Keeping Warm in Cold Weather

Kids always seem to have fun in the outdoors, right? While that might be true for most of our beautiful Colorado days, winter camping trips can also be dark, wet, and very cold. This can start out as just a little frightening for young Scouts, and without proper preparation it can turn in to a miserable experience and will likely cause us to call the parents to come pick up their son early. With this experience, the Scout could very easily turn away from future camping, outdoor experiences, and even Scouting.

Most of this can be avoided by simply following the Scout Motto: Be Prepared. And how do you prepare? That's what this paper is about.

Hypo what?

There are two cold weather medical conditions that you should be aware of: frostbite and hypothermia.

Frostbite is the freezing of skin and underlying body tissue.

Hypothermia is where the body temperature drops dangerously low.

What's Dead Air?

Dead air is the most important thing to keep you warm. Any air that is moving by exposed skin will cool the body - the "Wind Chill" effect. Dead air is air that does not move. Your body warms the dead air, and that dead air provides the insulation to keep you warm.

How do you create dead air? First you seal off the air from the outside air. Elastic, Velcro, zippers, flaps, and snaps on winter clothing all serve this purpose. Secondly, trapped air needs resistance from internal currents (inside a jacket for example). Adequate (but not excessive) clothing under the outer layer provides this resistance. Too little clothing (like a thin shirt) will not stop the internal currents from giving you a "Wind Chill".

Note that it's the dead air, not the clothing material that keeps you warm. So can you have on too much clothing? Definitely. If the additional clothing doesn't provide more dead air, then it will actually make things worse. First, the clothing will be compressed while taking up the same space, leaving less room for the insulating dead air. Secondly, too much clothing tends to be constrictive, not allowing your blood to flow as easily. Good blood circulation is important to keeping yourself warm.

Moisture

While dead air is the most important thing to keep you warm, moisture is the #1 enemy. Water is much more effective at absorbing heat than air. Moisture next to your body will literally pull the warmth out of your body. While it's fine for short periods of time, like during a ski trip or sledding, it can cause serious problems on a winter camping trip. Prolonged exposure to moisture must be prevented. And it's not just the moisture from snow or rain; perspiration can be just as bad. You may not think your Scout has a perspiration "problem", but with all the activity he'll participate in (e.g., Capture the Flag), his body will release a lot of moisture with the heat his body generates. Amount of dead air space and prevention of moisture on the body are the two most important factors (except maybe price) in determining winter clothing.

The worst material for winter clothing is one where the fibers actually absorb moisture. It's almost impossible to dry in the cold, so it will keep cooling the body until you get out of it. Unfortunately this perfectly describes the ever popular cotton. Sorry, but while you might enjoy "the feel of cotton", it is the worst thing you could wear for winter camping. Now before you think I'm saying you must replace all your Scout's clothing before a campout, note that I will describe a compromise position below.

The Key is Layers

There is actually different types of layers, and they're all important to keeping you warm.

Inner or Wicking Layer. This is the layer right next to the skin (i.e., long underwear). This layer should definitely not be cotton, i.e. those white or off-white long-johns. (For the jockey/boxer shorts, cotton is OK, but make sure they bring enough). Buy good "wicking" long underwear for your Scout. This wicking function will actually pull the perspiration moisture away from the skin and to the outer layers to keep him dry. The most popular material is polypropylene in various weights/thickness, but also known by the trademark names of Thermastat, CoolMax, and Thermax. Silk (trademark name of SilkSkins) also wicks, but isn't thick enough for camping (but is great for normal day wear). Be sure he has a fresh pair for each night, so he will sleep much warmer.

Insulating Layer(s). This layer is where the dead air is trapped, and can actually be a few layers (including the coat lining). This layer should stop the internal currents. The most popular material is fleece and wool. If you have a choice, chose fleece as it performs a little better when wet than wool. This, however, is where the cotton compromise comes in. For car camping, like the Freezoree, cotton sweatshirts can be used instead of fleece or wool, but make sure they have enough of them to change out.

Outer or "Shell" Layer. The primary function of this layer is to block the wind and rain/snow from reaching the other layers (and your body), and to trap in the dead air. Be sure it's good enough quality to take the wear and tear Scouts are likely to give. While not absolutely necessary, a nice feature is a "breathable" fabric. Perspiration is microscopic water vapor, while rain/snow water drops are much larger. A fabric weave with openings between these two sizes allows the perspiration to escape while preventing rain and snow from coming in. The most famous name for this breathable fabric is Gortex, but their patent expired a few years ago so you should be able to find similar products for less.

Body Parts

The layers listed above easily apply to most of your body, but three areas require additional discussion: hands, head, and feet.

Hands. Our relatively small fingers must heat up a comparably large space of dead air, so they are harder to keep warm. A good pair of gloves are needed here, providing both the shell and insulating layers. Some people like to wear separate layers: a shell and an insulated (like wool) gloves. Mittens keep your hands warmer than gloves, but you lose dexterity. Probably the best compromise is wool gloves and a shell mitten (that can be removed when dexterity is required).

Head. Your Scout needs a good wool or fleece stocking cap. This is also important to wear while sleeping. The Scout should also have a "shell" to keep out rain/snow moisture, and a scarf or pull-down stocking cap to cover the face in very cold weather.

Feet. Your Scout should wear a pair of thin polypropylene sock liners and a pair of wool or synthetic socks. The liners will pull moisture away from the feet, and the liner-to-sock movement will help prevent hot spots that cause blisters. Don't bring athletic shoes! You definitely need boots for winter camping.

Fuel for the Fire

We've talked a lot about your body heating the dead air space, but it can't do that without adequate fuel: food and water.

Food. Warm meals obviously help. Sugar can give you quick energy, but it won't last very long. Carbohydrates will provide the necessary longer-term energy. Good snacks here are granola bars with sugar (like chocolate), and Energy/Power Bars or Energy/Power Gels.

Water. Warm, water-based drinks (like hot chocolate) also help. Water is also required to convert the food you eat into energy. Another problem we run into, even in winter, is dehydration. In cold weather you think you don't need to drink very much water, but that's not true. Once you start dehydrating, not only might you get sick (as often happens), but the blood doesn't circulate as well, making you colder. Drink lots of water! By the way, pour the water out of the water jugs into the pots before going to bed, or you may not get the frozen water out of the jugs in the morning.

Other Stuff

Make sure your Scout has a good sleeping bag. These can sometimes be expensive for winter camping weather. Alternatives include putting one sleeping bag inside another and/or using warm (wool, fleece) blankets with the sleeping bag. Definitely get a pad (or two) to put under the sleeping bag. When you lay in a sleeping bag, you compress it underneath you, so there is no dead air space protecting you from the very cold ground.

It's important that when mother nature calls (even at night), you relieve yourself. All the fluid in your bladder is hard for your body to keep warm, so it will make you colder.

The last subject is artificial heat, those little hand warmers and foot warmers. You can get them fairly cheap, and they do a good job.

Epilogue

I hope this paper helps you understand what it takes to keep your Scout warm. Following this advice will help your Scout have exciting opportunities with winter camping.

Cold Weather Camping

COLD WEATHER COMFORT & SAFETY

Cold weather camping as defined by BSA is "camping in weather where the average daily temperature is below 50 degrees Fahrenheit and conditions are cold, wet or windy." The most important thing to remember about cold weather camping is to KEEP DRY. Moisture will reduce the insulating properties of almost everything. To keep yourself warm, remember the word COLD.

C keep yourself and your clothes **Clean.**
O avoid **Overheating.**
L wear clothes Loose and in **Layers.**
D keep **Dry.**

The hints listed below are in a random manner. There is no order of importance to the list, just some suggestions that have proven true for me over the years.

CLOTHING

1. Layer your clothing. Wear several layers of lighter clothing instead of one heavy layer. This way you can better regulate the amount of insulation. If you get warm you can take layers off and add some more clothing layers if you get cold.
2. Keep yourself dry, both from the weather and perspiration.
3. Wear loose fitting clothing, to optimize insulation.
4. Remember when buying clothes for cold weather that wool retains most of its insulation properties when wet, while cotton loose most of its.
5. There are also excellent manmade fibers and insulation's that retain their insulation properties as good as or better than wool. Other benefits include light weight, wide design options & wind-blocking.
6. Remember your rain gear is water proof and will not allow perspiration to exit. During rainy weather change your clothing several times a day.
7. Athletic shoes and nylon hiking boots do not provide enough insulation. You should wear either mukluks, water-proofed leather hiking boots, rubber overshoes or rubberized boots.
8. Waterproof your leather hiking boots with the appropriate commercial treatment. Be sure to use only silicon-based products on leathers which require it. Check the care tag that came with the boots.
9. If you choose to wear rubberized boots, remember they do not allow for ventilation, therefore you will need to change your socks several times a day. Also you may want to get some felt inserts for insulation.
10. Wear a pair of cotton and a pair of wool socks to increase insulation and take the perspiration way from your feet.
11. Pull trouser legs over top of shoes to keep out snow. You may want to use nylon gaiters (leggings), or tie or tape them to make sure of the seal.
12. Wear mittens instead of fingered gloves when you do not need independent use of your fingers. This will allow the fingers to help keep each other warm.
13. Use a pair of socks to cover hands if mittens get wet.
14. Wear a stocking cap or other warm hat. One that covers the ears and neck area is particularly effective. Remember, most heat loss is through the head. Wearing a warm hat warms the rest of your body, too.
15. Wear a scarf to reduce heat loss around the neck. Use a "ski mask" or scarf over your face for protection from the cold and wind.
16. In an emergency use your neckerchief to cover your ears.
17. If you need a fire to keep you warm you are not dressed properly. If the heat can get to your body, so can the cold.
18. Paper is a good insulator and can be wrapped around the body (under your clothes) to add insulation.

BEDDING DOWN

1. Natural fiber sleeping bags do not maintain their insulation properties when damp, down bags also fit here. A 3 to 4 pound synthetic bag will take care of most of your needs.
2. A mummy style bag is warmer than a rectangular, as there is less space for your body to heat. Also, most mummy bags have a hood to help protect your head.

3. If you only have a rectangular sleeping bag, bring an extra blanket to pack around your shoulders in the opening to keep air from getting in.
4. Do not sleep with your head under the covers. Doing so will increase the humidity in the bag that will reduce the insulation properties of the bag and increase dampness.
5. Remember to air out your sleeping bag and tent, when weather permits. Perspiration and breath condense in the tent at night and the water will reduce insulating properties of your bag.
6. Wear a stocking cap to bed in order to reduce heat loss.
7. Wear a loose fitting hooded pull over type sweatshirt to sleep in.
8. Make a loose fitting bag from an old blanket or carpet padding to put both feet in when in your sleeping bag.
9. A bag liner made from an old blanket, preferably wool, will greatly enhance the bags warmth.
10. Insulate yourself from the ground as much as possible to avoid cold spots at the shoulders and hips.
11. Use a sleeping pad of closed cell foam instead of an air mattress.
12. A good rule of thumb is that you want 2 to 3 times the insulation below you as you have over you.
13. Use a ground cloth to keep ground moisture from your bag. Your body will warm up frozen ground to a point were moisture can become important.
14. Space blankets, if used as a ground cloth, will not reflect the body heat. Instead it will conduct the cold from the ground to your body.
15. Cold air will be above and below you if you sleep on a cot.
16. Put a hand warmer (in a sock) at the foot of your sleeping bag before getting into it.
17. Fill a canteen with hot water (not boiling) and place at foot of bag to keep warm. Be careful with plastic canteens.
18. Exercise before bedding down to increase body heat. This will help to warm your bag quicker. Be careful not to start perspiring.
19. Remove the clothes you are wearing before bedding down if they are damp with perspiration. Put on dry clothing or pajamas before entering the sleeping bag.
20. Build a wind break outside your tent by piling up snow or leaves to a height sufficient to protect you when laying down.
21. Hang your sleeping bag up or just lay it out, between trips, so the filling will not compress and lose its insulating properties.
22. Before you get out of bed bring the clothes you plan to wear inside your bag and warm them up some before dressing.
23. Place an empty capped plastic bottle outside your tent door for "night calls." This will reduce your exposure when you have to answer that call. Think twice before using it inside the tent, you do have a tent mate. Remember to empty the bottle away from the camp in the morning.

ODDS AND ENDS

1. If at night you get cold, let the adult leadership know so action can be taken before injury from cold weather health problems occur. In other words it's better to be kidded about forgetting your sleeping bag than risking hypothermia.
2. Organization and proper preparation is very important in cold weather camping. Good meals, proper shelter and comfortable sleeping arrangements make for an enjoyable outing.
3. Drink 2 quarts of fluids per day besides what you drink at meals.
4. Learn to recognize and treat cold weather health problems. These include frostbite, hypothermia, dehydration, chilblains, trench foot, snow blindness and carbon monoxide poisoning.
5. Use the buddy system to check each other for cold weather health problems. Notify the adult leadership if symptoms do occur.
6. If you feel cold gather some wood or do some other type of work. Working will help warm you.
7. Eating ice or snow can reduce your body temperature and it is not pure. Don't eat it.
8. Snow and ice can be used for drinking water but only after boiling.
9. No open flames (candles, matches, etc.) inside the tents. Wiggling your toes inside your boots will help keep feet warm. If your feet get cold put on a stocking cap.
10. Take and wear dark sunglasses if snow is in the forecast. The glare of the sun off the snow could lead to snow blindness. The sunglasses will reduce the glare.
11. Use the solid fuel hand warmers. They are cheaper and you can light them yourself. Adult leaders must handle all liquid fuel.
12. The solid fuel hand warmers tend to have a flair up of heat after burning for a while and then they start to cool down. Placing them in an old sock will help to protect you from this "hot spot".

13. Keep off ice on steams, lakes and ponds.
14. It takes longer to cook food in cold weather, so plan accordingly. Before going to bed pour enough water for breakfast into a pot. It is easier to heat the pot than a plastic water can.
15. Keep your matches in a metal match safe as plastic can freeze and break if dropped.
16. Gather twice as much fuel as you think you'll need for fires.
17. Carry tinder from home. It may be hard to find in snow or wet conditions.
18. Gather your wood and tinder for the morning fire in the evening so that you will be able to start the fire quickly in the morning.
19. Space blankets make good wind shields only. The metallic properties take over the insulation properties in cold weather and become cold conductors.
20. Carry extra plastic bags in cold weather. They can be used as personal wind shields and ponchos by slitting a hole in the top for your head to go through.
21. Carry extra matches because the more you need a fire to warm up the less likely you will be able to start one easily.
22. Flashlight batteries are effected by cold. You can revive a dead battery by warming it up near the fire.
23. You may want to take a bottle of propane into your tent with you at night. This will keep it warmer and make it easier to light your stove for breakfast.
24. Heaters inside your tent can lead to carbon monoxide poisoning.

Cold weather camping references:

- OOPIK manual, No. 34040
- BSA Field manual
- BSA Snow Camping Venture manual

LAYERED CLOTHING SYSTEM

Select the proper type and amount of clothing. Regulate your clothing according to your activity rate. This is the most effective way to ensure comfort. Pay attention to your bodies' signals. Don't wait until you are cold to put on more clothing. Act when you first begin to feel cooler.
Clothing layers:

- Long, thermal underwear. polypropylene
- Shirt or inner layer
- Sweater, light jacket
- Wind or rain gear
- Long, thermal underwear. polypropylene
- Inner pants wool, wool blend
- Wind or rain pants
- Wicking inner socks polypropylene
- Insulating socks wool or wool blend
- Boot liners insulated insoles
- Footwear, boots waterproof, loose-fitting, mukluks or snow boots
- Head coverings
- Gloves and mittens

TYPES OF COLD:

Wet cold: 50º F to 14º F

The most dangerous. Wide temperature variations from melting during the day to freezing at night makes proper dressing difficult, and important. Damp conditions from melting snow or rain makes keeping dry difficult.

Dry cold: 14º F to -20º F

Ground is frozen and snow is dry and crystallized. Strong winds cause the most concern with keeping warm. Extra clothing layers and wind-proof outer garments should be added.

Arctic cold: below -20º F

Requires the most insulation and wind-proofing. Many materials change physical properties, becoming brittle. Only for the most experienced campers.

LOSS OF BODY HEAT

Homeostasis:

The body's process for maintaining an even temperature. The arms and legs are used as a radiator to remove excess heat from the body. This process dilates the blood vessels, allowing more blood to flow to the skin surfaces. When the body temperature drops, these blood vessels constrict, decreasing blood flow, and thereby, heat loss. This is why hands and feet get numb when cold, and why they're particularly vulnerable to frostbite.

Since your brain needs oxygen to function, your body can't cut off the flow of blood to your head in order to conserve heat. Consequently, much of your body head can be lost through an uncovered head and neck.

Radiation. (55%) A major source of heat loss. Heat is lost directly from exposed skin and the head. The head may lose up to one-half of the body's total heat production at 40 degrees F, and up to three-quarters at 5 degrees F.

Conduction. (15% w/convection) Heat is lost through skin contact with cold objects, primarily the hands, and wet or tight clothing. Handling gasoline, and other super-cooled liquids, at low temperatures is especially dangerous.

Convection. Heat is lost from the wind carrying away heat from the surface of the skin. This includes wind-chill effects.

Evaporation. (21%) Loss from evaporation of sweat, moisture from the skin and lungs produces substantial heat loss. This is little that can be done about this. We need to allow for this by using breathable fabrics to allow this moisture to pass out freely.

Respiration. (2-9%) Heat lost from inhaling cold air and exhaling warm air.

COLD WEATHER FIRST AID

Dehydration

Excessive loss of body water. Impairs the ability to reason, so the victim may not react properly.

Prevention:

- Drink at least 2 quarts of water a day.
- Avoid dehydrating foods (high protein) and fluids (coffee, caffeine).
- Increase fluid intake at first signs of darker yellow urine.

Symptoms:

1 to 5 % deficiency

- Increased pulse rate
- Nausea and loss of appetite
- Dark urine or constipation
- Irritability, fatigue
- Thirst

6 to 10 % deficiency

- Headache, dizziness
- Labored breathing
- Tingling
- Absence of salivation
- Inability to walk
- Cyanosis (bluish or grayish skin color)

11 to 20 % deficiency

- Swollen tongue, inability to swallow
- Dim vision, deafness
- Shriveled, numb skin
- Painful urination
- Delirium, unconsciousness and death

Treatment:

Mild cases - drink liquids, keep warm.
More severe cases require professional medical treatment.

Hypothermia

Lowering of the inner core temperature of the body. Can and usually does happen above freezing. The victim may not recognize the symptoms and may not be able to think clearly enough to react. Injury or death may result.

Predisposing Conditions:

- Poor physical condition.
- Inadequate nutrition and water intake.
- Thin build.
- Nonprotective clothing.
- Getting wet.
- Inadequate protection from wind, rain and snow.
- Exhaustion.

Symptoms:

- Loss of ability to reason.
- Shivering.
- Slowing, drowsiness, fatigue.
- Stumbling.
- Thickness of speech.
- Amnesia.
- Irrationality, poor judgment.
- Hallucinations.
- Cyanosis (blueness of skin).
- Dilation of pupils of eyes.
- Decreased heart and respiration rate.
- Stupor.

Treatment:

- Shelter the victim from wind and weather.
- Insulate the victim from the ground.
- Change wet clothing.
- Put on windproof, waterproof gear.
- Increase exercise, if possible.
- Put in a prewarmed sleeping bag.
- Give hot drinks, followed by candy or other high-sugar foods.
- Apply external heat; hot stones, hot canteens.
- Huddle for body heat from others.
- Place victim in a tub of 105º F water. Never above 110º F.

Prevention:

- Keep rested, maintain good nutrition.
- Consume plenty of high-energy food.
- Use proper clothing.
- Make camp early if tired, injured or lost.
- Get plenty of exercise. Don't sit around much.
- Appoint an experienced person to watch the group for signs.
- Take immediate corrective action for any signs.

Frostbite

Tissue injury involving the actual freezing of the skin and underlying tissues. Recovery is slow, severe frostbite can lead to gangrene. Once exposed the victim will be predisposed toward frostbite in the future.

Predisposing Conditions:

- Prolonged exposure to temperatures 32º F or below.

- Brief exposure at extremely low temperatures, -25º F and below.
- Exposed body parts
- Restriction of circulation.
- Fatigue, poor nutrition, low liquid intake, poor physical condition.
- Previous case of frostbite or other cold injury.

Symptoms:

First Degree (Frostnip)

- Redness, pain, burning, stinging or prickly sensation.
- Pain disappears and there is a sudden blanching of the skin.
- The skin may look mottled.
- Skin is firm to the touch, but resilient underneath.
- On thawing, there is aching pain or brownness. The skin may peel off, and the part may remain cold for some time.

Second Degree (Superficial Frostbite, Frostbite)

- No pain, the part may feel dead.
- Numbness, hard to move the part.
- Tissue and layers underneath are hard to the touch.
- After thawing (takes 3 to 20 days) pain, large blisters, sweating.
- Black or discolored skin sloughs off, leaving tender new skin.

Third degree (Severe Frostbite)

- Full thickness of the skin is involved.
- After thawing, pain continues for 2 to 5 weeks.

Fourth degree (Severe Frostbite)

- Skin and bone are frozen.
- Swelling and sweating occur.
- Gangrene may develop, amputation may be necessary.

Treatment:

- Do not rub affected area with snow. Hold it over fire, or use cold water to thaw it.
- Exercise the affected area to promote blood circulation.
- Use any warmth available to thaw area.
- Do not attempt to thaw frostbitten limbs in the field. It is less harmful for the victim to walk out on a frostbitten limb than to thaw it in the field. Thawing only risks additional injury and the victim will be in too much pain to walk.
- Check for hypothermia.
- For more severe cases refer to more complete instructions.

Prevention:

- Proper clothing.
- Good nutrition, drink water, maintain core temperature.
- Use buddy system to check face, nose, and ears.
- Immediate treatment of minor symptoms.

Snow Blindness

Inflammation of the eye caused by exposure to reflected ultraviolet rays when the sun is shining brightly on an expanse of snow.

Symptoms:

Sensation of grit in the eyes, made worse by eye movement, watering, redness, headache, and increased pain on exposure to light.

Treatment:

Blindfold the victim and get rest. Further exposure should be avoided. If unavoidable, the eyes should be protected with dark bandages or the darkest sunglasses. The condition heals in a few days without permanent damage once exposure is stopped.

Prevention:

Wear sunglasses when any danger is present. Do not wait for discomfort to begin.