the stalk every 12 hours, the flow will renew, making it possible to collect up to a litre per day. Nipa palm shoots grow from the base, so that you can work at ground level. On trees of other species, you may have to climb them to reach a flowering stalk. Milk from coconuts has a large water content, but may contain a strong laxative in ripe nuts. Drinking too much of this milk may cause you to lose more fluid than you drink.

12.4.3 WATER FROM CONDENSATION

Often it requires too much effort to dig for roots containing water. It may be easier to let a plant produce water in the form of condensation. Tying a clear plastic bag around a green leafy branch will cause water in the leaves to evaporate and condense in the bag. Placing cut vegetation in a plastic bag will also produce condensation. See **Solar Still** (Page 3-4).

12.5 FOOD

Food is usually abundant in a tropical survival situation. To obtain animal food, use the procedures outlined in **Food Procurement** (Page 4-1).

In addition to animal food, you will have to supplement your diet with edible plants. The best places to forage are the banks of streams and rivers. Wherever the sun penetrates the jungle, there will be a mass of vegetation, but river banks may be the most accessible areas.

If you are weak, do not expend energy climbing a tree for food. There are easier sources of food nearer the ground. Do not pick more food than you need. Food spoils rapidly in tropical conditions. Leave food on the growing plant until you need it, and eat it fresh.

There are an almost unlimited number of edible plants from which to choose. Unless you can positively identify these plants, it may be safer at first to begin with palms, bamboos, and common fruits.

13.6.5 COLD DIURESIS

Exposure to cold increases urine output. This decreases body fluids that you must replace.

13.6.6 SUNBURN

Exposed skin can become sunburned even when the air temperature is below freezing. The sun's rays reflect at all angles from snow, ice, and water, hitting sensitive areas of skin - lips, nostrils, and eyelids. Exposure to the sun results in sunburn more quickly at high altitudes than at low altitudes. Apply sunburn cream or lip salve to your face when in the sun.

13.6.7 SNOW BLINDNESS

The reflection of the sun's ultraviolet rays off a snow-covered area causes this condition. The symptoms of snow blindness are a sensation of grit in the eyes, pain in and over the eyes that increases with eyeball movement, red and teary eyes, and a headache that intensifies with continued exposure to light. Prolonged exposure to these rays can result in permanent eye damage. To treat snow blindness, bandage your eyes until the symptoms disappear.

You can prevent snow blindness by wearing sunglasses. If you don't have sunglasses, improvise. Cut slits in a piece of cardboard, thin wood, tree bark, or other available material. Putting soot under your eyes will help reduce shine and glare.

13.6.8 CONSTIPATION

It is very important to relieve yourself when needed. Do not delay because of the cold condition. Delaying relieving yourself because of the cold, eating dehydrated foods, drinking too little liquid, and irregular eating habits can cause you to become constipated. Although not disabling, constipation can cause some discomfort. Increase your fluid intake to at least 2 litres above your normal 2 - 3 litres daily intake and, if available, eat fruit and other foods that will loosen the stool.

13.7 SHELTERS

Your environment and the equipment you carry with you will determine the type of shelter you can build. You can build shelters in wooded areas, open country, and barren areas. Wooded areas usually provide the best location, while barren areas have only snow as building material. Wooded areas provide timber for shelter construction, wood for fire, concealment from observation, and protection from the wind.

> ! **CAUTION –** In extreme cold, do not use metal, such as an aircraft fuselage, for shelter. The metal will conduct away from the shelter what little heat you can generate.

Shelters made from ice or snow usually require tools such as ice axes or saws. You must also expend much time and energy to build such a shelter. Be sure to ventilate an enclosed shelter, especially if you intend to build a fire in it. Always block a shelter's entrance, if possible, to keep the heat in and the wind out. Use a rucksack or snow block. Construct a shelter no larger than needed. This will reduce the amount of space to heat. A fatal error in cold weather shelter construction is making the shelter so large that it steals body heat rather than saving it. Keep shelter space small.

Never sleep directly on the ground. Lay down some pine boughs, grass, or other insulating material to keep the ground from absorbing your body heat.

Never fall asleep without turning out your stove or lamp. Carbon monoxide poisoning can result from a fire burning in an unventilated shelter. Carbon monoxide is colourless and odourless. Always check your ventilation. Even in a ventilated shelter, incomplete combustion can cause carbon monoxide poisoning.

Usually, there are no symptoms. Unconsciousness and death can occur without warning. Sometimes, however, pressure at the temples, burning of the eyes, headache, pounding pulse, drowsiness, or nausea may occur. The one characteristic, visible sign of carbon monoxide poisoning is a cherry red colouring in the tissues of the lips, mouth, and inside of the eyelids. Get into fresh air at once if you have any of these symptoms.

There are several types of field-expedient shelters you can quickly build or employ. Many use snow for insulation.

13.6.2 FROSTBITE

This injury is the result of frozen tissues. Light frostbite involves only the skin that takes on a dull whitish pallor. Deep frostbite extends to a depth below the skin. The tissues become solid and immovable. Feet, hands, and exposed facial areas are particularly vulnerable to frostbite.

The best frostbite prevention, when you are with others, is to use the buddy system. Check your buddy's face often and make sure that they check yours. If you are alone, periodically cover your nose and lower part of your face with your mittened hand.

The following pointers will aid you in keeping warm and preventing frostbite when it is extremely cold or when you have less than adequate clothing —

Face	Maintain circulation by twitching and wrinkling the skin on your face making faces. Warm with your hands.
Ears	Wiggle and move your ears. Warm with your hands.
Hands	Move your hands inside your gloves. Warm by placing your hands close to your body.
Feet	Move your feet and wiggle your toes inside your boots.

A loss of feeling in your hands and feet is a sign of frostbite. If you have lost feeling for only a short time, the frostbite is probably light. Otherwise, assume the frostbite is deep. To rewarm a light frostbite, use your hands or mittens to warm your face and ears. Place your hands under your armpits. Place your feet next to your buddy's stomach. A deep frostbite injury, if thawed and refrozen, will cause more damage than a non-medically trained person can handle.

Do's –

- Periodically check for frostbite.
- Rewarm light frostbite.
- Keep injured areas from refreezing.

Do Not's –

- Rub injury with snow.
- Drink alcoholic beverages.
- Smoke.

13.6.3 TRENCH FOOT AND IMMERSION FOOT

These conditions result from many hours or days of exposure to wet or damp conditions at a temperature just above freezing. The symptoms are a sensation of pins and needles, tingling, numbness, and then pain.

The skin will initially appear wet, soggy, white, and shrivelled. As it progresses and damage appears, the skin will take on a red and then a bluish or black discoloration. The feet become cold, swollen, and have a waxy appearance.

Walking becomes difficult and the feet feel heavy and numb. The nerves and muscles sustain the main damage, but gangrene can occur. In extreme cases, the flesh dies and it may become necessary to have the foot or leg amputated.

The best prevention is to keep your feet dry. Carry extra socks with you in a waterproof packet. You can dry wet socks against your torso (back or chest). Wash your feet and put on dry socks daily.

13.6.4 DEHYDRATION

When bundled up in many layers of clothing during cold weather, you may be unaware that you are losing body moisture. Your heavy clothing absorbs the moisture that evaporates in the air. You must drink water to replace this loss of fluid.

Your need for water is as great in a cold environment as it is in a warm environment. One way to tell if you are becoming dehydrated is to check the colour of your urine on snow. If your urine makes the snow dark yellow, you are becoming dehydrated and need to replace body fluids. If it makes the snow light yellow to no colour, your body fluids have a more normal balance.

13 Cold Weather Survival

One of the most difficult survival situations is a cold weather scenario. Remember, cold weather is an adversary that can be as dangerous as an enemy soldier. Every time you venture into the cold, you are pitting yourself against the elements. With a little knowledge of the environment, proper plans, and appropriate equipment, you can overcome the elements. As you remove one or more of these factors, survival becomes increasingly difficult. Remember, winter weather is highly variable. Prepare yourself to adapt to blizzard conditions even during sunny and clear weather.

Cold is a far greater threat to survival than it appears. It decreases your ability to think and weakens your will to do anything except to get warm. Cold is an insidious enemy; as it numbs the mind and body, it subdues the will to survive.

Cold makes it very easy to forget your ultimate goal — to survive.

13.1 COLD REGIONS AND LOCATIONS

Cold regions include arctic and subarctic areas and areas immediately adjoining them. You can classify about 48% of the northern hemisphere's total landmass as a cold region due to the influence and extent of air temperatures. Ocean currents affect cold weather and cause large areas normally included in the temperate zone to fall within the cold regions during winter periods. Elevation also has a marked effect on defining cold regions.

Within the cold weather regions, you may face two types of cold weather environments — wet or dry. Knowing in which environment your area of operations falls will affect planning and execution of a cold weather operation.

Wet Cold Weather Environments

Wet cold weather conditions exist when the average temperature in a 24-hour period is -10°C or above. Characteristics of this condition are freezing during the colder night hours and thawing during the day. Even though the temperatures are warmer during this condition, the terrain is usually very sloppy due to slush and mud. You must concentrate on protecting yourself from the wet ground and from freezing rain or wet snow.

Dry Cold Weather Environments

Dry cold weather conditions exist when the average temperature in a 24-hour period remains below -10°C. Even though the temperatures in this condition are much lower than normal, you do not have to contend with the freezing and thawing. In these conditions, you need more layers of inner clothing to protect you from temperatures as low as -60°C. Extremely hazardous conditions exist when wind and low temperature combine.

13.2 WINDCHILL

Windchill increases the hazards in cold regions. Windchill is the effect of moving air on exposed flesh. For instance, with a 27.8-kph (15-knot) wind and a temperature of -10°C, the equivalent windchill temperature is -23°C. Remember, even when there is no wind, you will create the equivalent wind by skiing, running, being towed on skis behind a vehicle, working around aircraft that produce wind blasts.

13.3 BASIC PRINCIPLES

It is more difficult for you to satisfy your basic water, food, and shelter needs in a cold environment than in a warm environment. Even if you have the basic requirements, you must also have adequate protective clothing and the will to survive. The will to survive is as important as the basic needs. There have been incidents when trained and well-equipped individuals have not survived cold weather situations because they lacked the will to live. Conversely, this will has sustained individuals less well-trained and equipped.

You must not only have enough clothing to protect you from the cold, you must also know how to maximize the warmth you get from it. For example, always keep your head covered. You

can lose 40 - 45% of body heat from an unprotected head and even more from the unprotected neck, wrist, and ankles. These areas of the body are good radiators of heat and have very little insulating fat. The brain is very susceptible to cold and can stand the least amount of cooling. Because there is much blood circulation in the head, most of which is on the surface, you can lose heat quickly if you do not cover your head.

There are four basic principles to follow to keep warm —

Keep Clothing Clean

This principle is always important for sanitation and comfort. In winter, it is also important from the standpoint of warmth. Clothes matted with dirt and grease lose much of their insulation value. Heat can escape more easily from the body through the clothing's crushed or filled up air pockets.

Avoid Overheating

When you get too hot, you sweat and your clothing absorbs the moisture. This affects you in two ways: dampness decreases the insulation quality of clothing, and as sweat evaporates, your body cools.

Adjust your clothing so that you do not sweat. Do this by partially opening your jacket, removing an inner layer of clothing, removing mittens, or by changing to lighter headgear. The head and hands act as efficient heat dissipaters when overheated.

Wear Your Clothing Loose and in Layers

Wearing tight clothing and footgear restricts blood circulation and invites cold injury. It also decreases the volume of air trapped between the layers, reducing its insulating value.

Several layers of lightweight clothing are better than one equally thick layer of clothing, because the layers have dead-air space between them which provides insulation. Also, layers of clothing allow you to take off or add clothing layers to prevent excessive sweating or to increase warmth.

Keep Clothing Dry

In cold temperatures, your inner layers of clothing can become wet from sweat and your outer layer, if not water repellent, can become wet from snow and frost melted by body heat. Wear water repellent outer clothing, if available. It will shed most of the water collected from melting snow and frost.

Before entering a heated shelter, brush off the snow and frost. Despite the precautions you take, there will be times when you cannot keep from getting wet. At such times, drying your clothing may become a major problem.

On the march, hang your damp mittens and socks on your rucksack. Sometimes in freezing temperatures, the wind and sun will dry this clothing. You can also place damp socks or mittens, unfolded, near your body so that your body heat can dry them. In a campsite, hang damp clothing inside the shelter near the top, using drying lines or improvised racks. You may even be able to dry each item by holding it before an open fire. Dry leather items slowly. If no other means are available for drying your boots, put them between your sleeping bag shell and liner. Your body heat will help to dry the leather.

13.4 HYGIENE

Although washing yourself may be impractical and uncomfortable in a cold environment, you must do so. Washing helps prevent skin rashes that can develop into more serious problems.

In some situations, you may be able to take a snow bath. Take a handful of snow and wash your body where sweat and moisture accumulate, such as under the arms and between the legs, and then wipe yourself dry. If possible, wash your feet daily and put on clean, dry socks. Change your underwear at least twice a week. If you are unable to wash your underwear, take it off, shake it, and let it air out for an hour or two.

If your clothing has become infested with lice you can hang your clothes in the cold, then beat and brush them. This will help get rid of the lice, but not the eggs.

If you shave, try to do so before going to bed. This will give your skin a chance to recover before exposing it to the elements.

13.5 MEDICAL ASPECTS

When you are healthy, your inner core temperature (torso temperature) remains almost constant at 37°C (98.6°F). Since your limbs and head have less protective body tissue than your torso, their temperatures vary and may not reach core temperature.

Your body has a control system that lets it react to temperature extremes to maintain a temperature balance. There are three main factors that affect this temperature balance – heat production, heat loss, and evaporation. The difference between the body's core temperature and the environment's temperature governs the heat production rate. Your body can get rid of heat better than it can produce it. Sweating helps to control the heat balance. Maximum sweating will get rid of heat about as fast as maximum exertion produces it.

Shivering causes the body to produce heat. It also causes fatigue that, in turn, leads to a drop in body temperature. Air movement around your body affects heat loss. It has been calculated that a naked man exposed to still air at or about 0°C can maintain a heat balance if they shiver as hard as they can. However, you can't shiver forever.

It has also been calculated that a man at rest wearing the maximum arctic clothing in a cold environment can keep their internal heat balance during temperatures well below freezing. To withstand really cold conditions for any length of time, however, they will have to become active or shiver.

13.6 COLD INJURIES

The best way to deal with injuries and sicknesses is to take measures to prevent them from happening in the first place. Treat any injury or sickness that occurs as soon as possible to prevent it from worsening.

The knowledge of signs and symptoms and the use of the buddy system are critical in maintaining health. Following are cold injuries that can occur.

13.6.1 HYPOTHERMIA

Hypothermia is the lowering of the body temperature at a rate faster than the body can produce heat. Causes of hypothermia may be general exposure or the sudden wetting of the body by falling into a lake or spraying with fuel or other liquids.

The initial symptom is shivering. This shivering may progress to the point that it is uncontrollable. This begins when the body's core (rectal) temperature falls to about 35.5°C (96°F).

When the core temperature reaches 35 - 32°C (95 - 90°F), sluggish thinking, irrational reasoning, and a false feeling of warmth may occur.

Core temperatures of 32 - 30°C (90 - 86°F) and below will result in muscle rigidity, unconsciousness, and barely detectable signs of life. If the victim's core temperature falls below 25°C (77°F), death is almost certain.

To treat hypothermia, rewarm the entire body. If there are means available, rewarm the person by first immersing the trunk area only in warm water of 37.7 - 43.3°C (100 - 110°F). There is an increased risk of cardiac arrest with this method.

One of the quickest ways to get heat to the inner core is to give warm water enemas. Such an action, however, may not be possible in a survival situation. Another method is to wrap the victim in a warmed sleeping bag with another person who is already warm; both should be naked. Note the other individual in the sleeping bag could also get hypothermia if left too long.

If the person is conscious, give them hot, sweetened fluids. One of the best sources of calories is honey or dextrose; if unavailable, use sugar, cocoa, or a similar soluble sweetener.

There are two dangers in treating hypothermia – rewarming too rapidly and "after drop." Rewarming too rapidly can cause the victim to have circulatory problems, resulting in heart failure. After drop is the sharp body core temperature drop that occurs when taking the victim from the warm water. Its probable muse is the return of previously stagnant limb blood to the core (inner torso) area as recirculation occurs. Concentrating on warming the core area and stimulating peripheral circulation will lessen the effects of after drop. Immersing the torso in a warm bath, if possible, is the best treatment.

observing delivery means, you may be able to have some warning of chemical agents. Mustard gas in the liquid state will appear as oily patches on leaves or on buildings.

The sound of enemy munitions will give some clue to the presence of chemical weapons. Muffled shell or bomb detonations are a good indicator.

Irritation in the nose or eyes or on the skin is an urgent warning to protect your body from chemical agents. Additionally, a strange taste in food, water, or cigarettes may serve as a warning that they have been contaminated.

15.3.2 PROTECTION AGAINST CHEMICAL AGENTS

As a survivor, use the following general steps, to protect yourself from a chemical attack —

- Use protective equipment.
- Give fast and correct self-aid when contaminated.
- Avoid areas where chemical agents exist.
- Decontaminate your equipment and body as soon as possible.

Your protective mask and hazmat suit, that you don't have, are your key to survival. Without these, you stand very little chance. You must take care of these items and protect them from damage. Practice correct self-aid procedures before exposure to chemical agents. Detection of chemical agents and the avoidance of contaminated areas are extremely important to your survival. Use whatever detection kits that may be available. Since you are in a survival situation, avoid contaminated areas at all costs. You can expect no help should you become contaminated. If you do become contaminated, decontaminate yourself as soon as possible using proper procedures.

15.3.3 SHELTER

If you find yourself in a contaminated area, move out of the area as fast as possible. Travel crosswind or upwind to reduce the exposure to the hazard. If you cannot leave immediately and have to build a shelter, use normal construction techniques, with a few changes. Build in a clearing, away from vegetation. Remove all topsoil in the area of the shelter to decontaminate the area. Keep the shelter's entrance closed and oriented at a 90-degree angle to the prevailing wind. Do not build a fire using contaminated wood—the smoke will be toxic. Use extreme caution when entering your shelter so that you will not bring contamination inside.

15.3.4 WATER PROCUREMENT

As with biological and nuclear environments, getting water in a chemical environment is difficult. Obviously, water in sealed containers is your best and safest source. You must protect this water as much as possible. Be sure to decontaminate the containers before opening.

If you cannot get water in sealed containers, try to get it from a closed source such as underground water pipes. You may use rainwater or snow if there is no evidence of contamination. Use water from slow-moving streams, if necessary, but always check first for signs of contamination, and always filter the water as described under nuclear conditions. Signs of water source contamination are foreign odours such as garlic, mustard, geranium, or bitter almonds. Oily spots on the surface of the water or nearby, or the presence of dead fish or animals are signs of contamination. If these signs are present, do not use the water. Always boil or purify the water to prevent bacteriological infection.

15.3.5 FOOD PROCUREMENT

It is extremely difficult to eat while in a contaminated area. You will have to break the seal on your protective mask to eat so find an area where you can safely unmask. The safest source of food is sealed containers. Decontaminate all sealed food containers by boiling the container before opening, otherwise you will contaminate the food.

If you must eat local plants or animals, do not use plants from contaminated areas or animals that appear to be sick. When handling plants or animals, use protective gloves and clothing.

15.4 CONCLUSION

See how bleak it gets? The scenarios described here probably don't even begin to cover the horrors of the weapons that may be deployed. If there is one chapter that convinces you to move from concentrated city areas, this should be it.

14 Sea Survival

Perhaps the most difficult survival situation to be in is sea survival. Short or long-term survival depends upon rations and equipment available and your ingenuity. You must be resourceful to survive.

Water covers about 75 percent of the earth's surface, with about 70 percent being oceans and seas. You can assume that you will sometime cross vast expanses of water. There is always the chance that the plane or ship you are on will become crippled by such hazards as storms, collision, fire, or war.

14.1 THE OPEN SEA

As a survivor on the open sea, you will face waves and wind. You may also face extreme heat or cold. To keep these environmental hazards from becoming serious problems, take precautionary measures as soon as possible. Use the available resources to protect yourself from the elements and from heat or extreme cold and humidity.

Protecting yourself from the elements meets only one of your basic needs. You must also be able to obtain water and food. Satisfying these three basic needs will help prevent serious physical and psychological problems. However, you must know how to treat health problems that may result from your situation.

14.1.1 PRECAUTIONARY MEASURES

Your survival at sea depends upon —

- Your knowledge of and ability to use the available survival equipment.
- Your special skills and ability to apply them to cope with the hazards you face.
- Your will to live.

When you board a ship or aircraft, find out what survival equipment is on board, where it is stowed, and what it contains.

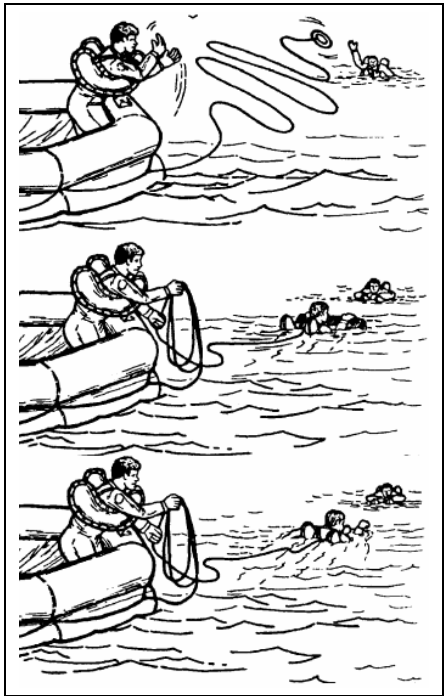
14.1.2 DOWN AT SEA

If you are in an aircraft that goes down at sea, take the following actions once you clear the aircraft. Whether you are in the water or in a raft —

- Get clear and upwind of the aircraft as soon as possible, but stay in the vicinity until the aircraft sinks.
- Get clear of fuel-covered water in case the fuel ignites.
- Try to find other survivors.

The best technique for rescuing someone from the water is to throw them a life preserver attached to a line. Another is to send a rescuer from the raft with a line attached to a flotation device that will support the rescuer's weight. This device will help conserve a rescuer's energy while recovering the survivor.

The least acceptable technique is to send an attached swimmer without flotation devices to retrieve a survivor. In all cases, the rescuer wears a life preserver. A rescuer should not underestimate the strength of a panic-stricken person in the water. A careful approach can prevent injury to the rescuer.



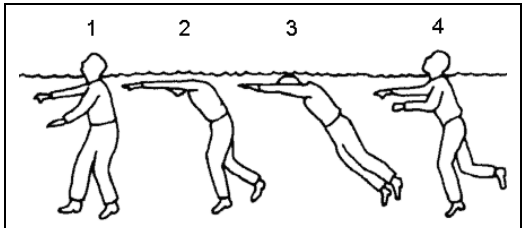
RESCUE FROM WATER

If you are in the water, make your way to a raft. or a large piece of floating debris to cling to.

Relax; a person who knows how to relax in ocean water is in very little danger of drowning. The body's natural buoyancy will keep at least the top of the head above water, but some movement is needed to keep the face above water.

Floating on your back takes the least energy. Lie on your back in the water, spread your arms and legs, and arch your back. By controlling your breathing in and out, your face will always be out of the water and you may even sleep in this position for short periods.

Your head will be partially submerged, but your face will be above water. If you cannot float on your back or if the sea is too rough, float facedown in the water as shown.



1. Float upright in the water and take a deep breath
2. Lower your face into the water (keeping your mouth closed) and bring your arms forward to rest at water level
3. Relax in this position until you need to take in more air
4. Raise your head above the surface, treading water, and exhale. Take another breath and return to the relaxed position

FLOATING POSITION

The following are the best swimming strokes during a survival situation —

Dog paddle	This stroke is excellent when clothed or wearing a life jacket. Although slow in speed, it requires very little energy.
Breaststroke	Use this stroke to swim underwater, through oil or debris, or in rough seas. It is probably the best stroke for long-range swimming: it allows you to conserve your energy and maintain a reasonable speed.
Sidestroke	It is a good relief stroke because you use only one arm to maintain momentum and buoyancy.
Backstroke	This stroke is also an excellent relief stroke. It relieves the muscles that you use for other strokes. Use it if an underwater explosion is likely.

If you are in an area where surface oil is burning —

- Discard your shoes and buoyant life preserver. Note, if you have an uninflated life preserver, keep it.
- Cover your nose, mouth, and eyes and quickly go underwater.
- Swim underwater as far as possible before surfacing to breathe.
- Before surfacing to breathe and while still underwater, use your hands to push burning fluid away from the area where you wish to surface. Once an area is clear of burning liquid, you can surface and take a few breaths. Try to face downwind before inhaling.
- Submerge feet first and continue as above until clear of the flames.

If you are in oil-covered water that is free of fire, hold your head high to keep the oil out of your eyes. Attach your life preserver to your wrist and then use it as a raft.

14.2 WATER

Water is your most important need. With it alone, you can live for ten days or longer, depending on your will to live. When drinking water, moisten your lips, tongue, and throat before swallowing.

Short Water Rations

When you have a limited water supply, use the water efficiently.

vegetation in constructing your shelter. Place your shelter's entrance at a 90-degree angle to the prevailing winds. Such placement will limit the entry of airborne agents and prevent air stagnation in your shelter. Always keep your shelter clean.

15.2.6 WATER PROCUREMENT

Water procurement under biological conditions is difficult but not impossible. Whenever possible, try to use water that has been in a sealed container. You can assume that the water inside the sealed container is not contaminated. Wash the water container thoroughly with soap and water or boil it for at least 10 minutes before breaking the seal.

If water in sealed containers is not available, your next choice under emergency conditions is water from springs. Boil the water and keep it covered while boiling to prevent contamination by airborne pathogens. Your last choice is to use standing water. Vectors and germs survive easily in stagnant water. Boil this water and filter it to kill all organisms. Use purification tablets or a few drops of bleach if possible.

15.2.7 FOOD PROCUREMENT

Food procurement is not impossible, but you must take special precautions. You can assume that sealed containers of food are safe. To ensure safety, decontaminate all food containers by washing with soap and water or by boiling the container in water for 10 minutes.

Consider local plants or animals only in extreme emergencies. There is no guarantee that cooking will kill the biological agents. Use local food only in life or death situations. Remember, you can survive for a long time without food, especially if the food you eat may kill you!

If you must use local food, select only healthy looking plants and animals. Do not select known carriers of vectors such as rats or other vermin. Select and prepare plants as you would in radioactive areas. Prepare animals as you do plants. Always use gloves and protective clothing when handling animals or plants. Cook all plant and animal food by boiling only. Boil all food for at least 10 minutes to kill all pathogens. Do not try to fry, bake, or roast local food. There is no guarantee that all infected portions have reached the required temperature to kill all pathogens. Do not eat raw food.

15.3 CHEMICAL ENVIRONMENTS

Chemical warfare can create extreme problems in a survival situation, but you can overcome the problems with the proper equipment, knowledge, and training. As a survivor, your first line of defence is your proficiency in nuclear, biological, and chemical (NBC) training.

This training includes donning and wearing the protective mask and hazmat suit, personal decontamination, recognition of chemical agent symptoms, and individual first aid for chemical agent contamination. If you are not proficient in these skills, you will have little chance of surviving a chemical environment.

The subject matter covered below is not a substitute for any of the individual tasks in which you must be proficient. Military documents, that you don’t have, address the various chemical agents, their effects, and first aid for these agents. The following information is only useful providing you are proficient in the use of chemical protective equipment and the symptoms of various chemical agents. Which you aren’t. Good luck.

15.3.1 DETECTION OF CHEMICAL AGENTS

The best method for detecting chemical agents is the use of a chemical agent detector. Since you don’t have one, you will have to rely on your physical senses. You must be alert and able to detect any clues indicating the use of chemical warfare. General indicators of the presence of chemical agents are tears, difficult breathing, choking, itching, coughing, and dizziness. With agents that are very hard to detect, you must watch for symptoms in fellow survivors. Your surroundings will provide valuable clues to the presence of chemical agents – for example, dead animals, sick people, or zombies.

Your sense of smell may alert you to some chemical agents, but most will be odourless. The odour of newly cut grass or hay may indicate the presence of choking agents. A smell of almonds may indicate blood agents.

Sight will help you detect chemical agents. Most chemical agents in the solid or liquid state have some colour. In the vapour state, you can see some chemical agents as a mist or thin fog immediately after the bomb or shell bursts. By observing for symptoms in others and by

- Numbness or tingling of skin.
- Paralysis.
- Convulsions.
- Rashes or blisters.
- Coughing.
- Nausea, vomiting, and/or diarrhea.
- Bleeding from body openings.
- Blood in urine, stool, or saliva.
- Shock.
- Death.

15.2.2 DETECTION OF BIOLOGICAL AGENTS

Biological agents are by nature difficult to detect. You cannot detect them by any of the five physical senses. Often, the first sign of a biological agent will be symptoms of the victims exposed to the agent. Your best chance of detecting biological agents before they can affect you is to recognize their means of delivery. The three main means of delivery are —

- Bursting-type munitions. These may be bombs or projectiles whose burst causes very little damage. The burst will produce a small cloud of liquid or powder in the immediate impact area. This cloud will disperse eventually – the rate of dispersion depends on terrain and weather conditions.
- Spray tanks or generators. Aircraft or vehicle spray tanks or ground-level aerosol generators produce an aerosol cloud of biological agents.
- Vectors. Insects such as mosquitoes, fleas, lice, and ticks deliver pathogens. Large infestations of these insects may indicate the use of biological agents.

Another sign of a possible biological attack is the presence of unusual substances on the ground or on vegetation, or sick-looking plants, crops, or animals.

15.2.3 INFLUENCE OF WEATHER AND TERRAIN

Knowledge of weather and terrain can help you avoid contamination. Major weather factors that affect biological agents are sunlight, wind, and rain. Sunlight rapidly kills most germs exposed. However, natural or man-made cover may protect some agents from sunlight.

High winds increase the dispersion of biological agents, dilute their concentration, and dehydrate them. The further downwind the agent travels, the less effective it becomes due to dilution and death of the pathogens. However, the downwind hazard area of the biological agent is significant and you cannot ignore it.

Rain tends to wash biological agents out of the air, reducing downwind hazard areas. However, the agents may still be very effective where they were deposited on the ground.

15.2.4 PROTECTION AGAINST BIOLOGICAL AGENTS

While you must maintain a respect for biological agents, there is no reason to panic. You can reduce your susceptibility to biological agents by maintaining current immunizations, avoiding contaminated areas, and controlling rodents and pests. You must also use proper first aid measures in the treatment of wounds and only properly treated sources of food and water.

If you don't have a protective mask, try to keep your face covered with cloth to protect yourself. Dust may contain biological agents so wear a mask when dust is in the air.

Clothes and gloves will protect you against bites from vectors (mosquitoes and ticks) that carry diseases. Tuck your trousers tightly into your boots. Wear a hazmat suit if available. Covering your skin will also reduce the chance of the agent entering your body through cuts or scratches. Practice high standards of personal hygiene to help prevent the spread of vectors.

Bathe with soap and water whenever possible. Use germicidal soap, if available. Wash your hair and body thoroughly, and clean under your fingernails. Clean teeth, gums, tongue, and the roof of your mouth frequently. Wash your clothing in hot, soapy water if you can. If you cannot wash your clothing, lay it out in an area of bright sunlight and allow the light to kill the micro-organisms.

15.2.5 SHELTER

You can build shelters under contamination conditions using the techniques in **Shelters** (Page 8-1). However, you must make slight changes to reduce the chance of biological contamination. Do not build your shelter in depressions in the ground. Aerosol sprays tend to concentrate in these depressions. Avoid building your shelter in areas of vegetation, as vegetation provides shade and some degree of protection to biological agents. Avoid using

Protect freshwater supplies from seawater contamination. Keep your body well shaded, both from overhead sun and from reflection off the sea surface. Allow ventilation of air; dampen your clothes during the hottest part of the day.

Do not exert yourself. Relax and sleep when possible. Fix your daily water ration after considering the amount of water you have, the output of solar stills and desalting kit, and the number and physical condition of your party.

If you don't have water, don't eat. If your water ration is 2 litres or more per day, eat any part of your ration or any additional food that you may catch, such as birds, fish, shrimp. The life raft's motion and anxiety may cause nausea. If you eat when nauseated, you may lose your food immediately. If nauseated, rest and relax as much as you can, and take only water.

To reduce your loss of water through perspiration, soak your clothes in the sea and wring them out before putting them on again. Don't overdo this during hot days when no canopy or sun shield is available. This is a trade-off between cooling and saltwater boils and rashes that will result. Be careful not to get the bottom of the raft wet.

Watch the clouds and be ready for any chance of showers. Keep the tarpaulin handy for catching water. If it is encrusted with dried salt, wash it in seawater. Normally, a small amount of seawater mixed with rain will hardly be noticeable and will not cause any physical reaction. In rough seas you cannot get uncontaminated fresh water.

At night, secure the tarpaulin like a sunshade, and turn up its edges to collect dew. It is also possible to collect dew along the sides of the raft using a sponge or cloth. When it rains, drink as much as you can hold.

Solar Still

When solar stills are available, read the instructions and set them up immediately. Use as many stills as possible, depending on the number of people in the raft and the amount of sunlight available. Secure solar stills to the raft with care. This type of solar still only works on flat, calm seas.

Desalting Kits

When desalting kits are available in addition to solar stills, use them only for immediate water needs or during long overcast periods when you cannot use solar stills. In any event, keep desalting kits and emergency water stores for periods when you cannot use solar stills or catch rainwater.

Water from Fish

Drink the aqueous fluid found along the spine and in the eyes of large fish. Carefully cut the fish in half to get the fluid along the spine and suck the eye. If you are so short of water that you need to do this, then do not drink any of the other body fluids. These other fluids are rich in protein and fat and will use up more of your reserve water in digestion than they supply.

Do Not –	
	• drink seawater.
	• drink urine.
	• drink alcohol.
	• smoke.
	• eat, unless water is available.

Sea Ice

In arctic waters, use old sea ice for water. This ice is bluish, has rounded comers, and splinters easily. It is nearly free of salt. New ice is grey, milky, hard, and salty. Water from icebergs is fresh, but icebergs are dangerous to approach. Use them as a source of water only in emergencies.

Sleep and rest are the best ways of enduring periods of reduced water and food intake. However, make sure that you have enough shade when napping during the day. If the sea is rough, tie yourself to the raft, close any cover, and ride out the storm as best you can. Relax is the key word – at least try to relax.

14.3 FOOD PROCUREMENT

In the open sea, fish will be the main food source. There are some poisonous and dangerous ocean fish, but, in general, when out of sight of land, fish are safe to eat. Nearer the shore there are fish that are both dangerous and poisonous to eat. There are some fish, such as the red snapper and barracuda that are normally edible but poisonous when taken from the waters of atolls and reefs.

14.3.1 FISH

In warm regions, gut and bleed fish immediately after catching. Cut fish that you do not eat immediately into thin, narrow strips and hang them to dry. A well-dried fish stays edible for several days. Fish not cleaned and dried may spoil in half a day. Fish with dark meat are very prone to decomposition. If you do not eat them all immediately, use the leftovers for bait.

Never eat fish that have pale, shiny gills, sunken eyes, flabby skin and flesh, or an unpleasant odour. Sea fish have a saltwater or clean fishy odour. The heart, blood, intestinal wall, and liver of most fish are edible. Cook the intestines. Also edible are the partly digested smaller fish that you may find in the stomachs of large fish. In addition, sea turtles are edible.

Shark meat is a good source of food whether raw, dried, or cooked. Shark meat spoils very rapidly due to the high concentration of urea in the blood, therefore, bleed it immediately and soak it in several changes of water.

Fishing Aids

You can use different materials to make fishing aids as described below —

Fish hooks	No survivor at sea should be without fishing equipment but if you are, improvise hooks as shown **Fishing Devices** (Page 4-13).
Fish lures	You can fashion lures by attaching hooks to any shiny piece of metal. Shredded rags and plastic also work well.
Bait	You can use small fish as bait for larger ones. Scoop the small fish up with a net. If you don't have a net, make one from cloth of some type. Hold the net under the water and scoop upward. Use all the guts from birds and fish for bait. When using bait, try to keep it moving in the water to give it the appearance of being alive.

Fishing Hints

Your fishing should be successful if you remember the following important hints —

- Be extremely careful with fish that have teeth and spines.
- Cut a large fish loose rather than risk capsizing. Try to catch small rather than large fish.
- Do not fish when large sharks are in the area.
- Watch for schools of fish – try to move close to these schools.
- Fish at night using a light. The light attracts fish.
- Always take care of your fishing equipment. Dry your fishing lines, clean and sharpen the hooks, and do not allow the hooks to stick into the fishing lines.

14.4 MEDICAL PROBLEMS FACED AT SEA

At sea, you may become seasick, get saltwater sores, or face some of the same medical problems that occur on land, such as dehydration or sunburn. These problems can become critical if left untreated.

Seasickness

Seasickness can result in —

- Extreme fluid loss and exhaustion.
- Others becoming seasick.
- Attraction of sharks to the raft.

To treat seasickness —

- Wash both the patient and the raft.
- Keep the patient from eating food until their nausea is gone.
- Have the patient lie down and rest.

Some survivors have said that erecting a canopy or using the horizon as a focal point helped overcome seasickness. Others have said that swimming alongside the raft for short periods helped, but extreme care must be taken if swimming.

Plants as a Food Source

Plant contamination occurs by the accumulation of fallout on their outer surfaces or by absorption of radioactive elements through their roots. Your first choice of plant food should be vegetables such as potatoes, turnips, carrots, and other plants whose edible portion grows underground. These are the safest to eat once you scrub them and remove their skins.

Second in order of preference are those plants with edible parts that you can decontaminate by washing and peeling their outer surfaces. Examples are bananas, apples, tomatoes and other such fruits and vegetables.

Any smooth-skinned vegetable, fruit, or plant that you cannot easily peel or effectively decontaminate by washing will be your third choice of emergency food.

The rougher the surface of the food is, the more radioactive particles it will trap. Rough-surfaced plants (such as lettuce and dried fruits) should only be eaten as a last resort because they cannot be easily decontaminated by peeling or washing.

In general, you can use any plant food that is ready for harvest if you can effectively decontaminate it. Growing plants, however, can absorb some radioactive materials through their leaves as well as from the soil, especially if rains have occurred during or after the fallout period. Avoid using these plants for food except in an emergency.

15.2 BIOLOGICAL ENVIRONMENTS

In a WWIII scenario, biological weapons may be deployed. Even if not deployed in your immediate area, winds can spread the agents over a wide area.

15.2.1 BIOLOGICAL AGENTS AND EFFECTS

Biological agents are micro-organisms that can cause disease among people, animals, or plants. They can also cause the deterioration of material. These agents fall into two broad categories – pathogens (germs) and toxins.

Pathogens are living micro-organisms that cause lethal or incapacitating diseases, such as bacteria, rickettsiae, fungi, and viruses. Toxins are poisons that plants, animals, or micro-organisms produce naturally. Possible biological warfare toxins include a variety of neurotoxic (affecting the central nervous system) and cytotoxic (causing cell death) compounds.

Germs

Only a few germs are needed to start an infection, especially if inhaled into the lungs. Germs are tiny and weigh so little that they can spread far and enter places that aren't airtight. Buildings can trap them and cause a higher concentration.

Germs must multiply inside the body and overcome the body's defences – a process called the incubation period. Incubation periods vary from several hours to months. Most germs must live within another host, such as you, to survive and grow. Outside a host most germs die rapidly.

Some germs can form protective shells called spores and survive outside the host. Spore-producing agents are a long-term hazard you must neutralize by decontaminating infected areas and people. Fortunately, most agents are not spore-producing. These agents must find a host within a day or so of their delivery or they die. Germs have three basic routes of entry into your body – through the respiratory tract, through a break in the skin, and through the digestive tract. Symptoms of infection vary according to the disease.

Toxins

Botulism is an example of a toxin that is produced by the botulin bacteria. Modern science can produce these toxins without the need for the bacteria. Yay for science. Toxins may produce effects similar to chemical agents, although victims may not respond to first aid measures in the same way as for a chemical agent. Toxins enter the body in the same manner as germs. However, some toxins, unlike germs, can penetrate unbroken skin. Symptoms appear almost immediately, since there is no incubation period. Many toxins are extremely lethal, even in very small doses. Symptoms may include any of the following —

- Dizziness.
- Mental confusion.
- Blurred or double vision.
- Fever.
- Aching muscles.
- Tiredness.

Safest Water Sources

Water from springs, wells, or other underground sources that undergo natural filtration will be your safest source. Water found in the pipes or containers of abandoned houses will also be free from radioactive particles. This water will be safe to drink, although you will have to take precautions against bacteria in the water. Snow taken from 15 cm or more below the surface is also a safe source of water.

Streams and Rivers

Water from streams and rivers will be relatively free from fallout within days after the nuclear explosion because of dilution. If possible, filter such water before drinking to get rid of radioactive particles. The best filtration method is to dig sediment holes or seepage basins along the side of a water source. The water will seep into the hole through the soil that will filter contaminated fallout that settled on the body of water. This method can remove up to 99 percent of the radioactivity in water. You must cover the hole in order to prevent further contamination. See **Water Filtration Devices** (Page 3-6) for an example of a filter.

Standing Water

Water from standing sources is likely to be contaminated, though most of the heavier, long-lived radioactive isotopes will settle to the bottom. Use this technique to purify the water —

- Fill a bucket 3/4 with contaminated water
- Take dirt from 10 cm or more below the ground and stir it into the water. Use about 2.5 cm of dirt for every 10 cm of water.
- Stir the water until most particles are suspended in the water.
- Let the water settle for at least 6 hours, then dip out the clear water.
- Purify this water using a filtration device.

The settling dirt will carry most of the fallout particles to the bottom and cover them. As a further precaution against disease, treat water with purification tablets, boil it or distil it.

15.1.9 FOOD PROCUREMENT

Although it is a problem to obtain food in a contaminated area, it is not impossible. There are special procedures in selecting and preparing foods for use. Securely packaged foods, such as canned foods are safe for use. Supplement these with any food you can find outside your shelter. Most processed foods you may are safe for use after decontaminating them. These include packaged foods after removing the containers or washing them free of fallout particles.

If little or no processed food is available in your area, you may have to supplement your diet with local food sources, such as animals and plants.

Animals as a Food Source

Most of the wild animals living in a fallout area are likely to become sick or die during the first month after a nuclear explosion. Even though animals may not be free from harmful radioactive materials, you can and must use them in survival conditions as a food source if other foods are not available. With careful preparation and by following several important principles, animals can be safe food sources.

Do not eat an animal that appears to be sick. It may have developed a bacterial infection as a result of radiation poisoning. Contaminated meat could cause severe illness or death if eaten.

Carefully skin all animals to prevent particles on the skin from entering the body. Do not eat meat close to the bones and joints as an animal's skeleton contains over 90 percent of the radioactivity. The remaining animal muscle tissue, however, will be safe to eat. Before cooking it, cut the meat away from the bone, leaving at least 3 mm of meat on the bone. Discard all internal organs since they tend to concentrate radioactivity. Cook all meat until it is very well done. To ensure this, cut it into pieces less than 15 mm thick before cooking.

The extent of contamination in fish and aquatic animals will be much greater than that of land animals. This is also true for water plants, especially in coastal areas. Use aquatic food sources only in conditions of extreme emergency.

All eggs, even if laid during the period of fallout, will be safe to eat. Completely avoid milk from any animals in a fallout area because animals absorb large amounts of radioactivity from the plants they eat.

Saltwater Sores

These sores result from a break in skin exposed to saltwater for an extended period. The sores may form scabs and pus. Do not open or drain. Flush the sores with fresh water, if available, and allow to dry. Apply an antiseptic, if available.

Immersion Rot, Frostbite, and Hypothermia

These problems are similar to those encountered in cold weather environments. Symptoms and treatment are the same as covered in Chapter 13.

Blindness/Headache

If flame, smoke, or other contaminants get in the eyes, flush them immediately with salt water, then with fresh water, if available. Apply ointment, if available. Bandage both eyes 18 - 24 hours, or longer if damage is severe. If the glare from the sky and water causes your eyes to become bloodshot and inflamed, bandage them lightly. Try to prevent this problem by wearing sunglasses. Improvise sunglasses if necessary.

Constipation

This condition is a common problem on a raft. Do not take a laxative, as this will cause further dehydration. Exercise as much as possible and drink an adequate amount of water, if available.

Difficult Urination

This problem is not unusual and is due mainly to dehydration. It is best not to treat it, as it could cause further dehydration.

Sunburn

Sunburn is a serious problem in sea survival. Try to prevent sunburn by staying in shade and keeping your head and skin covered. Use cream or Chap Stick from your first aid kit. Remember, reflection from the water also causes sunburn.

14.5 SHARKS

Whether you are in the water or in a boat or raft, you may see many types of sea life around you. Some may be more dangerous than others. Generally, sharks are the greatest danger to you. Other animals such as whales, porpoises, and stingrays may look dangerous, but really pose little threat in the open sea.

Consider any shark longer than 1 meter dangerous. Sharks in the tropical and subtropical seas are far more aggressive than those in temperate waters.

A shark will strike at injured or helpless animals. Sight, smell, or sound may guide them to their prey. Sharks have an acute sense of smell and the smell of blood in the water excites them. They are also very sensitive to any abnormal vibrations in the water. The struggles of a wounded animal or swimmer, underwater explosions, or even a fish struggling on a fish line will attract a shark.

Sharks can bite from almost any position; they do not have to turn on their side to bite. The jaws of some of the larger sharks are so far forward that they can bite floating objects easily without twisting to the side.

Sharks may hunt alone, but reports often cite more than one shark. The smaller sharks tend to travel in schools and attack in mass. Whenever one of the sharks finds a victim, the other sharks will quickly join it. Sharks will eat a wounded shark as quickly as their prey.

Some of the measures that you can take to protect yourself against sharks when you are in the water are —

- Stay with other swimmers. A group can maintain a 360-degree watch. A group can either frighten or fight off sharks better than one man.
- Always watch for sharks. Keep all your clothing on, to include your shoes. Historically, sharks have attacked the unclothed men in groups first, mainly in the feet. Clothing also protects against abrasions should the shark brush against you.
- Avoid urinating. If you must, only do so in small amounts. Let it dissipate between discharges.

If attacked, kick and strike the shark. Hit the shark on the gills or eyes if possible. If you hit the shark on the nose, you may injure your hand if it glances off and hits its teeth.

When you are in a raft and see sharks —

- Do not fish. If you have hooked a fish, let it go. Do not clean fish in the water.
- Do not throw garbage overboard.
- Do not let your arms, legs, or equipment hang in the water.
- Keep quiet and do not move around.
- Bury all dead as soon as possible. If there are many sharks in the area, conduct the burial at night.

When you are in a raft and a shark attack is imminent, hit the shark with anything you have, except your hands. You will do more damage to your hands than the shark. If you strike with an oar, be careful not to lose or break it.

14.6 DETECTING LAND

You should watch carefully for any signs of land. There are many indicators that land is near.

A fixed cumulus cloud in a clear sky or in a sky where all other clouds are moving often hovers over or slightly downwind from an island.

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

In the arctic, light-coloured reflections on clouds often indicate ice fields or snow-covered land. These reflections are quite different from the dark grey ones caused by open water.

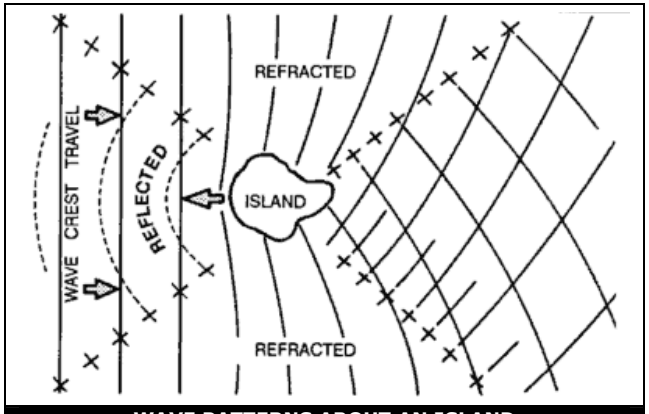
Deep water is dark green or dark blue. Lighter colour indicates shallow water, which may mean land is near.

At night, or in fog, mist, or rain, you may detect land by odours and sounds. The musty odour of mangrove swamps and mud flats carry a long way. You hear the roar of surf long before you see the surf. The continued cries of seabirds coming from one direction indicate their roosting place on nearby land.

There usually are more birds 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 land. During the day, birds are searching for food and the direction of flight has no significance.

Mirages occur at any latitude, but they are more likely in the tropics, especially during the middle of the day. Be careful not to mistake a mirage for nearby land. A mirage disappears or its appearance and elevation change when viewed from slightly different heights.

You may be able to detect land by the pattern of the waves (refracted) as they approach land. By travelling with the waves and parallel to the slightly turbulent area marked "X" on the illustration, you should reach land.



WAVE PATTERNS ABOUT AN ISLAND

You can construct a simple roof from a poncho anchored down with dirt or rocks. You can remove debris from the top of the poncho by beating it from the inside. This cover will not offer shielding from the radioactive particles deposited on the surface, but it will increase the distance from the fallout source and keep the shelter area from further contamination.

Shelter Site Selection and Preparation

To reduce your exposure time and dosage received, follow these guidelines —

- Seek an existing shelter that you can improve. If none is available, dig a trench.
- Dig the shelter deep enough to get good protection, then enlarge it as required for comfort.
- Cover the top of trench with any readily available material and a thick layer of earth, if you can do so without leaving the shelter. While a roof is desirable, it is probably safer to do without them than to expose yourself to radiation outside your position.
- While building your shelter, keep your body covered to protect against beta burns.
- Clean the shelter of any surface deposit to remove contaminated materials from your area. The cleaned area should extend at least 2 meters beyond your shelter.
- Decontaminate anything you bring into the shelter. This includes clothing and footgear. If you have contaminated clothing, remove it and bury it under a foot of earth until the radioactivity decays. If the clothing is dry, decontaminate it by beating or shaking it outside the shelter to remove the radioactive dust. You may use any body of water, even if contaminated, to rid materials of excess particles. Dip the material into the water and shake it. Do not wring it out, this will trap the particles.
- If possible without leaving the shelter, wash your body thoroughly with soap and water, even if the water may be contaminated. This washing will remove most of the radioactive particles. If water is not available, wipe your face and any other exposed skin surface to remove contaminated dust and dirt. You may wipe your face with a clean piece of cloth or a handful of uncontaminated dirt. You get this uncontaminated dirt by scraping off the top few inches of soil and using the "clean" dirt.
- Upon completing the shelter, lie down, keep warm, and rest as much as possible.
- Don't panic if you experience nausea and symptoms of radiation sickness. Your main danger from radiation sickness is infection. There is no first aid for this sickness. Resting, drinking fluids, taking any medicine that prevents vomiting, maintaining your food intake, and preventing additional exposure will help avoid infection and aid recovery. Even small doses of radiation can cause these symptoms which may disappear in a short time.

Exposure Timetable

The following timetable provides you with the information needed to avoid receiving serious dosage and still let you cope with survival problems —

- Complete isolation from 4 to 6 days following delivery of the last weapon.
- A very brief exposure to procure water on the third day is permissible, but exposure should not exceed 30 minutes.
- One exposure of not more than 30 minutes on the seventh day.
- One exposure of not more than 1 hour on the eighth day.
- Exposure of 2 to 4 hours from the ninth day through the twelfth day.
- Normal operation, followed by rest in a protected shelter, from the thirteenth day on.
- In all instances, make your exposures as brief as possible. Consider only mandatory requirements as valid reasons for exposure. Decontaminate at every stop.

The times given above are conservative. If forced to move after the first or second day, you may do so, Make sure that the exposure is no longer than absolutely necessary.

15.1.8 WATER PROCUREMENT

In a fallout area, water sources will be contaminated. If you wait at least 48 hours before drinking any water to allow for radioactive decay and select the safest possible water source, you will greatly reduce the danger of ingesting harmful amounts of radioactivity.

Although many factors (wind direction, rainfall, and sediment) will influence your choice in selecting water sources, consider the following guidelines.

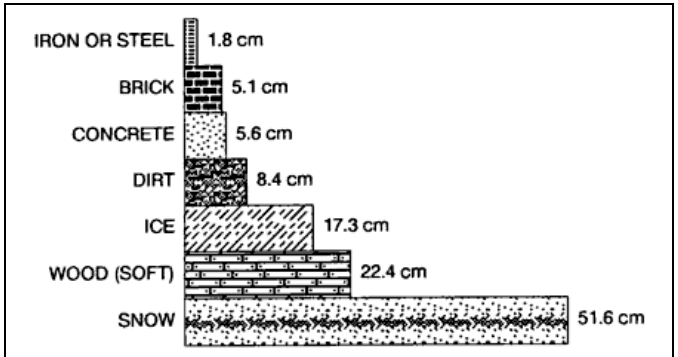
15.1.7 SHELTER

The effectiveness of shielding material depends on its thickness and density. An ample thickness of shielding material will reduce the level of radiation to negligible amounts.

Speed in finding shelter is absolutely essential. Five minutes to locate the shelter is a good guide. Without shelter, the dosage received in the first few hours will exceed that received during the rest of a week in a contaminated area. The dosage received in this first week will exceed the dosage accumulated during the rest of a lifetime in the same contaminated area.

Shielding Materials

The thickness required to weaken gamma radiation from fallout is far less than that needed to shield against initial gamma radiation. Fallout has less energy than a nuclear detonation's initial radiation. For fallout radiation, a relatively small amount of shielding material can provide adequate protection. This table gives an idea of the thickness of various materials needed to reduce residual gamma radiation by 50%.



THICKNESS NEEDED TO HALVE GAMMA RADIATION

The principle is useful in understanding the absorption of radiation by various materials. If 5 cm of brick reduce the gamma radiation level by 50%, adding another 5 cm will reduce the intensity by another half – to 25%.

Natural Shelters

Terrain that provides natural shielding and easy shelter construction is the ideal location for an emergency shelter. Remember – speed is of the essence. Good examples are ditches, ravines, rocky outcropping, hills, and river banks. In level areas without natural protection, dig a fighting position or slit trench.

Trenches

When digging a trench, work from inside the trench as soon as it is large enough to cover part of your body thereby not exposing all your body to radiation. In open country, try to dig the trench from a prone (on your stomach) position, stacking the dirt evenly around the trench. On level ground, pile the dirt around your body for additional shielding. Depending upon soil conditions, shelter construction time will vary from a few minutes to a few hours. If you dig as quickly as possible, you will reduce the dosage you receive.

Other Shelters

While an underground shelter covered by 1 meter of earth provides the best protection against radiation, the following structures (in order listed) offer the next best protection —

- Caves and tunnels covered by more than 1 meter of earth.
- Storm or storage cellars.
- Culverts.
- Basements or cellars of abandoned buildings.
- Abandoned buildings made of stone or mud.

Roofs

A roof is not mandatory. Build one only if the materials are readily available with only a brief exposure to outside contamination. If building a roof would require extended exposure to penetrating radiation, it would be wiser to leave the shelter roofless. A roof's sole function is to reduce radiation from the fallout source to your body. Unless you use a thick roof, a roof provides very little shielding.

15 World War III Survival

In a third world-war situation, countries going for broke may unleash everything at their disposal including nuclear, chemical and biological weapons – or all three.

If such a scenario is possible in your present location, you should consider moving to a less targetable area. Weapons of mass destruction did not earn their name because they are easy to survive.

This chapter will therefore sound like three "you're screwed" scenarios. However, if you are caught in the periphery of such an attack, this chapter will help you to understand the nature of the hazards and may save your life.

15.1 THE NUCLEAR ENVIRONMENT

If you are in the vicinity of a nuclear blast, there will be no mistake as to the type of attack upon you.

15.1.1 EFFECTS OF NUCLEAR WEAPONS

The effects of nuclear weapons are classified as either initial or residual. Initial effects occur in the immediate area of the explosion and are hazardous in the first minute after the explosion. Residual effects can last for days or years. The principal initial effects are blast and radiation.

Blast

The initial blast is the brief and rapid movement of air away from the explosions centre and the pressure from this movement. Strong winds accompany the blast. The blast will hurl debris, collapse lungs, rupture eardrums, destroy structures, and cause immediate injury or death with its crushing effect.

Thermal Radiation

Thermal radiation is the heat and light that a nuclear explosions fireball emits. Light radiation consists of visible, ultraviolet and infrared light. This radiation produces extensive fires, skin burns, and flash blindness.

Nuclear Radiation

Initial nuclear radiation consists of intense gamma rays and neutrons produced during the first minute after the explosion. This causes extensive damage to body cells. Radiation damage may cause headaches, nausea, vomiting, diarrhoea, and death – depending on the dose received. The problem in protecting yourself against initial radiation is that you may have received a dangerous dose before taking protective action. Anyone exposed to lethal amounts of initial radiation may as well have been killed by the initial blast or thermal radiation.

Residual radiation consists of all radiation produced after one minute from the explosion. It has more effect on you than initial radiation. Residual radiation is discussed further in the chapter.

Electro-magnetic pulse (EMP)

Any electrical equipment in the vicinity of a nuclear blast will be subject to a massive magnetic pulse. Such a pulse will induce large currents in any conductive material. This has the effect of destroying almost all electrical and electronic equipment. Low voltage devices are more susceptible than high voltage devices.

Despite some misconceptions, it does not matter wether the device is turned on or even connected to power. Anything with a chip, transistor or diode will be rendered useless.

Being **completely** surrounded by a conductive material can divert, or at least lessen, the effects of the pulse within the conductive container. Iron and aluminium are good shields against magnetic interference.

15.1.2 TYPES OF NUCLEAR BLASTS

There are three types of nuclear bursts – airburst, surface burst, and sub-surface burst. The type of burst directly affects your chances of survival. A sub-surface burst occurs completely underground or underwater. Its effects remain beneath the surface or in the immediate area where the surface collapses into a crater over the burst's location.

- **Sub-surface bursts** cause you little or no radioactive hazard unless you enter the immediate area of the crater. This type of deployment also produces the least danger of EMP damage to electrical equipment.
- **Airbursts** occur in the air above its intended target. The airburst provides the maximum radiation effect on the target and is, therefore, most dangerous to you in terms of immediate nuclear effects. An airburst also presents the greatest radius of EMP damage to electrical equipment.
- **Surface bursts** occur on the ground or water surface. Large amounts of fallout result, with serious long-term effects for you. This type of burst is your greatest nuclear hazard.

15.1.3 NUCLEAR INJURIES

Most injuries in the nuclear environment result from the initial effects of the detonation. These injuries are classed as blast, thermal, or radiation injuries. Further injuries may also occur if you do not take proper precautions against fallout.

Blast Injuries

Blast pressure can collapse lungs and rupture internal organs. Projectile wounds occur as the explosion's hurls debris at you. Blast pressure may throw you long distances, and you will suffer severe injury upon impact. Substantial cover and distance from the explosion are the best protection against blast injury. Cover blast injury wounds as soon as possible to prevent the entry of radioactive dust particles.

Thermal Injuries

The heat and light the nuclear fireball emits causes thermal injuries. Flash blindness can also occur. This blindness may be permanent or temporary depending on the degree of exposure. Substantial cover and distance from the explosion can prevent thermal injuries. First aid for thermal injuries is the same as first aid for burns. Cover open wounds to prevent the entry of radioactive particles. Wash all burns before covering.

Radiation Injuries

Neutrons, gamma radiation, alpha radiation, and beta radiation cause radiation injuries. Neutrons are high-speed, extremely penetrating particles that actually smash cells within your body. They will turn you into a pillar of salt. Gamma radiation is similar to X-rays and is also a highly penetrating radiation. During the initial fireball stage of a nuclear detonation, initial gamma radiation and neutrons are the most serious threat. Beta and alpha radiation are radioactive particles normally associated with radioactive dust from fallout. They are short-range particles and you can easily protect yourself against them if you take precautions. See **Bodily Reactions to Radiation** below, for the symptoms of radiation injuries.

15.1.4 RESIDUAL RADIATION

Residual radiation is all radiation emitted after 1 minute from the instant of the nuclear explosion. Residual radiation consists of induced radiation and fallout.

Induced Radiation

Induced radiation is a relatively small, intensely radioactive area directly underneath the nuclear weapon's fireball. The irradiated earth in this area will remain highly radioactive for an extremely long time. You should not travel into an area of induced radiation.

Fallout

Fallout consists of radioactive soil and water particles, as well as weapon fragments. During a surface detonation, large amounts of soil and water are vaporized along with the bomb's fragments, and forced to altitudes of 25 km or more. When these vaporized contents cool, they can form over 200 different radioactive products. The vaporized contents condense into tiny radioactive particles that the wind carries and they fall to earth as radioactive dust. Fallout emits alpha, beta, and gamma radiation. Alpha and beta radiation are relatively easy to counteract, and residual gamma radiation is much less intense than from the initial blast.

15.1.5 BODILY REACTIONS TO RADIATION

The effects of radiation can be classed as either chronic or acute. Chronic effects occur some years after exposure, such as cancer and genetic defects. Some acute effects occur within hours after exposure to radiation. Radiation sickness and beta burns are examples of acute

effects. Symptoms include nausea, diarrhoea, vomiting, fatigue, weakness, and loss of hair. Penetrating beta rays cause radiation burns – the wounds are similar to fire burns.

Recovery Capability

The extent of damage depends on the part of the body exposed, the length of exposure, and its ability to recover. The brain and kidneys have little recovery capability. Other parts (skin and bone marrow) have a great ability to recover from damage. Usually, a dose of 600 centigrams to the entire body will result in almost certain death. If only your hands received this same dose, your overall health would not suffer much, although your hands would suffer severe damage.

External and Internal Hazards

Highly penetrating gamma radiation or the less penetrating beta radiation that causes burns can cause external damage. Alpha or beta radiation-emitting particles inside the body can cause internal damage. The external hazard produces overall irradiation and beta burns. The internal hazard results in irradiation of critical organs such as the gastrointestinal tract, thyroid gland, and bone.

A very small amount of radioactive material can cause extreme damage to internal organs. The internal hazard can enter the body through consumption of contaminated water or food or by absorption through cuts or abrasions. Material that enters the body through breathing presents only a minor hazard. You can greatly reduce the internal radiation hazard by using good personal hygiene and carefully decontaminating your food and water.

Symptoms

The symptoms of radiation include nausea, diarrhoea, and vomiting. This is due to the extreme sensitivity of the gastrointestinal tract to radiation. The severity and speed of onset after exposure are indicators of the degree of radiation damage. The gastrointestinal damage can come from either the external or the internal radiation hazard.

15.1.6 COUNTERMEASURES AGAINST EXTERNAL RADIATION

Knowledge of the radiation hazards is extremely important in surviving in a fallout area. It is also critical to know how to protect yourself from the most dangerous form of residual radiation – penetrating external radiation.

The means you can use to protect yourself from penetrating external radiation are time, distance, and shielding. You can reduce the level of radiation and help increase your chance of survival by controlling the duration of exposure. You can also get as far away from the radiation source as possible. Finally you can place some radiation-absorbing or shielding material between you and the radiation.

Time

Time is important in two ways. First, The longer you are exposed to a radioactive source, the greater the dose you will receive. Second, radioactivity decreases or decays over time.

Distance

Distance provides effective protection against penetrating gamma radiation because radiation intensity decreases significantly with every metre from the source.

Shielding

Shielding is the most important method of protection from penetrating radiation. Shielding provides the greatest protection and is the easiest to use under survival conditions. Shielding works by absorbing or weakening the penetrating radiation, thereby reducing the amount of radiation reaching your body. The denser the material, the better the shielding effect. Lead, iron, concrete, and water are good examples of shielding materials.

Special Medical Aspects

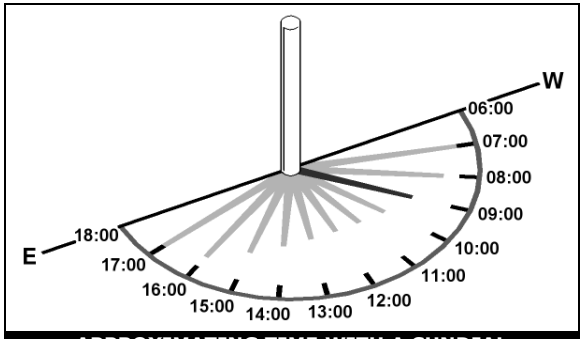
Fallout material in your area requires changes in first aid procedures. Cover all wounds to prevent contamination and the entry of radioactive particles. Wash burns of beta radiation, then treat them as ordinary burns. Take extra measures to prevent infection. Your body will be extremely sensitive to infections due to changes in your blood chemistry. Pay close attention to the prevention of colds or respiratory infections. Rigorously practice personal hygiene to prevent infections. Cover your eyes with improvised goggles to prevent the entry of particles.

18.1.2 DETERMINING TIME

Once you have found the East-West line, you can create a sundial to approximate the local time. Place a vertical stick in the centre of the East-West line.

When the shadow is cast on the West line, the time is approximately 06:00 AM. When the shadow is cast on the East line, the time is approximately 06:00 PM.

The North-South line is 90° to the East-West. When the shadow is cast along this line, and at its shortest, the time is 12 noon.



APPROXIMATING TIME WITH A SUNDIAL

This is as close to local time as you are likely to need. Unless you work for NASA and need to coordinate space shuttle launches, in which case – good luck with that.

18.1.3 USING A WATCH TO DETERMINE DIRECTION

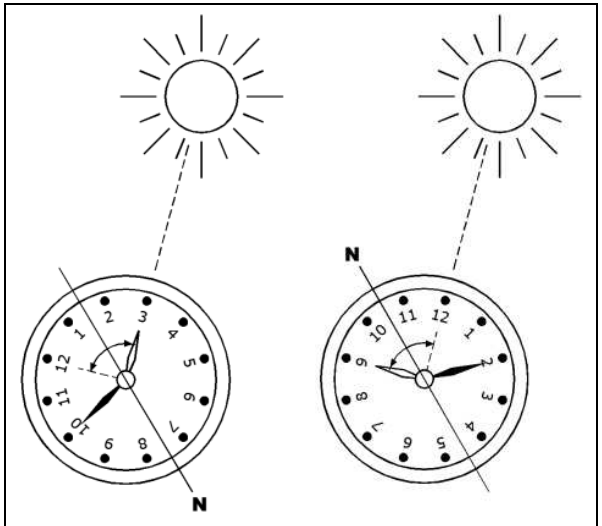
You can determine direction using a common analogue watch. The direction will only be accurate if you are using true local time.

The further you are from the equator, the more accurate this method will be.

If you only have a digital watch, draw a watch on paper or the ground with the correct time.

In the northern hemisphere, hold the watch horizontal and point the hour hand at the sun. Find the middle point between the hour hand and the 12 o'clock mark to get the north-south line.

In the southern hemisphere, point the 12 o'clock mark at the sun and find the midpoint between the 12 o'clock mark and the hour hand.



FINDING DIRECTION WITH A WATCH

18.2 USING THE MOON

Because the moon has no light of its own, we can only see it when it reflects the sun's light. As it orbits the earth on its 28-day circuit, the shape of the reflected light varies according to its position and our position in relation to the sun.

When the moon moves closer to the sun than the earth, the reflected light diminishes until the unlit side of the moon faces us. As the moon moves to the opposite side of the earth, we see the lit hemisphere straight on. This is the full moon. We can use this information to identify direction.

If the moon rises before the sun has set, the illuminated side will be the West. If the moon rises after midnight, the illuminated side will be the East. This discovery provides us with a rough East-West reference during the night.

16 Weather Prediction

Being able to predict the weather is a valuable tool. Knowing that bad weather is coming can give you warning to batten down, move to higher ground or cancel travel plans.

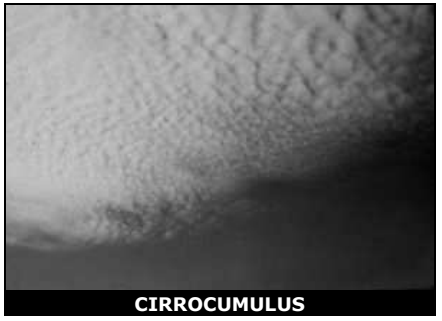
Knowing that good weather is on its way or continuing can give you the confidence to work on projects that may require a few days of clear skies.

16.1 CLOUD FORMATIONS

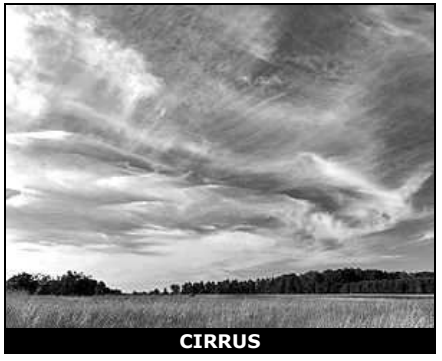
Clouds can be grouped into three categories, based on their appearance from the ground —

Cirrus	Thin, wispy streaks
Cumulus	Clumped globular forms
Stratus	Uniform 'blanket'

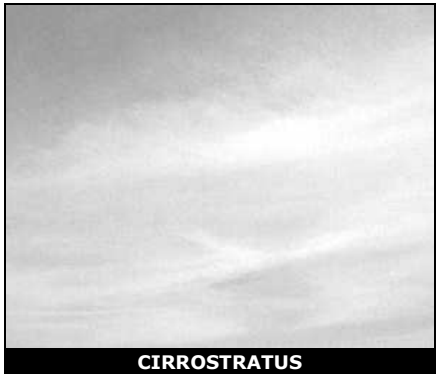
There are many variations and being able to recognise them is the first step in determining the coming weather.



CIRROCUMULUS



CIRRUS



CIRROSTRATUS

16.1.1 HIGH CLOUDS

High clouds indicate a high pressure system which generally indicates good weather.

Cirrocumulus (above 6 km / 20,000 ft)

These clouds are globe shaped and can form wave-like patterns. These indicate a high-pressure system which generally means fine, clear weather.

Cirrus (above 7 km / 23,000 ft)

Cirrus clouds are formed when water vapour freezes into ice crystals at high altitudes. Cirrus clouds are characterized by thin, wisplike strands. They indicate a high-pressure system which usually means fine weather, though may indicate rain within 36 hours.

Sometimes these clouds are so extensive that they are virtually indistinguishable from each other. This forms a layer of cloud referred to as cirrostratus.

If these clouds are not so extensive as to blur into one another (cirrostratus), they will not be rain producing clouds.

Cirrostratus (above 6 km / 20,000 ft)

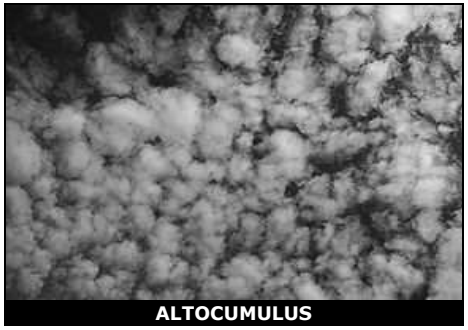
These clouds often form a white semi-transparent veil across the sky. You can still see the sun or moon, although diffused, through these clouds. Again these indicate a high-pressure system and good weather.

Sometimes cirrostratus clouds are so thin that they are barely visible. This may indicate a large amount of moisture in the atmosphere.

These clouds may indicate the beginning of a warm front and may signal rain in the next 12-24 hours.

16.1.2 MIDDLE CLOUDS


ALTOSTRATUS


ALTOCUMULUS

Altostratus (2-6 km / 8,000-20,000 ft)

Altostratus clouds are characterized by a generally uniform gray sheet or layer, lighter in colour than nimbostratus and darker than cirrostratus. The sun can be seen shining through them, and they frequently cover the sky. They are similar to lower altitude stratus clouds. On the coast they can bring rain but inland, especially in winter, they are uncertain.

Altocumulus (2-6 km / 8,000-20,000 ft)

Altocumulus clouds are characterized by globular masses or rolls in layers or patches, the individual elements being larger and darker than those of cirrocumulus and smaller than those of stratocumulus. These clouds often precede a cold front, and their presence on a warm, humid, summer morning frequently signals the development of thunderstorms later in the day.

16.1.3 LOW CLOUDS


CUMULUS


STRATOCUMULUS

Cumulus (base below 2 km / 6,500 ft – tops vary)

Cumulus clouds are fluffy, white, heaped-up clouds. These clouds, which are much lower than cirrus clouds, are often fair weather clouds. They usually appear around midday on a sunny day, looking like large cotton balls with flat bottoms. As the day advances, they may become bigger and push higher into the atmosphere. Piling up to appear like a mountain of clouds. These can turn into storm clouds.

Cumulus clouds are often precursors of other types of clouds, such as cumulonimbus, when influenced by weather factors such as instability, moisture, and temperature gradient.

Stratocumulus (usually below 2.4 km / 8,000 ft)

A dense grey cloud with darker shadings in patches, sheets or layers. Generally it is a fine weather cloud but can bring some light drizzle.

'Dull weather' commonly describes overcast stratocumulus days. If the air over land is moist and hot enough they may develop to various cumulus clouds, or more commonly, the sheets of thick stratocumuli may have a nimbostratus look to them. The distinction here is the amount of rain produced. On drier areas they quickly dissipate over land.

18 Expedient Direction Finding

In most end-of-the-world scenarios it is likely that satellites, and with that – GPS, will be not be functioning. It is also likely that in the event of a pole shift, the earth's magnetic field will be weak and erratic – rendering compasses useless.

There are several other methods by which you can determine direction by using the sun and the stars. These methods, however, will give you only a general direction.

Bear in mind also that the order in the heavens will be completely different after a shift so you will need to take note of the earth's new movement in relation to the sun moon and stars.

18.1 USING THE SUN AND SHADOWS

The earth's relationship to the sun can help you to determine direction on earth. For now, the sun rises in the east and sets in the west, but not exactly due east or west. There is also some seasonal variation. In the northern hemisphere, the sun will be due south when at its highest point in the sky, or when an object casts it's smallest shadow. In the southern hemisphere, this same noon sun will mark due north.

Shadows move clockwise in the northern hemisphere and counter clockwise in the southern hemisphere. With practice, you can use shadows to determine both direction and time of day. The shadow methods used for direction finding are the shadow-tip and watch methods.

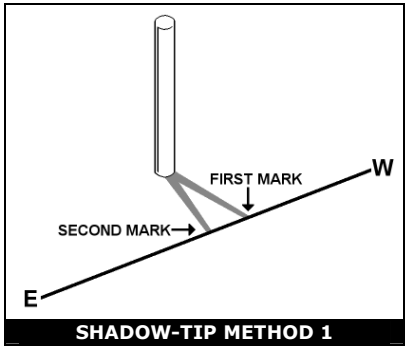
18.1.1 SHADOW-TIP METHODS

In the first shadow-tip method, find a straight stick 1 meter long and a level clear patch of dirt where the stick will cast a clear shadow. This method is simple and reasonably accurate.

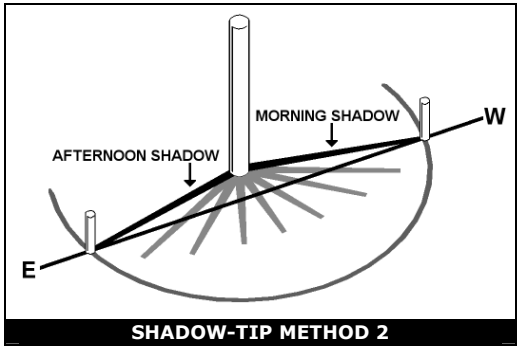
Step 1	Place the stick or branch into the ground at a level spot where it will cast a distinctive shadow. Mark the shadow's tip with a stone, twig, or other means.
Step 2	Wait 15 to 30 minutes until the shadow tip moves a few cm. Mark the shadow tip's new position in the same way as the first.
Step 3	Draw a straight line through the two marks to obtain an approximate east-west line.

An alternate method is more accurate but requires more time.

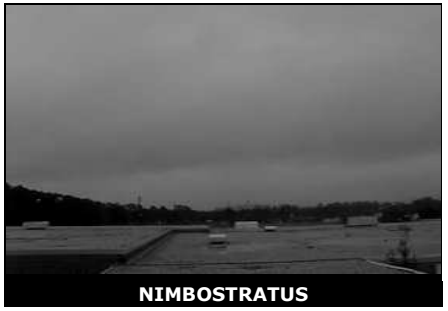
Step 1	Set up your shadow stick and mark the first shadow in the morning. Use a piece of string to draw a clean arc through this mark and around the stick.
Step 2	At midday, the shadow will shrink and disappear. In the afternoon, it will lengthen again and at the point where it touches the arc, make a second mark.
Step 3	Draw a line through the two marks to get an accurate east-west line.

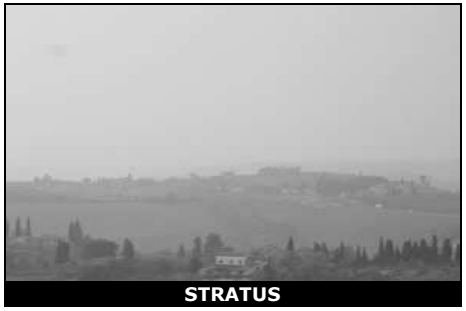


SHADOW-TIP METHOD 1



SHADOW-TIP METHOD 2


NIMBOSTRATUS


STRATUS

Nimbostratus (below 2.4 km / 8,000 ft)

A Nimbostratus cloud is characterized by a formless cloud layer that is almost uniformly dark gray. The prefix 'nimbo' is derived from the latin 'nimbus', meaning rain.

Usually, nimbostratus is a sign of steady moderate to heavy rain, as opposed to the shorter period of typically heavier rain released by a cumulonimbus cloud. However, the rain may evaporate before it reaches the ground. Precipitation may last for several days.

Stratus (below 2 km / 6,000 ft)

Stratus is latin for 'blanket' and used to describe flat, featureless clouds of low altitude varying in colour from dark gray to nearly white. When stratus clouds reach the ground, it is called fog.

These clouds are essentially above-ground fog formed either through the lifting of morning fog or when cold air moves at low altitudes over a region. These clouds do not usually bring heavy precipitation, although drizzle and snow may occur.

16.1.4 VERTICAL CLOUDS

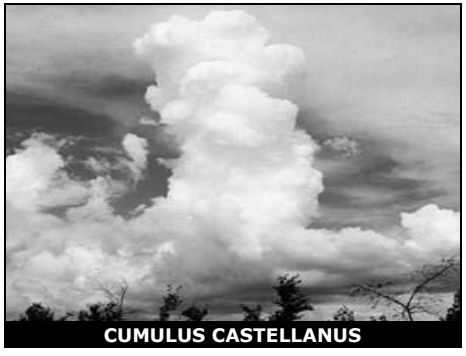
These clouds can have strong up-currents, rise far above their bases and form at many heights. The most well known form is the cumulonimbus.

Cumulonimbus (2-16 km / 6,500-60,000 ft)

Cumulonimbus is a type of cloud that is tall, dense, and involved in thunderstorms and other intense weather. It is a result of atmospheric instability. These clouds can form alone, in clusters, or along a cold front.

Well-developed cumulonimbus clouds are also characterized by a flat, anvil-like top. This anvil shape can precede the main cloud structure for many miles, causing anvil lightning. This is the tallest of the clouds. Lightning and gale-force winds often accompany the cloud mass. The storms can be extremely dangerous, doing great damage to the area.


CUMULONIMBUS


CUMULUS CASTELLANUS

Castellanus (2-6 km / 6,500-20,000 ft)

These towering clouds (cumulus castellanus and altocumulus castellanus) indicate mid-atmospheric instability. In the summer time expect the possibility of showers in the afternoon. These clouds can develop into cumulonimbus which will usually bring a thunderstorm.

16.2 BAROMETERS

Perhaps the most useful of weather instruments is the barometer. Air pressure plays a significant role in weather and, unlike wind speed/direction, temperature or humidity, cannot be sensed directly by the human body.

There are many types of barometers commercially available and I suggest you buy one that doesn't require power. To take an accurate reading from a liquid barometer will require a simultaneous temperature reading due to the density of the fluid changing with temperature.

However, a liquid barometer is often quicker to react than a mechanical (aneroid) thermometer due to play and 'stickiness' in the mechanisms. It is also not necessary to know the exact reading on any particular scale, as it is the overall trend that is important.

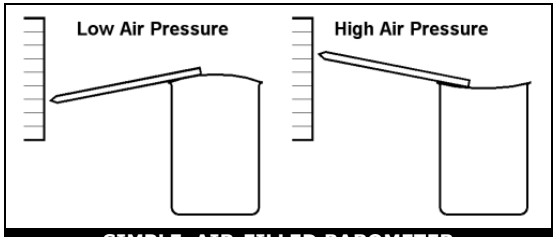
Read the instructions for your type of barometer and consult with your local weather reports to calibrate the device, although this is not strictly necessary.

Improvised Air-Filled Barometer

A simple barometer can be made using a large jar or other container with a flexible membrane stretched tightly over the top.

If you use a balloon or rubber glove for the membrane, inflate it first to pre-stretch it, then cut to fit.

The seal needs to be air-tight. This can be done with rubber bands or a few wraps of cordage.



SIMPLE AIR-FILLED BAROMETER

Future readings will be relative to the air pressure at the time it was sealed. The membrane will bulge out when the pressure drops, and will bulge in when the pressure rises.

You can simply watch the membrane to determine changes in air pressure, or you can attach a long stick as shown to act like a lever and expand the scale.

Eventually the rubber will fatigue but this will be slowed if you keep it out of the sun.

Improvised Liquid-Filled Barometer

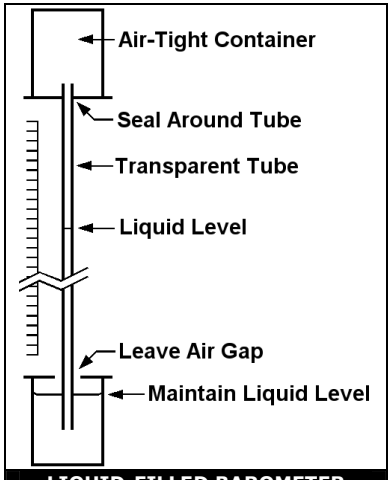
A more complicated barometer can be constructed if you have the time and the resources. If constructed properly, this instrument will last longer than Yoda.

The vertical tube needs to be about 2m (6 ft) tall to accommodate the range of likely pressures. It will be difficult to find a glass tube that long, but transparent beverage hose is inexpensive.

Beverage hose also has the advantage that it will not crack if the water freezes, and it is flexible which will simplify construction.

The top container is sealed airtight, while the bottom container is open to the air. It can be completely open, but if there is only a small air gap then evaporation is reduced.

When you have sealed the tube in the top container, create a partial vacuum by sucking the air out. Cap the end of the hose with your finger, and immerse in the bottom container before letting go. The liquid will then rise up the tube.



LIQUID-FILLED BAROMETER

When taking a reading, make sure the liquid in the bottom container is always at the same level. The level in the tube will rise with high pressure, and fall with low pressure.

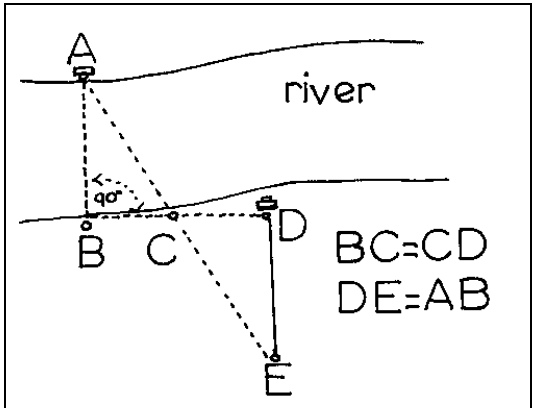
Bear in mind that temperature will affect the density of the liquid, so try to take a reading at the same temperature each time.

To provide extra stability and to stop violent swaying under heavy loads, the rope bridge can be 'anchored' by attaching a heavy stone to a rope and suspending it from the middle of the bridge span.

You should keep the anchor well above the flooding level of the river, otherwise strong currents would drag the stone and rip the bridge in two.

17.6 MEASURING CROSSING DISTANCE

- Select a visual site on the opposite bank to use as marker A and then drive a stake on the near bank B to match this site.
- Walk at 90° for a known number of paces and put another marker stake C.
- Continue an equal number of paces and put in a third marker D.
- Turn away from the river and keep moving back until the centre marker stake C lines up with visual marker A. Mark this spot E.
- The distance between E and D equals the distance of the river crossing.



MEASURING DISTANCE OF A RIVER OR RAVINE

17.4.1 VEGETATION OBSTACLES

Some water areas you must cross may have underwater and floating plants that will make swimming difficult. However, you can swim through relatively dense vegetation if you remain calm and do not thrash about. Stay as near the surface as possible and use the breaststroke with shallow leg and arm motion. Remove the plants around you as swim. When you get tired, float or swim on your back until you have rested enough to continue with the breaststroke.

The mangrove swamp is another type of obstacle that occurs along tropical coastlines. Mangrove trees or shrubs throw out many prop roots that form dense masses. To get through a mangrove swamp, wait for low tide. If you are on the inland side, look for a narrow grove of trees and work your way seaward through these. You can also try to find the bed of a waterway or creek through the trees and follow it to the sea. If you are on the seaward side, work inland along streams or channels. Be on the lookout for crocodiles that you find along channels and in shallow water. If there are any near you, leave the water and scramble over the mangrove roots. While crossing a mangrove swamp, it is possible to gather food from tidal pools or tree roots.

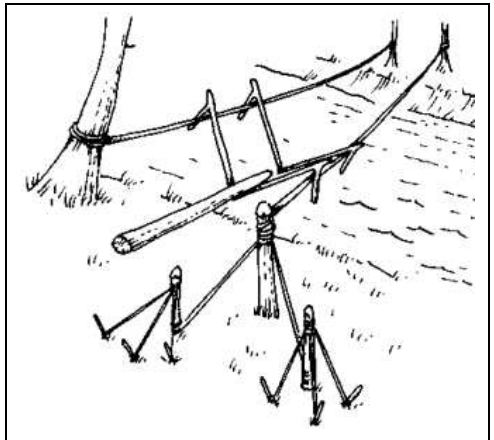
To cross a large swamp area, construct some type of raft.

17.5 ROPE BRIDGES

Building a rope bridge is no easy undertaking. This should be done only if the situation requires and allows, if you are crossing at this point often for example.

To build a rope bridge —

- Stretch two ropes taught across a river. Where possible trees should be used as the main support, but a **1-2-3 Anchor** (Page 8-3) can be used if made strong.
- Make a number of light 'V' frames, depending on the length of the crossing.
- The first V-frame is hooked onto the ropes and pushed forward with a long pole.
- The footing, a strong, straight sapling, is dropped into the crotch of the frame.
- The builder walks out along this and hooks on the next V-frame and pushes it out the required distance.
- These steps are repeated until the far bank is reached.

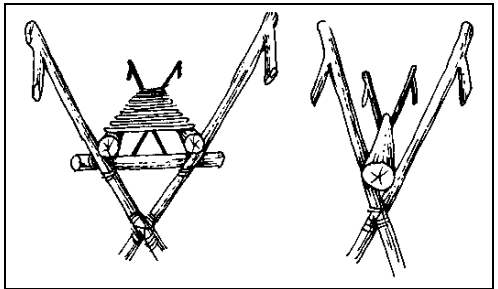


BEGINNING OF A ROPE BRIDGE

During building, bridges must not be overloaded – one worker at a time is the rule.

- Once the base poles have been extended to the far bank, crossbars should be lashed to the V-frames above the base pole.
- Short lengths of flat-split timber can then be lashed to these poles to provide secure decking.

If the situation is only semi-permanent, the single pole may be all that is needed. Be sure to lash it securely. The bottom frame lashings should be especially strong.



BRIDGE WITH AND WITHOUT DECK

16.3 GENERAL PREDICTION TIPS

These are no hard and fast rules for weather prediction, especially when looking at the local system from the ground, but these tips can give you a general idea of what is going on.

Check for Dew at Sunrise

If the grass is dry this can indicate clouds or strong breezes which can mean rain. If there's dew then it probably won't rain that day. This method is not reliable if it has rained overnight.

Red Sky at Night, Sailor's Delight, Red Sky at Morning, Sailor's Warning

Look for any sign of red in the sky (not a red sun). Depending on where you live, it will probably not be a bold orange or red most of the time.

If you see a red sky during sunset (when you're looking West), this can indicate a high pressure system with dry air that is stirring up dust particles. Since prevailing front movements and jet streams usually move from west to East (due to the rotation of the Earth below the atmosphere) the dry air is moving toward you.

A red sky in the morning (in the East) means that dry air has already moved past you and what follows behind it is a low pressure system that carries moisture.

Rainbow in the Morning, Heralds a Warning

A rainbow in the West at sunrise is the result of the rays of the sun striking moisture in the West. Most major storm fronts travel from West to East, and a rainbow in the west means moisture, which can mean rain is on its way.

A rainbow in the East at sunset means that the rain has passed and a sunny day is ahead.

Note the Wind Direction

Use a wind sock, weather vane, wet finger or simply drop a light piece of grass to determine the direction of the wind. Easterly winds can indicate an approaching storm front, westerly winds the opposite.

Strong winds indicate high pressure differences which can be a sign of advancing storm fronts.

Smell the Air

In a low pressure atmosphere, plants release their 'waste' which generates a smell like compost. A low pressure system can indicate bad weather approaching.

Swamps will release gasses just before a storm because of falling pressure.

According to a proverb, "flowers smell best before a rain". This is due to moist air. Humidity in the air can also usually be smelt, or felt directly. This usually means rain, but if you are in a tropical region, the humidity can build up and dissipate daily for a long time before raining.

Clouds on a Winter Night

This will bring warmer weather in the morning because the cloud cover prevents heat radiation that would lower the temperature on a clear night.

16.3.1 DROPPING PRESSURE

If the pressure is dropping, there can be many reasons why this is so —

- A low pressure system is approaching, such as a front or trough of low pressure
- An area of low pressure is not approaching, but deepening
- Both of the above conditions are present, in which case the pressure will drop rapidly, usually bringing heavier rains or snow. The greater the drop, the greater the winds will blow (usually from the direction of the equator)
- In this case, the weather will rapidly deteriorate and the pressure will continue to drop until the weather hits, then rise rapidly because cold air is heavy.
- Warm air movements (usually from the direction of the equator) will bring warm air, which is lighter, causing a pressure drop.
- Pressure also changes due to daily air temperature changes. From a slight high in the morning, to a slight minimum in the late afternoon, with a slight increase as the sun sets into the night. These changes will be less if there is cloud cover and therefore less heating from the sun.

16.3.2 OBSERVATION OF ANIMALS

- If birds are flying high in the sky there will probably be fair weather. Falling air pressure will cause discomfort in birds ears, so they fly low to alleviate it. Large numbers of birds roosting in trees or on power lines indicate rapidly falling pressure.
- Seagulls tend to stop flying and take refuge at the coast if a storm is coming.
- Animals, especially birds get quiet immediately before it rains.
- Cows will typically lie down before a thunderstorm. They also tend to stay close together if bad weather is on the way.
- Ants build their hills with very steep sides just before a rain.

16.3.3 OTHER EMPIRICAL WEATHER RULES

Stand with Your Back to the Wind

The low pressure system will be to your left and the high pressure system will be to your right.

If low clouds move in from the left the weather will deteriorate, if they come from the right the weather will improve. If the clouds move in the same direction as the surface wind, expect no change for at least 12 hours.

Observe the Moon at Night

If it is reddish or pale, dust is in the air. But if the moon is bright and sharply focused, it's probably because low pressure has cleared out the dust, and low pressure can mean rain.

A ring around the moon (caused by light shining through cirrostratus clouds associated with warm fronts and moisture) can indicate that rain will probably fall within the next three days.

Remember: Circle around the moon, rain or snow soon.

Green Hue in Thunderstorm (Cumulonimbus) Clouds

This indicates extreme vertical height and is often linked to hail and extreme downburst winds.

Observe the edges of Cumulus Clouds

Cumulus clouds that have dark, raggedy edges are dissipating (usually with sunset). Cumulus that is white with rounded edges is building and may develop into storm clouds in the afternoon.

Wind Direction

If the wind is blowing from the equator, this will cause a temperature increase. If they are moving toward the equator, the temperature will fall.

Make a Campfire

Smoke that rises steadily indicates high pressure. If the smoke swirls and descends, there is low pressure and rain could be on the way.

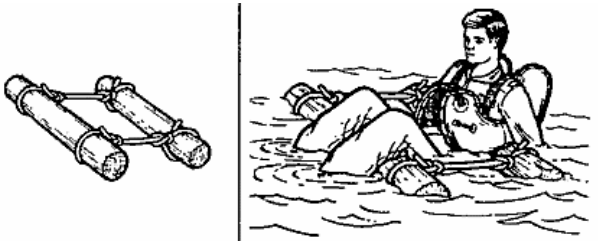
16.3.4 PERSISTENCE AND TRENDS

The rule of persistence means if the weather was good yesterday and the wind sky and pressure haven't appreciably changed, then the weather will probably be good for the next 12-24 hours. Don't forecast a change without a good reason.

Observe the Long-Term Local Trends

The skill of weather forecasting is about pattern recognition in the local area. Consider all the evidence and trends (clouds, pressure, winds, time of year etc). If no records are available, then keeping your own will aid you greatly.

And remember, forecasting is difficult beyond 24 to 48 hours, even for the experts.

Trousers	Knot each leg at the bottom and close the fly. With both hands, grasp the waistband and scoop air into the trousers. Quickly hold the top closed and hold it underwater so that the air will not escape. You now have water wings to keep you afloat as you cross the body of water. Wet the trousers before inflating to trap the air better. You may have to reinflate the trousers several times when crossing a large body of water.
Empty containers	Lash together her empty gas cans, water jugs, or other items that will hold air. Use them as water wings. Use only in a slow-moving river or stream.
Plastic bags and ponchos	Fill some plastic bags with air and secure them together at the opening. Or use a poncho and roll green vegetation tightly inside it so that you have a roll at least 20 cm in diameter. Tie the ends of the roll securely.
Logs	 Use a drift log or a log near the water as a float. Be sure to test the log before using it. Some tree logs, palm for example, will sink even when the wood is dead. Another method is to tie two logs about 60 cm apart. Sit between the logs with your back against one and your legs over the other.
Cattails	Gather stalks of cattails and tie them in a bundle 30 cm or more in diameter. The many air cells in each stalk cause a stalk to float until it rots. Test the cattail bundle to be sure it will support your weight before trying to cross a body of water.

There are many other flotation devices that you can devise by using some imagination. Just make sure to test the device before trying to use it.

17.4 OTHER WATER OBSTACLES

Other water obstacles that you may face are bogs, quagmire, muskeg, or quicksand. Do not try to walk across these. Trying to lift your feet while standing upright will make you sink deeper. Try to bypass these obstacles. If you are unable to bypass them, you may be able to bridge them using logs, branches, or foliage.

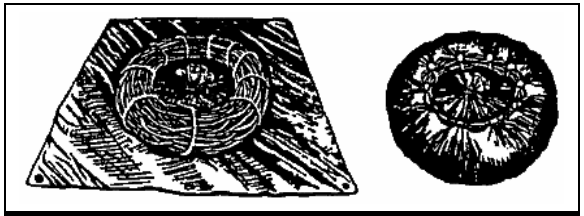
A way to cross a bog is to lie face down, with your arms and legs spread. Use a flotation device or form pockets of air in your clothing. Swim or pull your way across moving slowly and trying to keep your body horizontal.

In swamps, the areas that have vegetation are usually firm enough to support your weight. However, vegetation will usually not be present in open mud or water areas. If you are an average swimmer, however, you should have no problem swimming, crawling, or pulling your way through miles of bog or swamp.

Quicksand is a mixture of sand and water that forms a shifting mass. It yields easily to pressure and sucks down and engulfs objects resting on its surface. It varies in depth and is usually localized. Quicksand commonly occurs on flat shores, in silt-choked rivers with shifting watercourses, and near the mouths of large rivers. If you are uncertain whether a sandy area is quicksand, toss a small stone on it. The stone will sink in quicksand. Although quicksand has more suction than mud or muck, you can cross it just as you would cross a bog. Lie face down, spread your arms and legs, and move slowly across.

- Spread the second poncho on the ground, inner side up. If you need more buoyancy, place some fresh green brush on this poncho.
- Place the bundle, tied side down, on the centre of the second poncho. Wrap the second poncho around the bundle as before.
- Tie ropes around the raft about 30 cm from the end of each pigtail.
- Tie an empty canteen to the raft with a length of rope. This will help you tow the raft.

17.3.3 PONCHO DONUT RAFT



PONCHO DONUT RAFT

Another type of raft is the poncho donut raft. It takes more time to construct than the brush raft or Australian poncho raft, but it is effective. To construct it, use one poncho, small saplings, and rope or other material as follows —

- Make a framework for the circle by placing several stakes in the ground that roughly outline an inner and outer circle.
- Using young saplings, willow, or vines, construct a donut ring within the circles of stakes.
- Wrap several pieces of cordage around the ring about 30 cm apart and tie them securely.
- Push the poncho's hood to the inner side and tightly tie off the neck using the drawstring.
- Place the poncho on the ground, inner side up. Place the donut ring on the centre of the poncho. Wrap the poncho up and over the donut ring and tie off each grommet on the poncho to the ring.
- Tie an empty canteen to the raft with a length of rope. This will help you tow the raft.

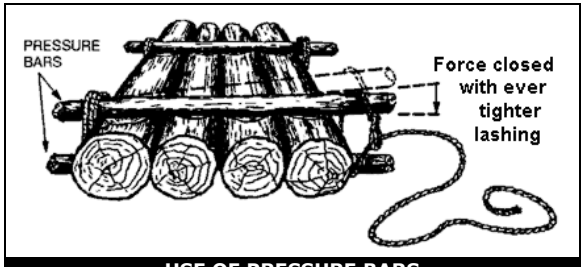
When launching any of the above rafts, take care not to puncture or tear it by dragging it on the ground. Before you start to cross the river or stream, let the raft lay on the water a few minutes to ensure that it floats.

If the river is too deep to ford, push the raft in front of you while you are swimming. The design of the above rafts do not allow them to carry a person's full body weight. Use them as a float to get you and your equipment safely across the river or stream.

Be sure to check the water temperature before trying to cross a river or water obstacle. If the water is extremely cold and you are unable to find a shallow fording place in the river, do not try to ford it. Devise other means for crossing. For instance, you might improvise a bridge by felling a tree over the river. Or you might build a raft large enough to carry you and your equipment. For this, however, you will need an axe, a knife, a rope or vines, and time.

17.3.4 LOG RAFT

You can make a raft using any dry, dead, standing trees for logs. However, spruce trees found in polar and subpolar regions make the best rafts. A simple method for making a raft is to use pressure bars lashed securely at each end of the raft to hold the logs together.



USE OF PRESSURE BARS

17.3.5 OTHER FLOTATION DEVICES

If the water is warm enough for swimming and you do not have the time or materials to construct one of the poncho-type rafts, you can use various flotation devices to negotiate the water obstacle. Some items you can use for flotation devices are —

17 Expedient Water Crossings

In a survival situation, you may have to cross a water obstacle. It may be in the form of a river, a stream, a lake, a bog, quicksand, quagmire, or muskeg. Even in the desert, flash floods occur, making streams an obstacle. Whatever it is, you need to know how to cross it safely.

17.1 RIVERS AND STREAMS

You can apply almost every description to rivers and streams. They may be shallow or deep, slow or fast moving, narrow or wide. Before you try to cross a river or stream, develop a good plan.

Your first step is to look for a high place from which you can get a good view of the river or stream. From this place, you can look for a place to cross. If there is no high place, climb a tree. Good crossing locations include —

- A level stretch where it breaks into several channels. Two or three narrow channels are usually easier to cross than a wide river.
- A shallow bank or sandbar. If possible, select a point upstream from the bank or sandbar so that the current will carry you to it if you lose your footing.
- A course across the river that leads downstream so that you will cross the current at about a 45-degree angle.

The following areas possess potential hazards; avoid them, if possible —

- Obstacles on the opposite side of the river that might hinder your travel. Try to select the spot from which travel will be the safest and easiest.
- A ledge of rocks that crosses the river. This often indicates dangerous rapids or canyons.
- A deep or rapid waterfall or a deep channel. Never try to ford a stream directly above or even close to such hazards.
- Rocky places. You may sustain serious injuries from slipping or falling on rocks. Usually, submerged rocks are very slick, making balance extremely difficult. An occasional rock that breaks the current, however, may help you.
- An estuary of a river. An estuary is normally wide, has strong currents, and is subject to tides. These tides can influence some rivers many kilometres from their mouths. Go back upstream to an easier crossing site.
- Eddies. An eddy can produce a powerful backward pull downstream of the obstruction causing the eddy and pull you under the surface.

The depth of a fordable river or stream is no deterrent if you can keep your footing. In fact, deep water sometimes runs more slowly and is therefore safer than fast-moving shallow water. You can always dry your clothes later, or if necessary, you can make a raft to carry your clothing and equipment across the river.

You must not try to swim or wade across a stream or river when the water is at very low temperatures. This swim could be fatal. Try to make a raft of some type. Wade across if you can get only your feet wet. Dry them vigorously as soon as you reach the other bank.

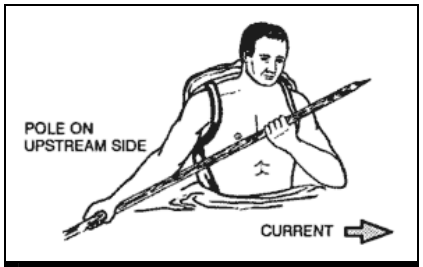
17.2 RAPIDS

If necessary, you can safely cross a deep, swift river or rapids. To swim across a deep, swift river, swim with the current, never fight it. Try to keep your body horizontal to the water. This will reduce the danger of being pulled under.

In fast, shallow rapids, lie on your back, feet pointing downstream, finning your hands alongside your hips. This action will increase buoyancy and help you steer away from obstacles. Keep your feet up to avoid getting them bruised or caught by rocks.

In deep rapids, lie on your stomach, head downstream, angling toward the shore whenever you can. Watch for obstacles and be careful of backwater eddies and converging currents, as they often contain dangerous swirls. Converging currents occur where new watercourses enter the river or where water has been diverted around large obstacles such as small islands.

To ford a swift, treacherous stream, apply the following steps —

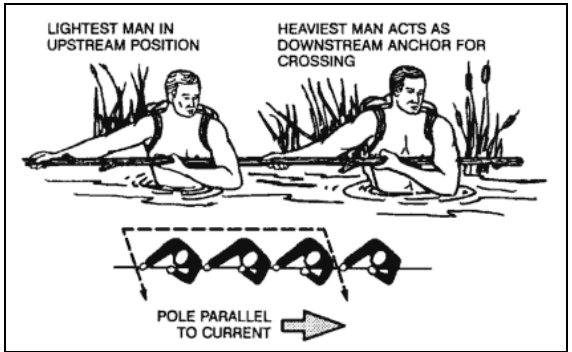


ONE MAN CROSSING SWIFT STREAM

- Remove your pants and shirt to lessen the water's pull on you. Keep your footgear on to protect your feet and ankles from rocks. It will also provide you with firmer footing.
- Tie your pants and other articles to the top of your rucksack or in a bundle, if you have no pack. This way, if you have to release your equipment, all your articles will be together.
- Carry your pack well up on your shoulders and be sure you can remove it if necessary. Not being able to get a pack off quickly enough can drag even the strongest swimmers under.
- Find a strong pole about 2 - 3 meters long to help you ford the stream. Grasp the pole and plant it firmly on your upstream side to break the current. Plant your feet firmly with each step, and move the pole forward a little downstream from its previous position, but still upstream from you. With your next step, place your foot below the pole. Keep the pole well slanted so that the force of the current keeps the pole against your shoulder.
- Cross the stream so that you will cross the downstream current at a 45° angle.

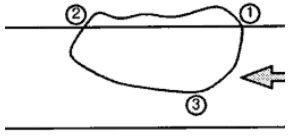
Using this method, you can safely cross currents usually too strong for one person to stand against. Do not concern yourself about your pack's weight, as the weight will help rather than hinder you in fording the stream.

If there are other people with you, cross the stream together. Ensure that everyone has prepared their pack and clothing as outlined above. Position the heaviest person on the downstream end of the pole and the lightest on the upstream end. In using this method, the upstream person breaks the current, and those below can move with relative ease in the eddy formed by the upstream person. If the upstream person gets temporarily swept off their feet, the others can hold steady while they regain their footing.

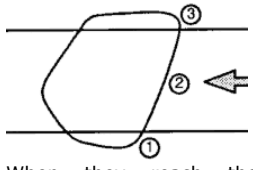


SEVERAL MEN CROSSING SWIFT STREAM

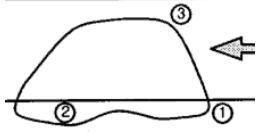
If you have three or more people and a rope available, you can use the technique shown to cross the stream. The length of the rope must be three times the width of the stream.



The person crossing is secured to the loop around the chest. The strongest person crosses first. The other two are not tied on - they pay out the rope as needed and can stop the person crossing from being washed away.



When they reach the bank, 1 unties themself and 2 ties on. 2 crosses, controlled by the others. Any number of people can be sent across this way.



When 2 has reached the bank, 3 ties on and crosses. 1 takes most of the strain, but 2 is ready in case anything goes wrong.

INDIVIDUALS TIED TOGETHER TO CROSS STREAM

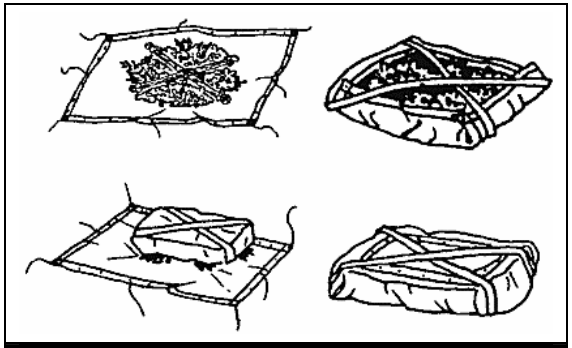
17.3 RAFTS

If you have two ponchos, you can construct a brush or Australian poncho raft. With either of these rafts, you can safely float your equipment across a slow-moving stream or river.

17.3.1 BRUSH RAFT

The brush raft, if properly constructed, will support about 120 kilograms. Use ponchos, fresh green brush, two small saplings, and rope or vine as follows —

- Push the hood of each poncho to the inner side and tie off the necks using the drawstrings.
- Attach the ropes or vines at the corner and side grommets of each poncho. Make sure they are long enough to cross to and tie with the others attached at the opposite corner or side.
- Spread one poncho on the ground with the inner side up. Pile fresh, green brush (no thick branches) on the poncho until the brush stack is about 50 cm high. Pull the drawstring up through the centre of the brush stack.
- Make an X-frame from two small saplings and place it on top of the brush stack. Tie the X-frame securely in place with the poncho drawstring.
- Pile another 50 cm of brush on top of the frame, then compress the brush slightly.
- Pull the poncho sides up around the brush and, using the ropes or vines attached to the comer or side grommets, tie diagonally from comer to corner and from side to side.

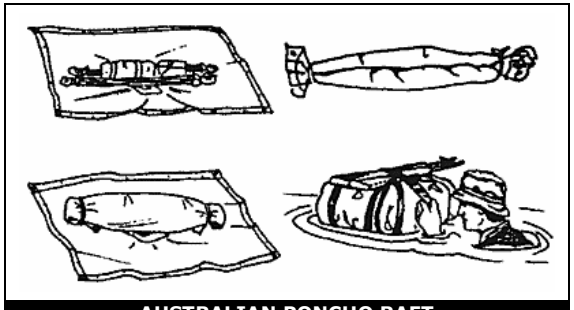

BRUSH RAFT

- Spread the second poncho, inner side up, next to the brush bundle.
- Roll the bundle onto the second poncho with the tied side down. Tie the second poncho around the bundle in the same manner as you tied the first poncho around the brush.
- Place it in the water with the tied side of the second poncho facing up.

17.3.2 AUSTRALIAN PONCHO RAFT

This raft is more waterproof than the poncho brush raft, but will support less weight.

To construct this raft, use two ponchos, two rucksacks, two 1 meter poles, and ropes or cordage as follows —


AUSTRALIAN PONCHO RAFT

- Push the hood of each poncho to the inner side and tightly tie off the necks using the drawstrings.
- Spread one poncho on the ground with the inner side up. Place and centre the two 1 meter poles on the poncho about 50 cm apart.
- Place your rucksacks or packs or other equipment between the poles. Also place other items that you want to keep dry between the poles. Snap the poncho sides together.
- Hold the snapped portion of the poncho in the air and roll it tightly down to the equipment.
- Twist the ends of the roll to form pigtails in opposite directions. Fold the pigtails over the bundle and tie them securely in place using ropes, bootlaces, or vines.

Using the Moon When You Know the Time

If you know the local time, you can use the moon to determine the approximate direction based on the adjacent table —

Local Time	18:00	21:00	24:00	03:00	06:00
First Quarter	S	SW	W	-	-
Full Moon	E	SE	S	SW	W
Last Quarter	-	-	E	SE	S

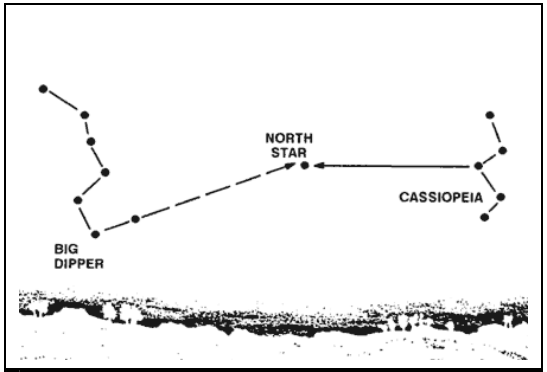
USING MOON AND TIME TO DETERMINE DIRECTION

18.3 USING THE STARS

Your location in the Northern or Southern Hemisphere determines which constellation you use to determine your north or south direction.

18.3.1 THE NORTHERN SKY

The main constellations to learn are the Ursa Major, also known as the Big Dipper, and Cassiopeia. These constellations never set and are always visible on a clear night. Use them to locate Polaris, also known as the North Star. The North Star forms part of the Little Dipper handle and can be confused with the Big Dipper. Prevent confusion by using both the Big Dipper and Cassiopeia together.

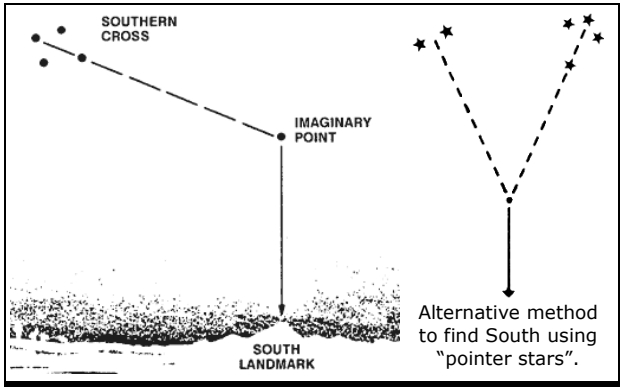


THE BIG DIPPER AND CASSIOPEIA

The Big Dipper and Cassiopeia are always directly opposite each other and rotate counter clockwise around Polaris. The Big Dipper is a seven star constellation in the shape of a dipper. The two stars forming the outer lip of this dipper are the "pointer stars" because they point to the North Star. Mentally draw a line through these two stars extended by about five times to find the North Star.

18.3.2 THE SOUTHERN SKY

There is no star bright enough to be easily recognized near the South celestial pole, so a constellation known as the Southern Cross, or Crux, is used as a signpost.



THE SOUTHERN CROSS

Crux has five stars. Its four brightest stars form a cross that rotates throughout the night. The two stars that make up the long axis are named Gacrux and Acrux. To determine south, extend a line through these stars for about five times the distance. The point where this imaginary line ends is in the general direction of South. Trace this point down to the horizon to select a landmark.

Alternative Method in the Southern Hemisphere

Another method to finding South in the Southern hemisphere is to use the pointer stars east of Crux. Take an imaginary line from between the pointer stars, at a 90° angle. Where this line intersects another imaginary line running from the long axis of the cross, is South.

Using Any Star to Determine Direction

If you cannot find a directional star, pick any star and watch for 10-20 minutes.

If the star —

- Appears to be **falling**, it is approximately **West**
- Appears to be **rising**, it is approximately **East**
- Is travelling to the **right**, it is approximately **South**
- Is travelling to the **left**, it is approximately **North**

18.4 MAKING AN IMPROVISED COMPASS

You can construct an improvised compass using a piece of ferrous (containing iron) metal that is needle shaped or a flat double-edged razor blade and a piece of non-metallic string or long hair from which to suspend it, or you can place it on a light piece of material floating in liquid.

You can magnetize or polarize the metal by slowly stroking it in one direction on another magnet or even a piece of silk. Always rub in one direction only.

Magnetising Electrically

If you have a battery and some electric wire, you can polarize the metal electrically. The wire should be insulated. If not insulated, wrap the metal object in a single thin strip of paper to prevent contact. Form a coil with the electric wire and touch its ends to the battery's terminals.

Repeatedly insert one end of the metal object in and out of the coil. Don’t be tempted to shortcut this procedure by simply tapping one end of the coil to the battery while leaving the material to be magnetised inside the coil. Due to the principles of induction, this will create an alternating magnetic field and is actually a good way to de-magnetise an object.

If the wire coil or battery is getting excessively hot, too much current is being drawn. In this case, use more turns of wire, or thinner wire to increase the resistance.

Magnetising By Heat

Another way to magnetise a piece of metal is to heat it red hot and let it cool while inside or next to a magnetic field. The magnetic field of the Earth itself can be used for this purpose, but of course, you need to determine first where north and south lie.

18.5 OTHER MEANS

The old saying about using moss on a tree to indicate North (in the Northern Hemisphere) is not accurate because moss grows completely around some trees. Actually, sometimes growth is more lush on the side of the tree facing the South in the Northern Hemisphere and vice versa in the Southern Hemisphere.

If there are several felled trees around for comparison, look at the stumps. Growth is more vigorous on the side toward the equator and the tree growth rings will be more widely spaced. This means fatter rings on the Southern side in the Northern Hemisphere and the Northern side in the Southern Hemisphere.

Wind direction may be helpful in some instances where there are prevailing directions. In all places on earth, the prevailing winds come from the East (due to the earth’s rotation) this is mostly evident near or on the West coast.

19 Stealth

In a survival situation, especially in an environment where discovery could be disastrous, you may find it necessary to camouflage yourself, your equipment, and your movement. It may mean the difference between survival and being rumbled. Camouflage and movement techniques, such as stalking, can help you move through undesirable areas to a safer location, it will also help you get animals or game for food using primitive weapons and skills.

19.1 PERSONAL CAMOUFLAGE

When camouflaging yourself, consider that certain shapes are particular to humans. The enemy will look for these shapes. The shape of a hat, helmet, or boots can give you away. Even animals know and run from the shape of a human silhouette. Break up your outline by placing small amounts of vegetation from the surrounding area in your clothes and equipment. Try to reduce any shine from skin or equipment. Blend in with the surrounding colours and simulate the texture of your surroundings.

19.1.1 SHAPE AND OUTLINE

Change your outline by tying vegetation or strips of cloth onto them. When hiding, cover yourself and your equipment with leaves, grass, or other local debris.

19.1.2 COLOUR AND TEXTURE

Each area of the world and climate condition has colour patterns and textures that are natural for that area. Surface textures may be smooth, rough, rocky, leafy, or many other possible combinations. Use colour and texture together to camouflage yourself effectively. It makes little sense to camouflage yourself with green grass in the middle of a desert or rocky area.

To hide movement, take on the colour and texture of the immediate surroundings. Use natural or man-made materials to camouflage yourself. Camouflage paint, charcoal, mud, grass, leaves, strips of cloth, vegetation, and camouflaged uniforms are a few examples.

Cover all areas of exposed skin, including face, hands, neck, and ears. Areas that stand out more and catch more light (forehead, nose, cheekbones, chin and ears) should be covered with darker colours. Recessed areas (around the eyes, under the chin) should be covered with lighter colours. Be sure to use irregular patterns.

Use large blotches for deciduous forests, vertical slashes for coniferous forests, broad slashes in jungle, thin slashes in desert, a wide blotch in barren snow and very thin slashes in grasslands.

Attach vegetation from the area or strips of cloth of the proper colour to clothing and equipment. If you use vegetation, replace it as it wilts. If you discard old wilted vegetation, do not leave it where it may be found, indicating your presence. As you move through an area, be alert to the colour changes and modify your camouflage colours as necessary.

19.1.3 SHINE

As skin gets oily it becomes shiny. Equipment with worn off paint is also shiny. Even painted objects may shine. Glass objects such as mirrors, glasses, binoculars, and telescopes shine. Cover these glass objects when not in use. Anything that shines attracts attention. When observing people through binoculars, be aware of the position of the sun or moon.

When possible, wash skin and reapply camouflage. Skin oil will wash off camouflage, so reapply it frequently. If you must wear glasses, apply a thin layer of dust to lenses to diffuse the reflected light. Cover shiny spots on equipment by painting, covering with mud, or wrapping with cloth. Pay attention to covering buckles, watches, jewellery, and zippers.

19.1.4 SHADOW

When hiding or travelling, stay in the deepest part of the shadows. If you are in an area where there is plenty of vegetation, keep as much vegetation between you and others as possible. This will make it very hard for the enemy to see you as the vegetation will mask you from his view. Forcing an enemy to look through many layers of masking vegetation will fatigue their eyes very quickly. Try not to disturb the vegetation as you move through it.

When travelling, especially in urban areas at night, be aware of where you cast your shadow. It may extend out around the comer of a building and give away your position. Also, if you are in a dark shadow and there is a light source to one side, an enemy on the other side can see your silhouette against the light.

19.1.5 MOVEMENT

Movement attracts attention. If possible avoid movement in the presence of an enemy. If capture appears imminent and you must move, move away slowly making as little noise as possible. By moving slowly, you decrease the chance of detection and conserve energy that you may need later.

When moving past obstacles, avoid going over them. If you must climb over an obstacle, keep your body level with its top to avoid silhouetting yourself. Do not silhouette yourself against the skyline when crossing hills or ridges. When you are moving, you will have difficulty detecting the movement of others. Stop frequently, listen, and look around slowly to detect signs of hostile movement.

19.1.6 NOISE

Noise attracts attention, especially a sequence of loud noises such as several snapping twigs. If possible, avoid making any noise at all. Slow down your pace as much as necessary to avoid making noise when moving around or away from possible threats.

Use background noises to cover the noise of your movement. Sounds of aircraft, trucks, generators, strong winds, and people talking will cover some or all the sounds produced by your movement. Rain will mask a lot of movement noise, but it also reduces your ability to detect potential enemy noise.

19.1.7 SCENT

Whether hunting animals or avoiding the enemy, it is always wise to camouflage the scent associated with humans. Start by washing yourself and your clothes without using soap. This will remove soap and body odours. Avoiding strong smelling foods such as garlic will help reduce body odours. Do not use tobacco products, candy, gum, or cosmetics.

You can use aromatic herbs or plants to wash yourself and your clothing, to rub on your body and clothing, or to chew on to camouflage your breath. Pine needles, mint, or any similar aromatic plant will help camouflage your scent from both animals and humans. Standing in smoke from a fire can help mask your scent from animals. While animals are afraid of fresh smoke, old smoke scents are normal after forest fires and do not scare them.

While travelling, use your sense of smell to help you find or avoid humans. Pay attention to smells associated with humans, such as fire, cigarettes, gasoline, oil, soap, and food. Such smells may alert you to their presence long before you can see or hear them, depending on wind speed and direction. Note the wind's direction and, when possible, approach from or skirt around on the downwind side when nearing humans or animals.

19.2 METHODS OF STALKING

If you need to get close to an enemy without being detected, for surveillance or an attack, you will need more than just camouflage to be successful. The ability to stalk or move without making any sudden quick movement or loud noise is essential to avoiding detection. Be especially careful to not produce any unnatural noises, such as metal on metal.

You must practice stalking if it is to be effective. Use the following techniques —

19.2.1 UPRIGHT STALKING

Take steps about half your normal stride when stalking in the upright position. Such strides help you to maintain your balance. You should be able to stop at any point in that movement and hold that position as long as necessary. Curl the toes up out of the way when stepping down so the outside edge of the ball of the foot touches the ground.

Feel for sticks and twigs that may snap when you place your weight on them. If you start to step on one, lift your foot and move it. After making contact with the outside edge of the ball of your foot, roll to the inside ball of your foot, place your heel down, followed by your toes. Then gradually shift your weight forward to the front foot. Lift the back foot to about knee height and start the process over again.

Keep your hands and arms close to your body and avoid waving them about or hitting vegetation. When moving in a crouch, you gain extra support by placing your hands on your knees. One step usually takes 1 minute to complete, but the time it takes will depend on the situation and your level of practice.

19.2.2 STEALTHY WALKING

This method is not as quiet as stalking, but is quicker. It is useful in situations where you need to move stealthily to avoid detection and drawing attention toward you, not to stalk prey.

Again, one foot is moved at a time, your weight is shifted to your rear leg. Push twigs and stones out of the way with the toes of your lead foot and place your heel down, gradually rolling the weight along the outside of the foot and lowering the sole to the ground. Then, shift your weight onto your lead foot and begin again.

19.2.3 CRAWLING

Crawl on your hands and knees when the vegetation is too low to allow you to walk upright unseen. Move one limb at a time and be sure to set it down softly, feeling for anything that may snap and make noise. Be careful that your toes and heels do not catch on vegetation.

19.2.4 PRONE STALKING

To stalk in the prone position, you do a low, modified push-up on your hands and toes, moving yourself forward slightly, and then lowering yourself again slowly. Avoid dragging and scraping along the ground as this makes excessive noise and leaves large trails for trackers to follow.

19.2.5 ANIMAL STALKING

Before stalking an animal, select the best route. If the animal is moving, you will need an intercepting route. Pick a route that puts objects between you and the animal to conceal your movement from it. By positioning yourself in this way, you will be able to move faster, until you pass that object. Some objects, such as large rocks and trees, may totally conceal you, and others, such as small bushes and grass, may only partially conceal you. Pick the route that offers the best concealment and requires the least amount of effort.

Keep your eyes on the animal and stop when it looks your way or turns its ears your way, especially if it suspects your presence. As you get close, squint your eyes slightly to conceal both the light-dark contrast of the whites of the eyes and any shine from your eyes. Keep your mouth closed so that the animal does not see the whiteness or shine of your teeth.

19.3 TRAVELLING UNDETECTED

If you or your group need to travel for a long distance, it is best to do it undetected. There will be many individuals that will take advantage of a lawless situation for their own gain. Spotting a single traveller or group out in the open may be all the encouragement they need to attack.

You may think that you are prepared for any attack, but some groups will be military units turned rogue. They will be well trained, and well armed. You may even find yourself up against a fully functioning military, in which case you will probably be dragged off to a camp.

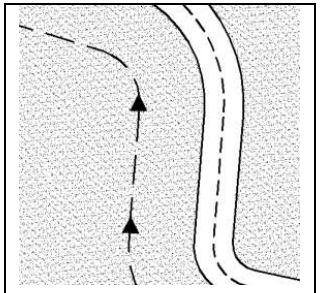
Threats like this will be around – make no mistake. It is better for you to see them first, then the decision is yours wether to attack, avoid, or approach others. If you decide to avoid or attack, consider watching their movements for a day or more to better understand the threat.

Before undertaking a journey, consider —

- Where you are going. Do you have a destination or do you just need to move?
- If everyone in the group is fit enough for a long trek.
- If what you are seeking may have been destroyed or looted.
- If it will be any better or safer than where you are now.
- If you have enough supplies to last the journey or if you will need to hunt along the way.
- If others have had the same idea. Will you end up in a shitfight over a few scraps after travelling for days?

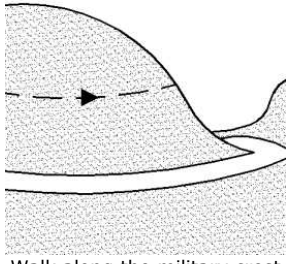
If you are determined to travel a large distance, your group should gather your resources and prepare. This won't be an easy undertaking and you may face many unexpected dangers along the way. Children especially must be protected so you need to be alert at all times.

19.3.1 GENERAL GUIDELINES FOR STEALTHY TRAVEL



'Hand-railing' allows stealthy travel along main routes

HAND-RAILING



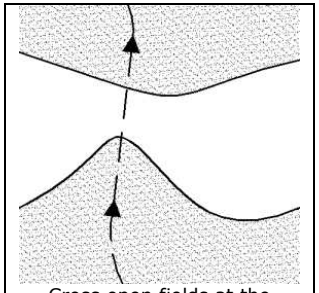
Walk along the military crest of a hill to avoid creating silhouettes against the sky

TRAVEL ALONG HILLS

To minimise your risk of unwanted exposure to others, stay off beaten paths and main routes as much as possible. If you need to use a major road for direction, you can travel parallel to the road at some distance. This is known as 'hand-railing'. This way you can follow the road, but keep in cover.

Move at a slow but steady pace and keep your eyes and ears open for the presence of others. If time is not a factor, stop every now and then to rest and *listen*.

Distant noises such as vehicles or gunshots will alert you to a possible need to change your route. If you hear indications of a close human presence then quickly and quietly find cover. From cover you can decide if there is a threat and if so, wether you engage or remain hidden until they pass.



Cross open fields at the narrowest point

CROSSING OPEN FIELDS

You may need to cross an open field, in this case speed may be necessary.

Use any shadows and depressions in the ground for cover, crouch or crawl if you need to and consider waiting for nightfall.

Cross the area quickly, quietly and at the narrowest point possible.

If you need to travel through hilly areas, do not walk on the crest of the hill as your silhouette will be visible. Travel on what is known as the 'military crest', which is low enough to hide your silhouette, yet far enough from a main route.

Night Travel

When travelling at night, be careful of the use of torchlight – it can often be seen for great distances. Instead, let your eyes adjust to the darkness.

Even though travelling at night is generally safer, darkness brings its own dangers. Movement is slower and navigation more difficult. Shape, colour and distance are distorted. Light coloured objects appear closer and dark objects appear further away.

The moon may provide some light, but you must take care to ensure your form is not silhouetted against the sky, or casting long, moving shadows.

Sounds also travel further at night. This is not just because things are generally quieter, there is also a natural phenomenon that usually occurs around dusk and again before dawn.

A component of the atmosphere known as an inversion layer sinks almost to the ground at these times and sound travels along this dense layer of air very effectively. Many animals instinctively use this time to communicate to each other, so this may be an indication that the phenomenon is in effect.

Camping

If you need to camp during your trip, make sure your camp is well hidden and keep noise and fires to a minimum. Eat food cold if you have to. If a fire is essential then use a pit fire, ideally a **Dakota Fire Hole** (Page 6-1) to minimise the light radiation. While setting up the camp, have someone keep watch. If you are in a high risk area, someone may need to take one for the team and keep watch while everyone else sleeps.

Have a contingency plan in the case of discovery, either an escape route or choose a site with a narrow entrance so you are in a good position to defend yourself.

When leaving, bury any rubbish and evidence of fire. If you have cleared ground, then try to spread natural debris throughout to make it look like an old campsite should it be discovered.

19.4 TRACKING

There probably won't be much need for tracking but the situation may arise where you need to track down a thief who has invaded your camp, or to determine who else may be in your area. Having knowledge of tracking will also help you in your own stealthy travel practices.

19.4.1 SIGN

For a tracker, slight man-made disturbances in the environment are the first clue to the presence of others. These clues are known as 'sign'. Spotting them is like being presented with two nearly identical pictures, and trying to spot the differences.

There are two classifications of sign – top sign (above knee height) and ground sign (below knee height). These are further divided into permanent and temporary sign.

	Temporary sign	Permanent sign
Ground sign	Foot prints. Food cans, cigarette butts, scraps of paper, cloth. Old wilted camouflage. Rocks pushed into ground when stepped on. Grass flattened in direction of travel. Piles of leaves disturbed so their rotting black undersides are showing.	Animal traps and snares. Holes dug for latrines. Pegs driven into the ground. Trenches. Evidence of a cleared area.
Top sign	Broken tree branches in the direction of travel. Climbers and vines pulled free as a party moves through.	Shelters. Scuff marks and wounds on tree trunks from equipment. Obvious man made changes to trees, such as sawn off limbs.

EXAMPLES OF DIFFERENT CLASSIFICATIONS OF SIGN

Temporary sign is destroyed quickly by wind, rain, sunlight, frost and snow but is useful to indicate the age of the track. An old campsite will show many types of ground sign, Human waste eventually decays but the degree of decomposition and the number of flies and bugs will approximately indicate the age.

Evidence such as food cans, cigarette butts, paper, cloth, and old fireplaces will eventually wither and age, but will persist for much longer. Rust can form on metal within 12 hours, paper exposed to the sun will at first turn yellow in about three days, then white. Cloth is flattened by rain and eventually covered in dirt and debris.

The type of sign may also give an indication of the type of group you are dealing with. MRE's and spent ammunition may indicate a military unit, while old baked bean cans and muesli-bar wrappers can indicate a civilian presence. Though this not a hard and fast rule, as many civilians carry MRE's and ex-military equipment in their survival kits, and military groups may acquire civilian goods. Use your judgement.

19.4.2 FOOTPRINTS

Tracks or footprints are the best type of ground sign. These are often incomplete but provide positive evidence for the presence of other people. The prints will erode with time so can give you an estimate of the age. They will erode quicker in times of high wind or rainfall.

Tracks are most visible when a shadow is cast across them, therefore the best time to track is when the sun is low in the sky. However, tracking while moving toward the sun makes it difficult to see, so the tracks need to be followed from the side where they are more obvious.

If tracking at night, shine a torch low and across the print. If possible use a dim red light to prevent being spotted and preserve your night vision.

Calculating the Number of Travellers

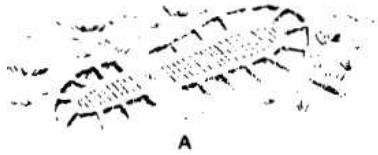
If the group you are tracking are all wearing different shoes, then simply count the number of different tread patterns. If they are all barefoot, then note the different feet size and styles of walking. Some people are biased to one side of their feet, or have risen or fallen arches.

If the group are all wearing the same types of shoes, this is a good indication that they are part of the military. Wether they have turned rogue or still answer to the man, a frontal confrontation is not in your best interests, but it is useful to know their movements.

In this case there is another way to determine the size of the group based on the assumption that the stride length of most adults is similar.

First, seek out the clearest set of footprints, known as 'key prints', these are usually left by the last person in the group. Choose two successive prints and place a marker in line with the back of the heel of the rear key print. Place a second marker at the instep of the front print.

An imaginary box can now be drawn containing both markers. On average, each person within the group will have made one print inside, or partially inside the box. This estimate is good for groups of 18 or less people.



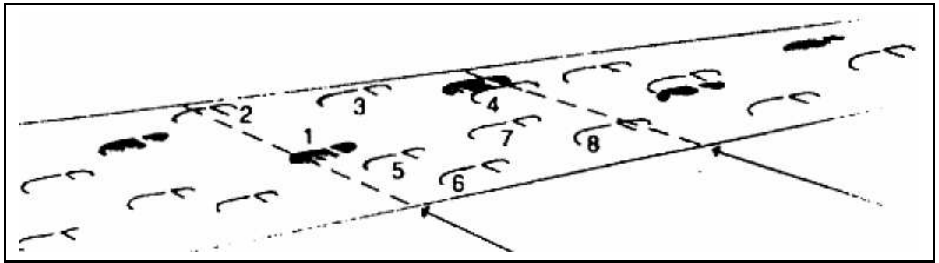
A

Print A is freshly made and clearly visible.

B

Print B has been eroded over time. The leaves are not crushed into the print therefore have been blown onto it later.

FRESH VS OLD PRINTS



ESTIMATING GROUP SIZE

If you cannot find clear key prints, an estimate can be made by counting the prints in an area of 92 cm (36 in). To increase the accuracy of your count, take three readings at different points along the trail, then divide the total by three.

What can be Determined by Footprints

Carefully read footprints can reveal many facts about the party you are tracking. A runner will leave prints emphasizing the ball of the foot. Someone carrying a heavy load will leave deep prints that are again deepest at the front of the foot. The stride may be shorter and there may be top sign where a pack has snagged on foliage.

An injured person may leave blood drops, or favour one leg constantly. Wounded or exhausted travellers may fall behind and occasionally have to run to keep up.

Age of Prints

Heavy rain will erode footprints. If you know when the last rain was, you can determine if the party travelled through the area before or after the rain, giving a general idea of distance.

Animal prints may be over human footprints, or under them. Knowledge of local wildlife movements may help to determine the time of day when the humans passed through.

19.5 COUNTER-TRACKING

Even if you don't think you are being followed, it is good practice to limit the amount of evidence you leave. Other parties travelling through the area may spot signs of your recent or

current presence. This may mean they will come looking for you, and if they are adept at tracking it will not take long. Another reaction is that they may begin or increase their own efforts at stealth, which will mean they might spot you before you spot them.

19.5.1 PASSIVE COUNTER-TRACKING

Passive counter-tracking is the efforts of the group to leave as little disturbances as possible.

Never drop any wrappings, empty containers or other man-made items. Carry them with you and when you stop to camp, burn or bury them.

Man-made objects stand out distinctly against nature and it is easy to tell the difference between a freshly dropped item and one that has been exposed to the weather over time.

Hiding Footprints

There are measures you can take to hide your footprints. Wrap your footwear in cloth or tape a piece of cardboard to the soles to remove the tread pattern.

Moving along a river and leaving your footprints below the waterline will hide your prints while the water is covering them, however mud can be suspended in still water for hours. If the river is tidal, your footprints may be revealed when the waterline recedes, however the movement of the water will destroy your footprints quicker than on dry land.

Beware of the danger of river banks, such as crocodiles or alligators.

Travelling Single File

If you are travelling through an area of soft ground where you can't help but leave footprints, you may be tempted to travel single file and step in the leaders' footprints to disguise your numbers. This may be useful in a military situation but in a lawless environment, a roaming gang is less likely to confront a large group, as such people are opportunistic and cowardly by nature. Although it is recommended that children step in the footprints of adults to hide their presence, and then have an adult step on those tracks to further confuse the print.

Vegetation

Try not to break branches or flatten vegetation as you pass through. It is easy to determine the direction of travel from flattened grass, or a tree limb that has been repeatedly bent back by members of your group passing through.

When walking through crops, it is easy to see a path made if care is not taken. At least when entering and exiting the crop, carefully move the stalks aside, one by one, and let them enclose you as you move through. You may need to do this through the entire crop.

Long grass will lie after being trodden on and will indicate the direction of travel. Man is one of very few animals that will break a stick in two places.

19.5.2 ACTIVE COUNTER TRACKING

Active counter-tracking is the deliberate attempt to confuse and mislead the tracker.

When moving through ground with little cover, travelling into the setting or rising sun forces the tracker to follow the sign from the side and track diagonally into the sun. As the sun rises or dusk falls, the tracks become increasingly difficult to follow.

Laying multiple trails will slow the tracker as they are forced to study each track, and determine your intentions.

Walking Backwards

Walking backwards for a long distance is not recommended. It is tiring and requires constant looking over your shoulder to navigate, reducing your awareness of potential threats. Walking backwards also results in a smaller and wider stride. A tracker will notice the age of the prints increases with apparent direction of travel, and dirt and stones kicked in the real direction.

Walking backwards for a short distance at a strategic point (such as crossing between two fields) may be sufficient to confuse the tracker and buy you some time.

In this time of chaos, one of the most important aspects to your survival is your ability to —

KEEP YOUR HEAD DOWN!