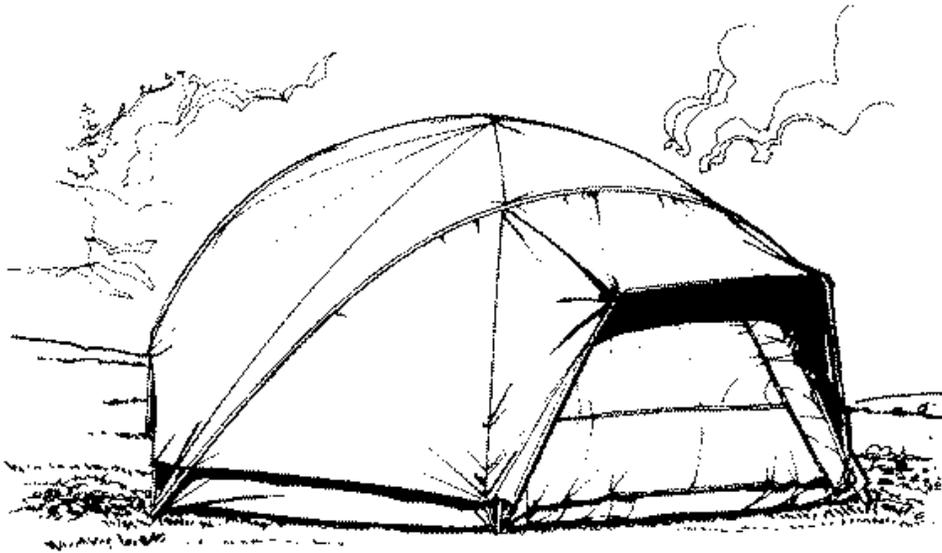


# Snow Shelters



# Snow Shelters

## Shelters

Shelters are an important consideration in planning for any type of cold weather outings. Your first winter campout should be in a cabin or other fixed shelter. The next time you may want to try a tent, or if in snow country, a “thermal” or snow shelter. You should even consider shelters for cold-weather hikes. Crew equipment, different from that used in mild-weather camping.

## Types of Shelters

You can choose from a variety of shelters when you go winter camping. Possibilities include cabins, tents, thermal shelters, and other natural shelters.

## Cabins

Your first cold-weather camping should be done at a camp or other location where cabins are available. A cabin can be small or quite large, like the lodge of many camps. The size is not the important consideration. The important part is how it helps you train for more extensive cold-weather camping. The staff cabins at Camp Hi-Sierra are available in winter. The tent cabins in Yosemite’s Curry Village are perfect for “first-timers”. The Okpik sleeping cabins (with front and rear doors) designed by the BSA Engineering Service are also available at Northern Tier BSA High Adventure Base.

## Tents

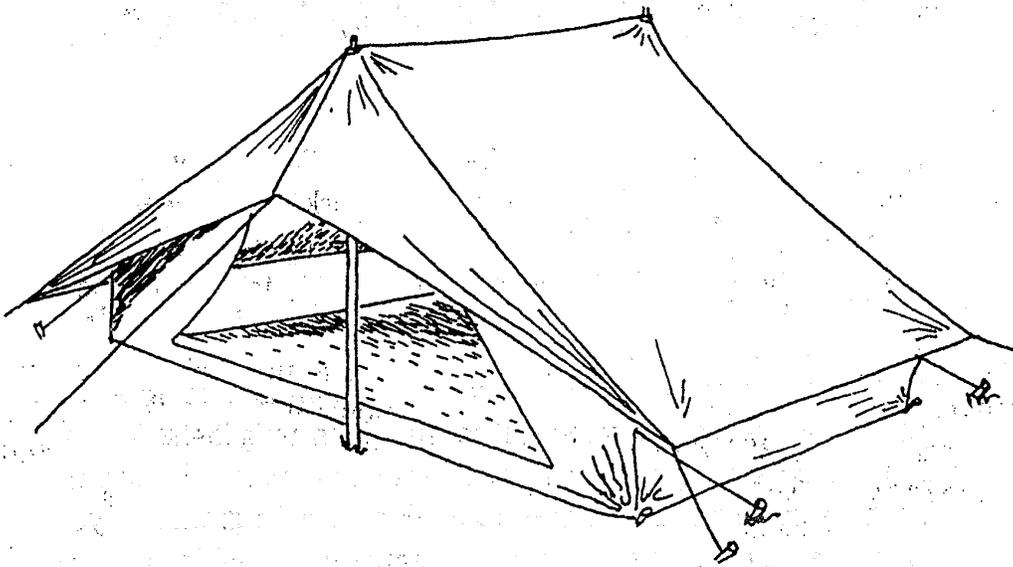
Many types and styles of tents are available. The BSA Supply Service is a good resource for tentage. Most styles of tents work in cold weather. You may want one a little larger than the one you use in the summer, since cold-weather clothing and bedding take up more room. Your tent should be large enough so that you can sit up in it.

A good winter or “four-season” tent will have strong poles to hold up to wind and snow loading, it will have guy ropes that come out from the sides to add additional strength to the tent, especially in high winds, it will have a rain fly that comes all the way down to the ground, and it will have vestibules that attach on the ends of the tent to create an entryway out of the wind and blowing snow where boots can be removed without bringing mud or snow into the tent, and where some gear can be stored.

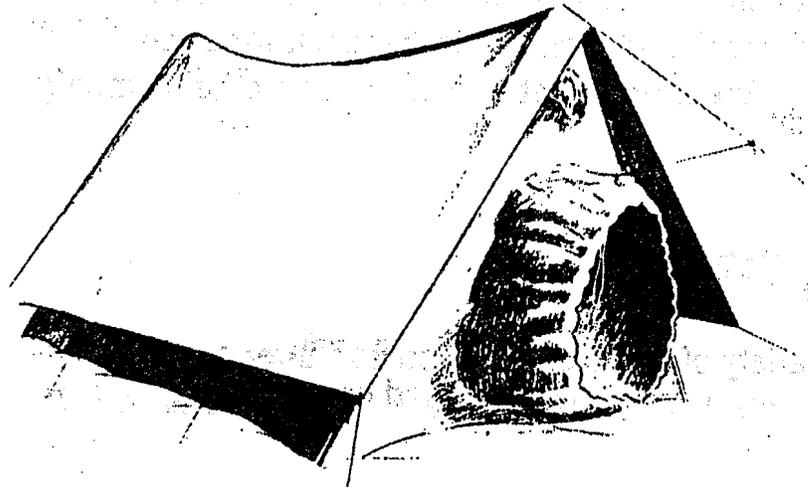
Bring clothing and boots into the tent at night, however, and put next to you to keep warm, or your boots will freeze. It can be very difficult to put them on in the

morning if this happens. Make sure they don't get your sleeping bag and other clothes wet, however.

If you camp in the mountains, you may prefer a mountaineering tent. A tent design that works well for cold-weather snow camping is the "A"-frame style tent. This tent is a BSA design made by the National Supply Division and developed by the Northern Tier National High Adventure Program as a year-round tent. It can be used with a self-supporting frame. The double entrances work well for weather protection and make zippers unnecessary. The tent will usually accommodate four campers, is large enough to dress in, and is spacious enough for extra equipment. The tunnel doors can also be used for storage. A vestibule can be attached to either end, extending the storage space available. In extremely low temperatures, water vapor from respirations and perspiration collects on the inside of the tent and freezes, forming a frost on the inside of the tent. A frost liner can be constructed to fit the inside of the tent to provide more insulation. This also helps to keep the tent frost-free in extreme low temperatures.



**"A"-Frame Style Tent**

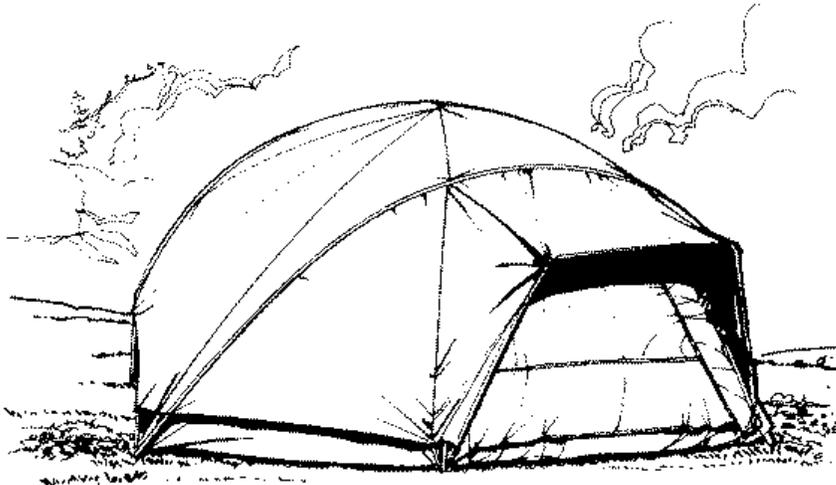


### **“A” – Frame Style Tent With Tunnel Entrances to Keep Out Snow**

A frost liner is nothing more than a lightweight inner tent. It can be made of almost any lightweight, porous material. It should be suspended inside the tent with about two inches of space between it and the tent walls. The frost liner provides insulation and protection from the wind, helping hold heat in a smaller area, less affected by air currents. The warm, moist air inside the frost liner passes through the porous material and forms frost on the outside of the liner.

Each morning the liner can be taken out and the frost removed. It should be packed separately from the tent, dried as often as practical, and replaced inside the tent every morning.

**CAUTION:** Open flames should not be used in any tent. Refer to Guide to Safe Scouting for the BSA policy on the use of stoves and fuels.



## **Dome Style Tents provide stronger support against wind and snow buildup**

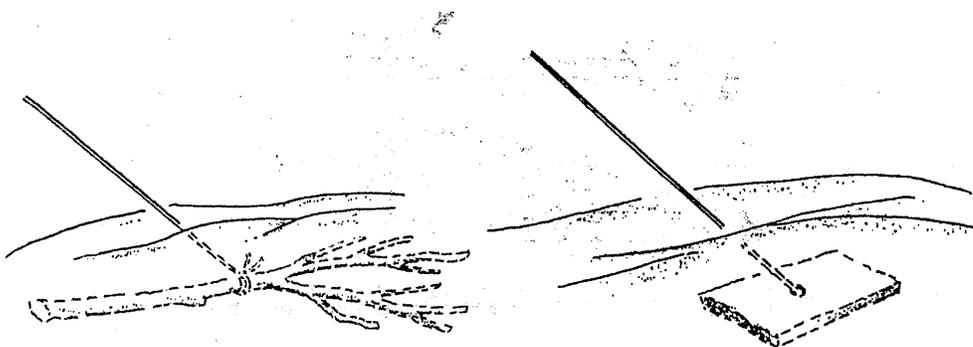
The dome style tent is more stable in wind and heavy snow than the “A” – Frame Tent. Because of the rounded sides, It also provides more room alongside each camper inside the tent for gear.

## **Modified Dome Style Tents**

Modified dome style tents are constructed similarly to the dome style tent, but typically have lower profiles, allowing them to slip the wind easier and stand up even better than the dome style to winter storms.

## Anchor Your Tent In Snow

It is always important to stake down your tent completely. Well-designed tents “slip” a certain amount of the wind, and rain flies keep rain and snow from touching the breathable fabric of the tent itself, plus they provide a dead-air space between the tent fly and tent, providing additional insulation. These features only work, however, if the tent and fly are stretched taut, set up properly, and staked down properly using all of the stakes. **Regular tent pins do not work well in snow.** Special “snow stakes” do work well in snow. These are typically 1 foot long, 2 inch wide aluminum sheet metal stakes, curved slightly, and often with ½ “ holes drilled in them. They can be pushed into the snow at an angle and the tent attached at the top of the stakes as with regular tent stakes, or they can be buried in the snow sideways with the cord attached in the middle of the stake. When placed in loose or soft snow, and packed down, the snow tends to congeal and firm over the next hour or so (as long as the temperature is below freezing), securing the tent for all but the strongest winds.



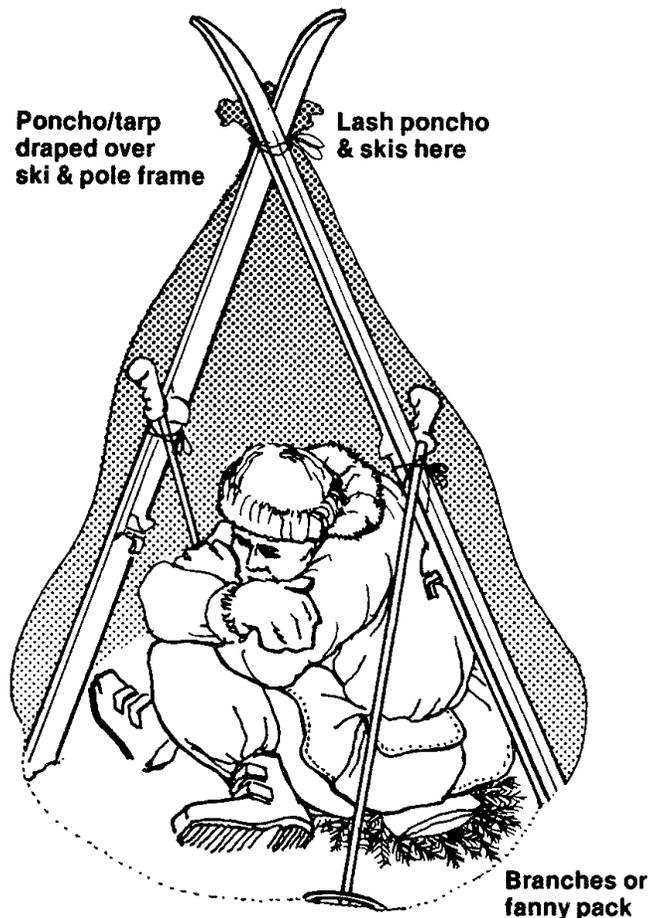
Two methods of holding down the tent ropes in the snow

## Natural and Emergency Shelters

The use of natural shelters is encouraged as your group becomes more acquainted with cold-weather camping. When using natural materials, do so in accordance with the policies of low-impact camping and of your local council. While utilizing natural shelters can be an important tool in an emergency, we still need to limit our impact on the natural environment, even while practicing to **Be Prepared**.

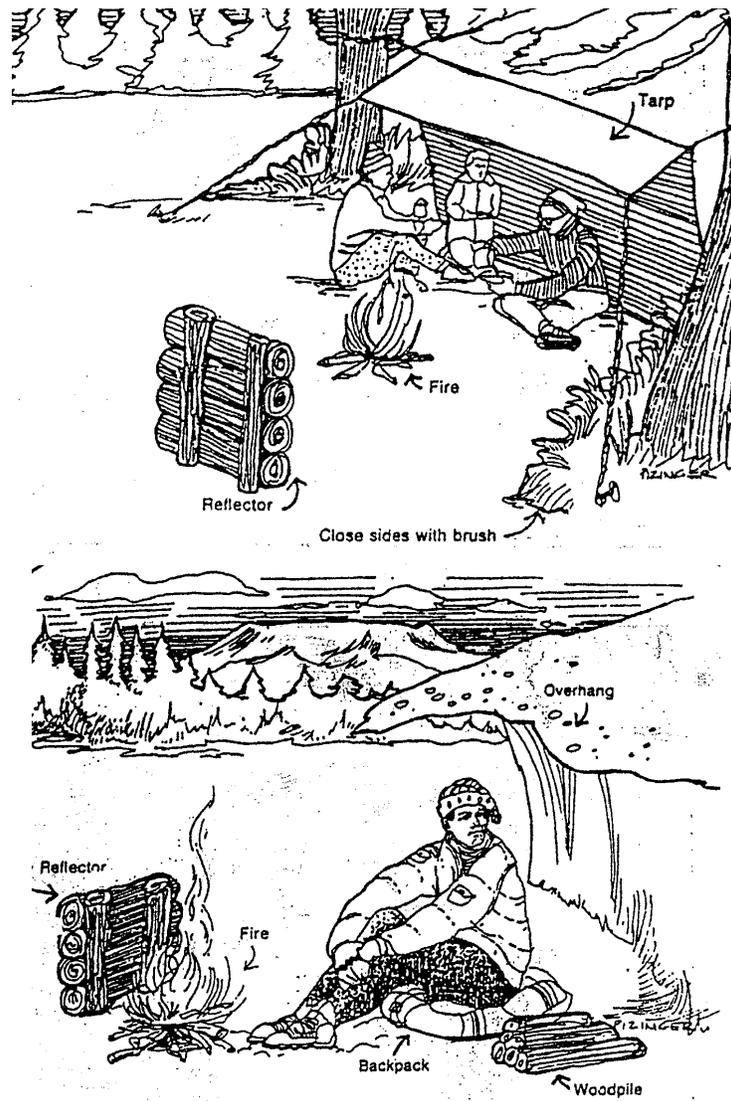
Many references on the construction of natural shelters are available. Use the ones that are appropriate for your area and climate. Trying to learn to build a cut-block igloo in parts of Utah and the Midwest, for example, may not be practical since the snow there often does not pack well. In areas of limited snow depth, a snow cave may not be possible, but a snow trench may work well.

## Emergency Shelter Constructed Using Skis and Poncho

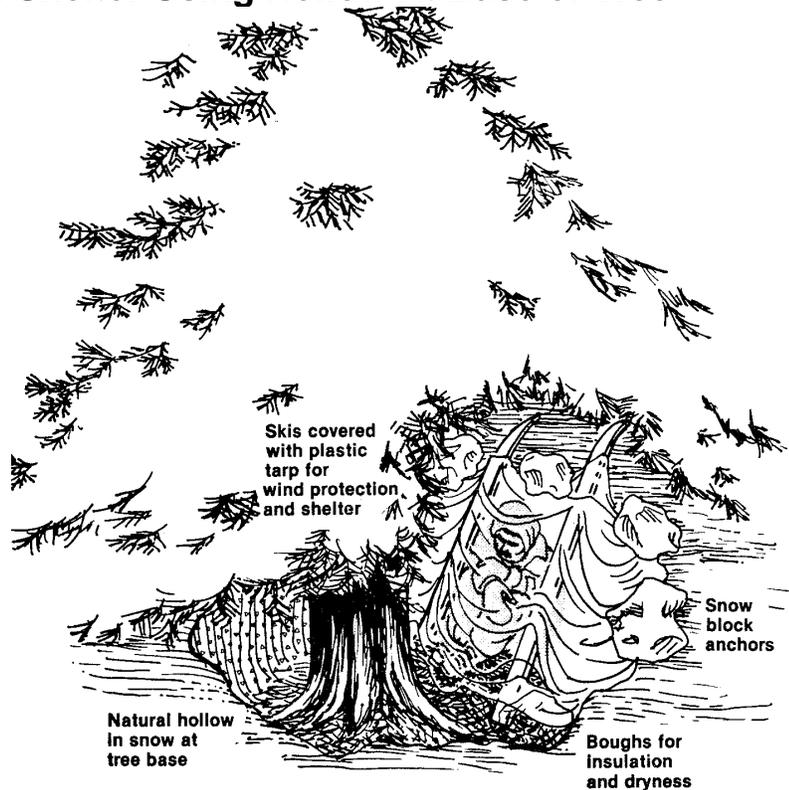


Cold weather demands a tighter closing of structures than mild weather does. This necessitates more attention to proper ventilation. Review the liquid fuel policy as well as the policy in your local area regarding the use of natural materials before you consider means for staying warm. Carbon monoxide is a product of inefficient burning of fossil fuels. It is colorless and odorless and can be deadly. Carbon monoxide is a threat in any camp, but is a greater threat in cold weather.

### Lean-to Using Tarp and Trees



## Natural Shelter Using Hollow At Base of Tree



## Thermal Shelters

A thermal shelter is any natural shelter that, through insulation, uses the heat coming from the earth to warm it. In temperate climates the earth is continually giving off 12 degrees to 16 degrees Fahrenheit of heat. This doesn't sound very warm, since you know that 32 degrees Fahrenheit is freezing, but it makes a difference when the air temperature is well below freezing, or even below zero.

Snow is a very good insulator; actually, about the same insulating value as wood. Following is a chart comparing snow with several common materials for thermal conductivity and density.

### Thermal Conductivity Values

<u>Material</u>	<u>Conductivity (cal/sec-C)</u>	<u>Density (gms/cm<sup>3</sup>)</u>
Air	.00006	.0013
Down	.0001	.006
Polyester (hollow fiber)	.00016	.006
Polyester (solid fiber)	.00019	.006
Snow	.0004	.25
Wood (pine)	.0004	.45
Polyester (solid)	.0005	1.1
Cardboard	.0007	1.1

Water	.0014	1.0
Metals (typical)	.1 – 1.0	3 - 9

With a good, insulated thermal shelter at –20 degrees F, the heat of the earth combined with the body heat of two people warms the shelter to around the freezing point. That is a difference of 52 degrees F from the temperature outside!

A shelter can be large, or small enough to accommodate one person in emergency or survival situations. The following are several important points about the thermal shelter:

- A door plug must be used, or any heat trapped is immediately lost.
- Each sleeper needs an insulating pad underneath his body. Even though the earth is giving off heat, it is still much colder than your body temperature. Unprotected, your body loses heat to the earth through conduction.
- Ventilation holes should be made at a 45 degree angle in the side of the shelter. Since warm, moist air passes through these vents, it is necessary to continually clear them of frost.
- Make the shelter so that you can sit up without touching the ceiling.
- The more insulating snow that is piled on the shelter, the warmer it will be.
- Do not use an open flame in a thermal shelter.

## **Building Snow Shelters**

The snow shelters described in this handbook include the snow cave, the cut-block igloo, and the molded snow dome called the quinzees.

Patience and practice are both necessary to develop skill at building any type of snow shelter. If you are in the mountains, expert instruction is suggested. The mountains have additional hazards that go well beyond the scope of this guide. Avalanches and extreme temperature fluctuations are just two of the serious mountain conditions that necessitate competent, skilled instruction.

Snow shelters hold a certain fascination for Scouts, they are easy to construct, and they work very well. However, even in extremely low temperatures, snow-shelter builders usually get wet. Therefore, certain precautions should be taken. In a moist snow shelter, drying clothes is difficult. Follow these guidelines when building a thermal shelter:

- Pace the work on the shelter – let everyone get involved. Stop before perspiration becomes a problem. Remember to ventilate.
- Wear waterproof clothing, especially rain or snow pants. When building a snow cave, wear a hooded, waterproof jacket with the hood up, as you will be constantly kneeling in snow and rubbing against the top of the cave and cave entrance with your hood and shoulders.
- Proceed slower than you think you should to avoid overheating. Especially with waterproof gear on, most or all of the water vapor coming off of your body will be trapped and gradually get you wet on the inside.
- Scouts in the Scandinavian countries use a clothing item called a fotposer to keep legs and feet dry. The *fotposer* is just a large, waterproof sock that covers the boot and continues up the leg, fastening like a pair of chaps. Another Scandinavian Scout item used in shelter building, the *vindsekk*, or wind sock, is a small, portable shelter that provides protection when building a shelter.
- Try to keep mitts from getting wet.
- Watch out for snow on garments. Continue to use the buddy system and keep snow brushed off.
- Relax! You are not building a lasting monument. Snow shelters do not survive when warm weather returns.

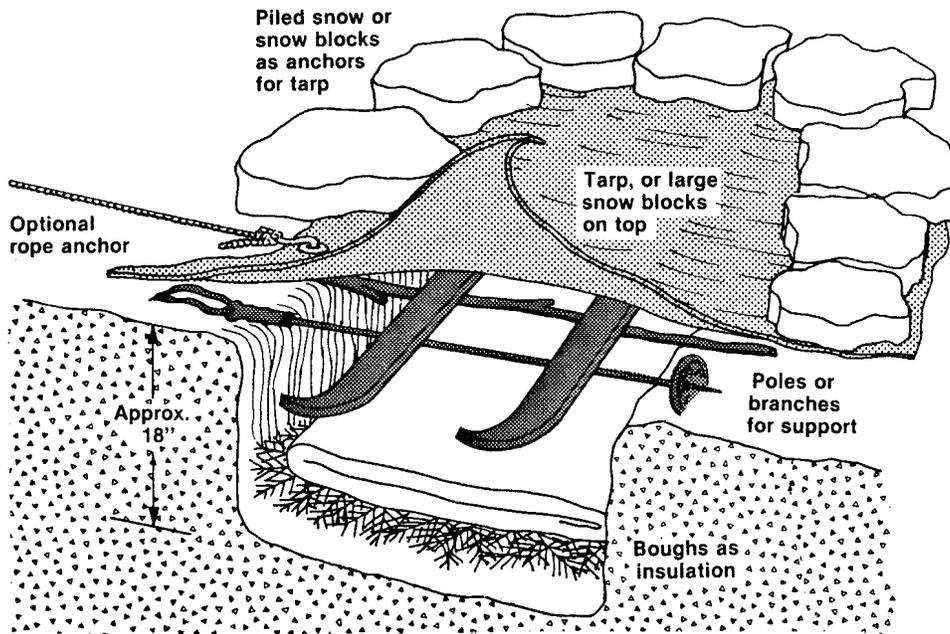
Ideally, the first time a group builds a snow shelter should be while camping in a cabin or tent. Learn how first, and then use the skills to build shelters in which you will actually sleep.

The temperatures in a well-constructed snow shelter with the entrance sealed will rarely be below freezing when campers are inside. If you leave the door wide open, however, the shelter will be the same temperature inside as outside. While ventilation is important in a snow shelter, the vent holes should go out at a 45-degree angle from the sidewall, as opposed to straight up. If you place the vent in the middle of the ceiling, the holes will get larger as the warmer air rushes out. Placed at a 45-degree angle in the side of the dome, the vent replaces the slightly cooler air lower in the snow shelter without causing a draft in the shelter.

When planning to construct any type of snow shelter, the following points must be considered:

- Never plan to build or stay in a snow shelter if the temperature is above freezing. Snow provides excellent insulation in below-freezing conditions, but it is cold and wet when temperatures are above freezing.

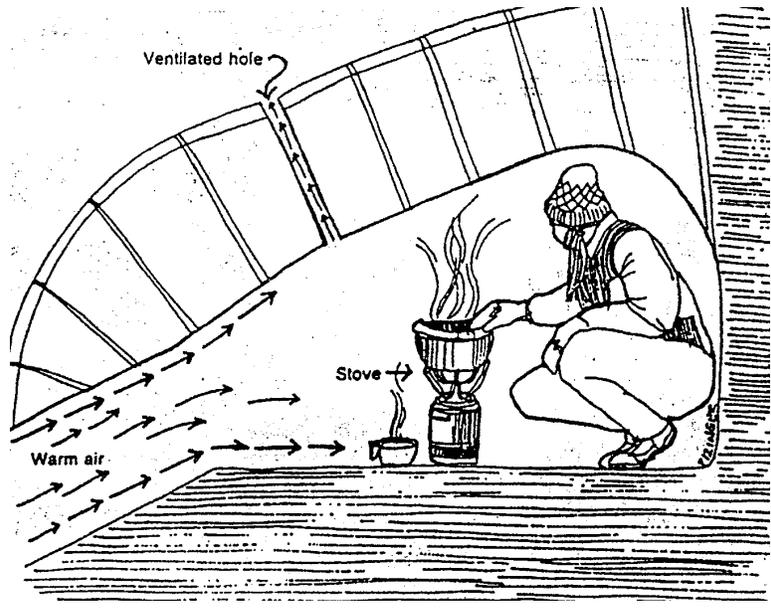
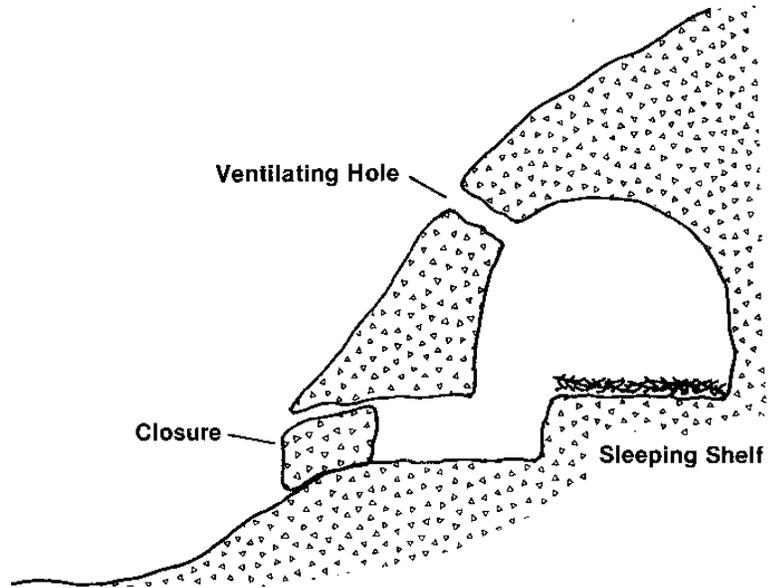
## Trench Shelters

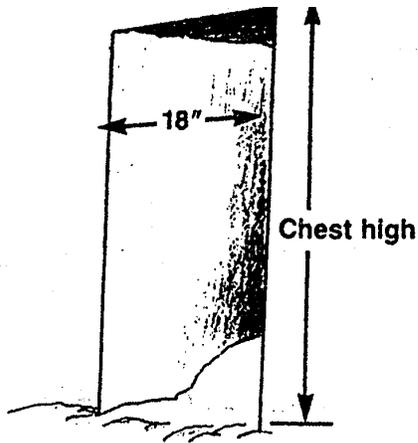


The snow trench can be stomped or dug quickly and with a tarp or snow cover provides good protection from cold wind.

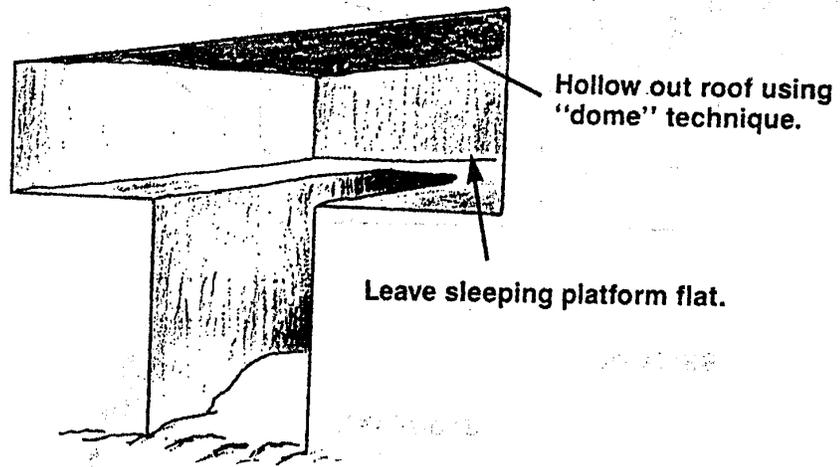
- Always let the snow set at least 1 to 2 hours before starting to dig when constructing a snow dome or quinzee.
- Use the buddy system during snow shelter construction. It is important to have good supervision outside the structure, along with extra scoops and shovels in case of a cave-in.
- Make your entrance as small as comfort allows.
- The sleeping area should be equal or above the lip of the entrance.
- A smooth, arched roof is the key factor in snow shelter construction. One, for strength, and two, so melting water runs down the walls to the side of the shelter, rather than drip on the occupants. Make sure everyone understands this principle.
- Design the entrance so cold air is forced to the base of the crawl-way.
- Smaller shelters are easier to heat.
- Don't expose rock; snow is the best insulating material.
- When constructing snow caves in mountainous areas, consult a specialist regarding the proper location for constructing caves.
- When sleeping in a snow shelter, be sure to keep digging tools inside in case an unexpected exit is necessary.

# Snow Cave Construction

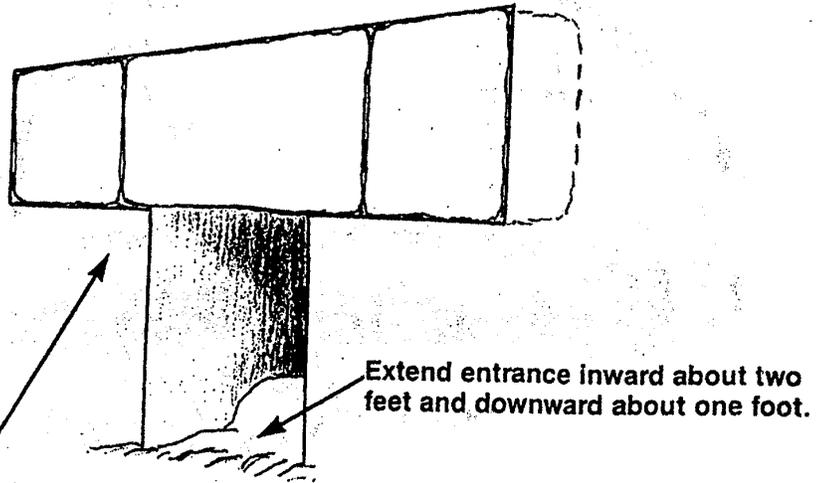




Dig the entrance tunnel 18 inches wide and chest high.



Remove a rectangular portion of snow crosswise to the entrance. Then dig upward and in all directions—leaving the sleeping floor flat.



Cut entrance blocks and place them across the entrance.

THE SNOWSTORM OR BLIZZARD COMES ON FAST, SO THERE'S NOT MUCH TIME. DOOLEY'S MOM DOESN'T HAVE A SHOVEL, SO SHE PULLS OFF A SUN VISOR FROM THE CAR, OR A HUBCAP. THE VISOR THEN BECOMES A SHOVEL TO DIG A SNOW CAVE...



DOOLEY AND TINA HELP MOM, USING A HUBCAP AND A DIGGING STICK, 'CAUSE IF THEY USE JUST THEIR HANDS, THEY COULD GET TOO COLD.

FIRST, THEY DIG A CRAWL-IN HOLE, THEN THEY SCOOP OUT A SNOW CAVE BIG ENOUGH FOR THEM TO FIT IN EASY LIKE THIS.



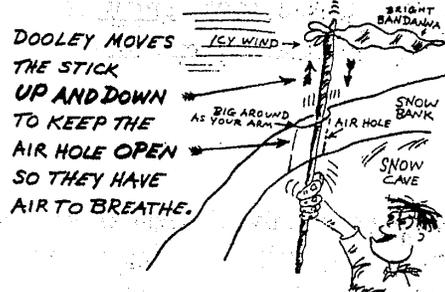
AND THEN THEY USE THE SUN VISOR, HUBCAP, A FLAT ROCK OR A CHUNK OF TREE BARK TO PACK THE SNOW GENTLY, SO THE CAVE WON'T CAVE IN ON THEM. ONCE INSIDE, THEY TAKE TURNS WARMING EACH OTHER'S HANDS AND FEET: HANDS UNDER ARMPITS, FEET AGAINST STOMACH.

WHEN THE SNOWSTORM FINALLY REACHES THEM, THE WIND GETS REALLY COLD. IT'S BELOW FREEZING. DEEP INSIDE THEIR SNOW CAVE, MOM, DOOLEY, AND TINA ARE WARM AND SAFE FROM THE COLD ICY WIND. DOOLEY HAS BROUGHT IN A STICK TO KEEP AN AIR HOLE OPEN, 'CAUSE THEY'VE CLOSED OFF THE CRAWL-IN HOLE WITH SNOW TO KEEP THE COLD WIND OUT.



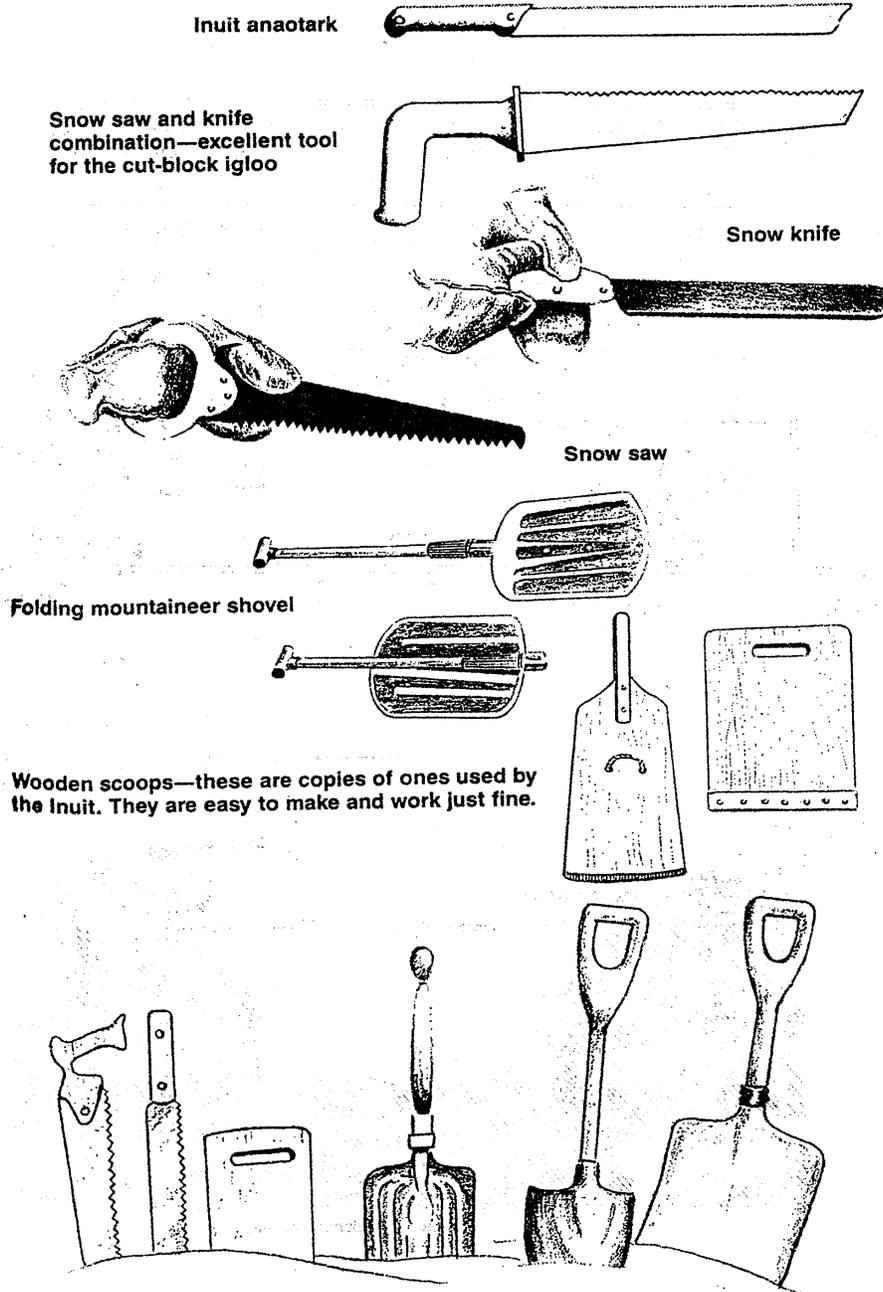
IF DOOLEY AND HIS FAMILY HAD STAYED IN THE CAR, THEY MIGHT HAVE FROZEN. A 2-FOOT THICK SNOW CAVE WALL IS A WHOLE LOT BETTER THAN A SKINNY CAR WINDOW BETWEEN YOU AND A BLIZZARD.

TINA TIES HER BRIGHT ORANGE BANDANNA ONTO THE STICK. THE BRIGHT PIECE OF CLOTH CAN BE SEEN BY ANYONE LOOKING FOR THEM.

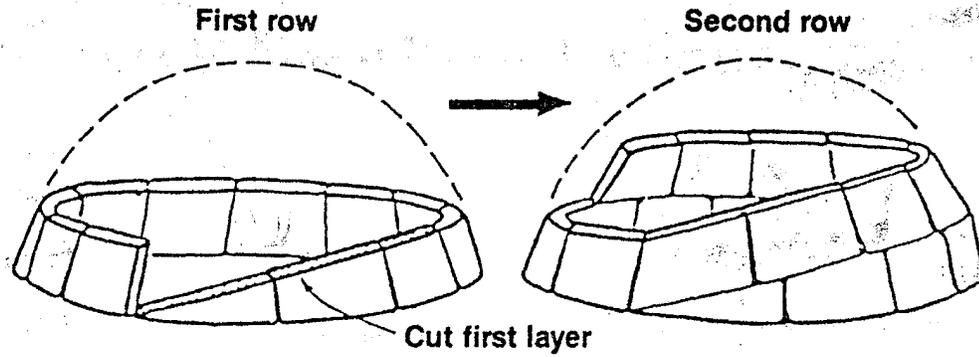


## Igloos

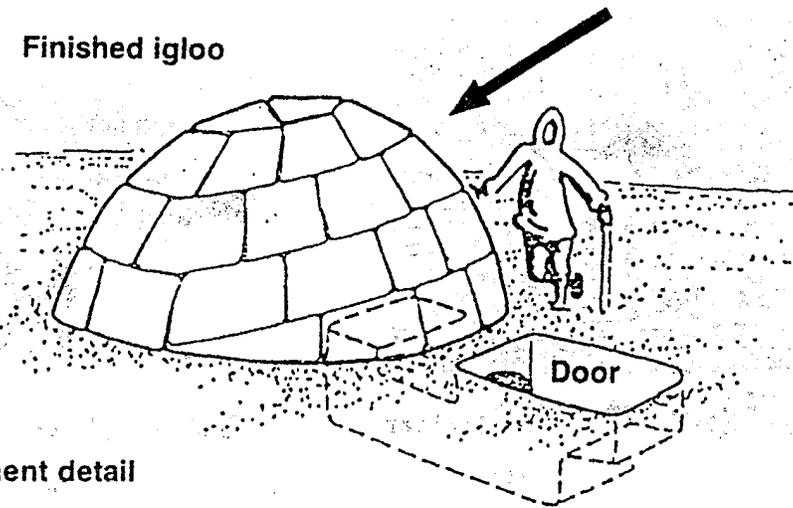
To build an igloo, start by tamping down and packing the snow in an area about ten feet across using snowshoes or skis. Outside this area, cut snow blocks of firm snow using a snow saw, snow knife, folding mountaineering shovel, large toothed tree limb saw (see illustrations):



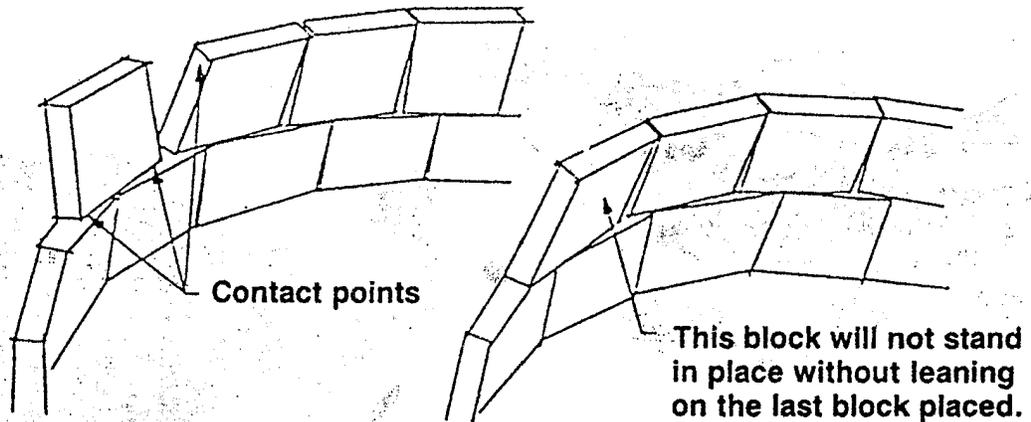
Begin laying the snow blocks in a circle. Cut the blocks in the first layer so that a ramp is formed, allowing the second layer to spiral up onto the first layer so that the entire igloo is a one continuous row spiraling from base to the top.

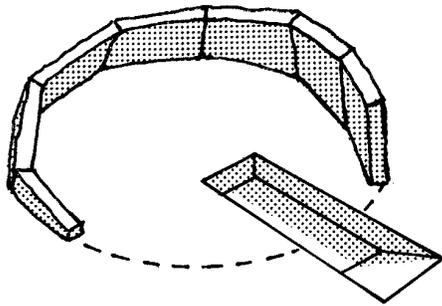


**Finished igloo**

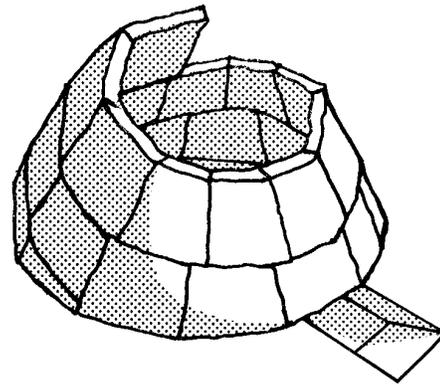


**Block placement detail**



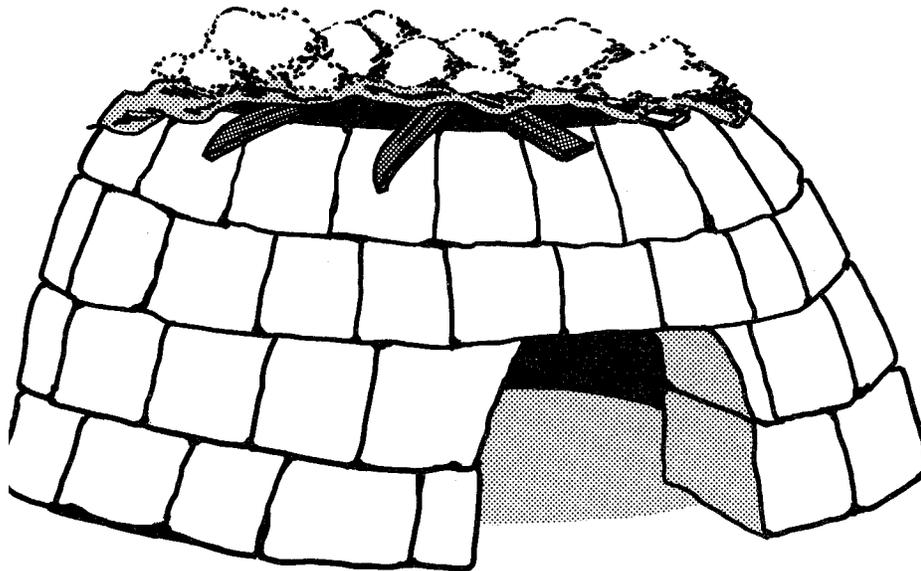


Starting row



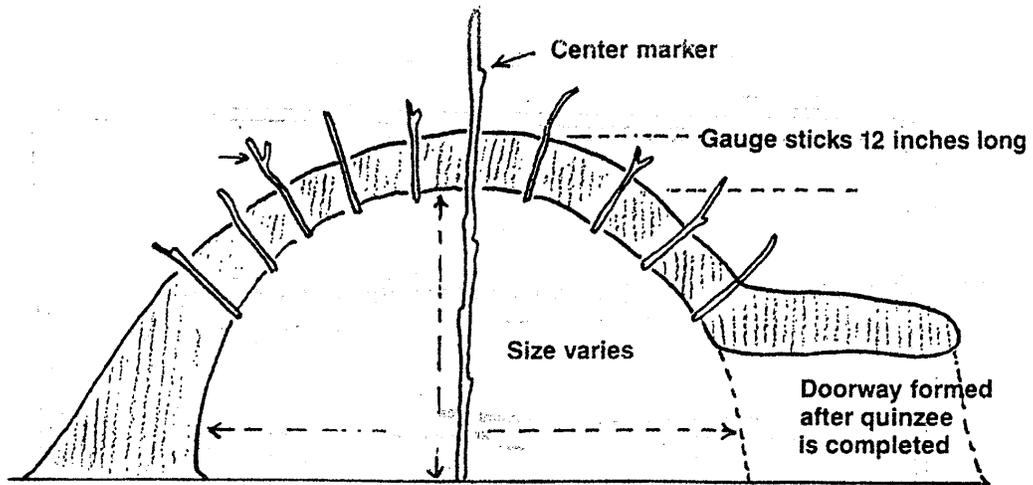
Later stage

### Modified Igloo



### Quinzees

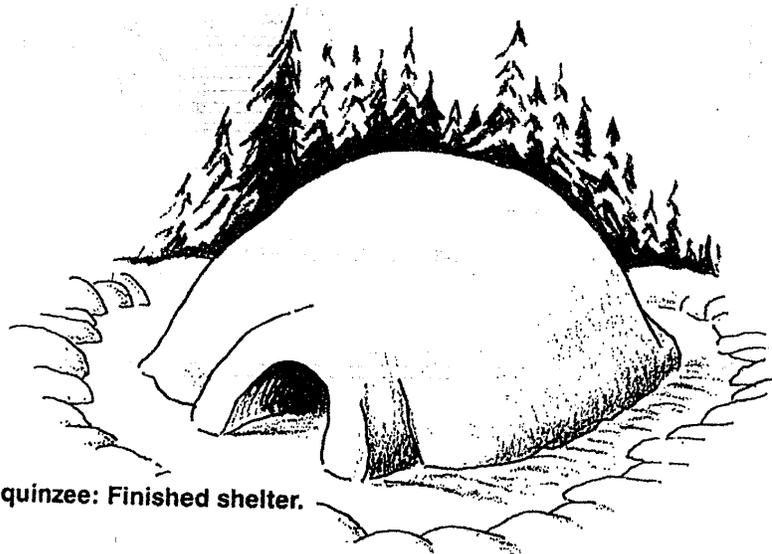
To build a quinzee, begin by piling up snow to a height of about six feet. Stir the snow as you accumulate it to help it re-settle and congeal. After it has settled, place one-foot sticks in the outside of the snow cave. Then hollow out the quinzee using the sticks as markers so that you don't make the walls too thick or too thin.



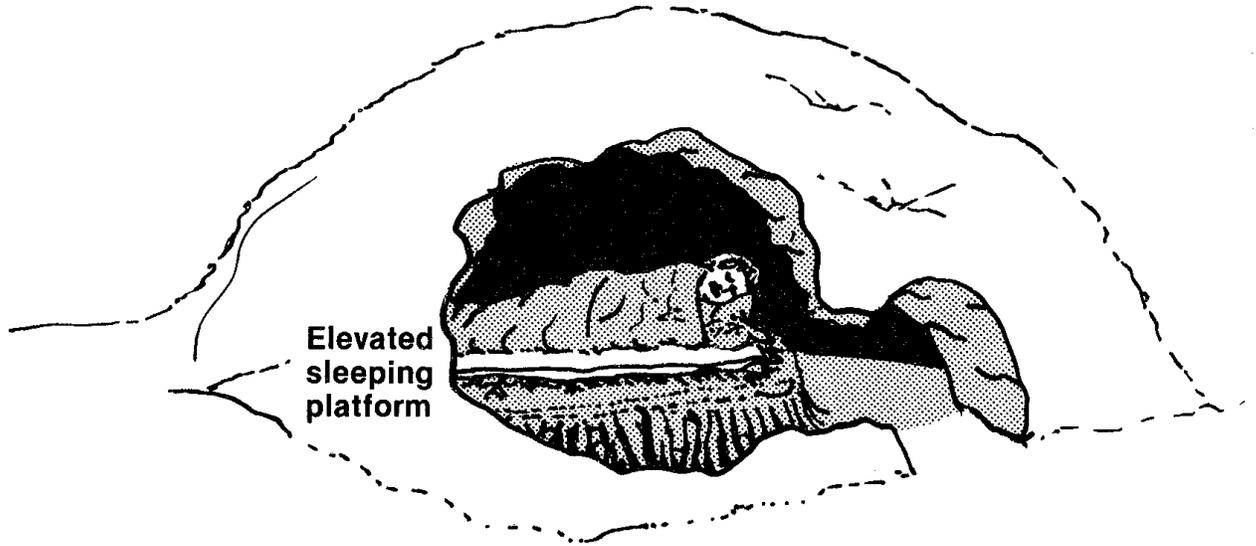
**Building a quinzee: center pole and gauge sticks.**



**Building the quinzee: Shelter almost finished, still showing gauge sticks.**



**Building a quinzee: Finished shelter.**



**Elevated  
sleeping  
platform**