Winter Camping – The Complete Experience

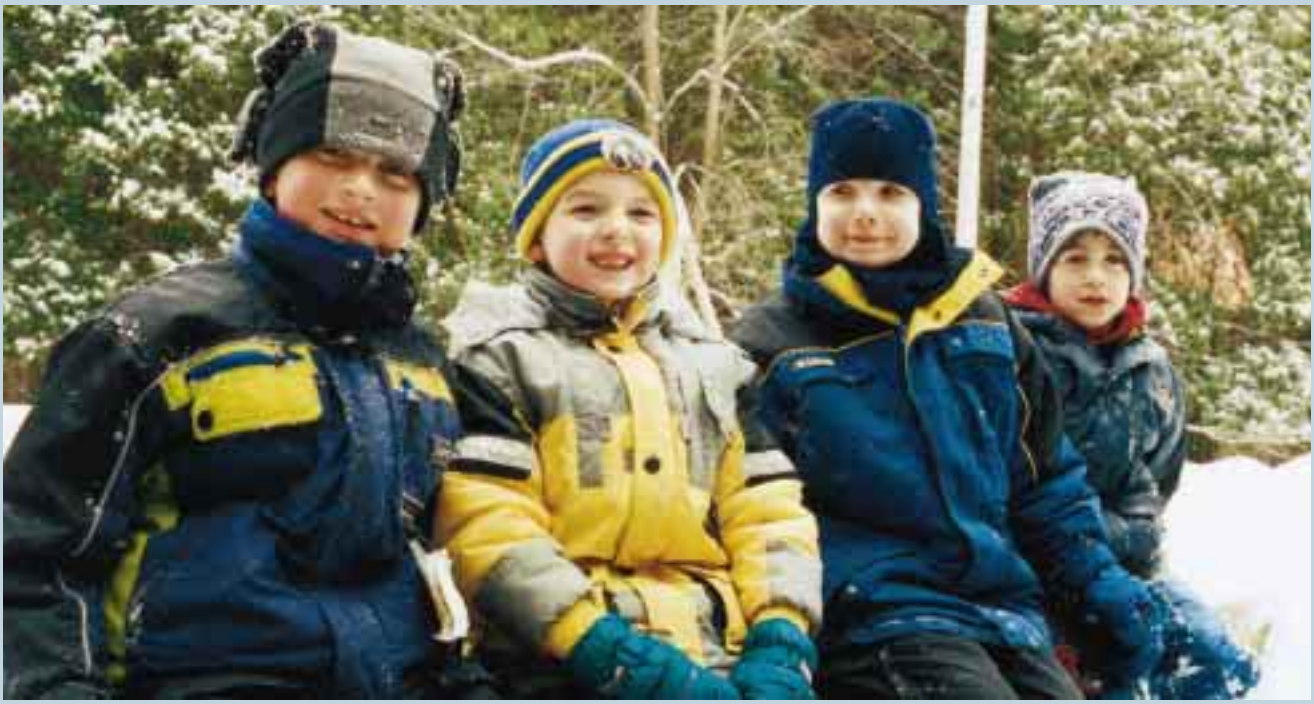

Photo: M. Kennedy, 1st Ballantrae Beavers

Part One – Be Prepared to Keep Warm

by Rick Curtis

Welcome to the first in a series of articles on everything you always wanted to know about winter camping! We'd like to thank Rick Curtis, Director of the Outdoor Action Program at Princeton University, author of *The Backpacker's Field Manual* and founder of OutdoorEd.com.

Exploring the wilderness in winter is a wonderful experience. You are far from the crowds, in a hushed, tranquil world of white. At the same time you must realize that this environment can be extremely dangerous. If you aren't aware of the hazards and of the proper precautions, skills, and equipment to have you can be at great risk.

Trip Planning

Planning a trip in the winter means spending a good deal of time researching areas and conditions to determine where, when, and how the trip will work. All of these factors will interact to determine what your daily pace and mileage can be.

- Goals for the trip
- Route (will you be on a trail or off trail, or a mix)
- Snow level (shallow or deep)
- Snow quality (powder, packed, breakable crust, or variable)
- Trail (breaking trail or on a broken trail)
- Mode of travel (will you be hiking, snowshoeing, or skiing)
- Elevation changes (going up may be very slow while coming down may be very fast)
- Strength and experience of group
- Group size

Keeping all these factors in mind, set up a Time Control Plan for your trip. Keep in mind that everything takes "twice" as long in the winter (setting up camp, breaking camp, cooking, going to the bathroom, etc.). Look at your proposed route for potential campsites for each day. Also look to see where you could camp before your planned site if you can't make it. Know what your emergency and bail-out options are if conditions deteriorate or you have problems. Talk to area rangers about permits and camping restrictions. Find out about snow levels, avalanche danger, safety of ice crossings, etc.

Heat Loss

The essence of staying warm in the winter is having the proper clothing layers and knowing how to use them effectively. The body basically acts as a furnace, producing heat through chemical reactions and activity. This heat is lost through conduction, convection, evaporation,

radiation, and respiration. As physical activity increases, so does heat production; conversely, as activity decreases so does heat production. The key to keeping warm is to add insulation to the body.

Insulation

The thermal insulation of clothing is proportional to the thickness of the dead air space enclosed. Dead air is defined as any enclosed unit of air that is small enough that natural convection currents would not arise in it. Such currents have been detected in units as small as 2 millimetres in diameter. The dead air next to the skin is heated up by the body and provides a layer of warmth around the body. The clothing is not what is keeping you warm - it is the dead air. This is because the denser the material, the faster it can transfer heat through conduction.

The Layering Principle

The key to providing this dead air space is having a number of layers of clothing. This allows you to add or shed layers to increase or decrease your accumulated dead air space as the temperature changes and/or as your activity level changes. Remember, your body is the heat source; the clothing layers only serve to trap the heat and slow down your heat loss to the cold environment. If you have too much clothing on, you will overheat and start to sweat. You need to find the proper heat balance between the number and types of layers and your activity level.

Example 1: You are snowshoeing up a steep incline with a 50 lb. pack. The air temperature is -12 degrees Celsius and you are dressed in wool pants and a lightweight polypropylene shirt. As soon as you stop for a rest, your heat production slows. If you stop for more than a couple of minutes, you will begin to chill. So you need to have an outer layer handy to put on.

Example 2: You are skiing along a level surface. The air temperature is -4 degrees Celsius and you are dressing in light polypropylene tops and bottoms, a down vest, and a windshell. You come to a long steep hill and have to push hard to get up and over. You start to sweat as your heat production increases with greater muscle activity. To prevent overheating, you pull off the vest and stick it in your pack.

Why not just have lots of layers on and sweat? Heat loss from a wet surface can be up to 25 times greater than a dry surface (due to the higher density of water). If you sweat and get soaked, you will lose heat much more quickly through evaporation of the water. Also you are losing an incredible amount of water through sweating since the air is so dry. Too much water loss leads to dehydration which significantly increases the risk of hypothermia. So you want to control your layers so as to be warm at the activity level you are in (but not sweating profusely).

You need to have clothes that fit properly but not tightly.

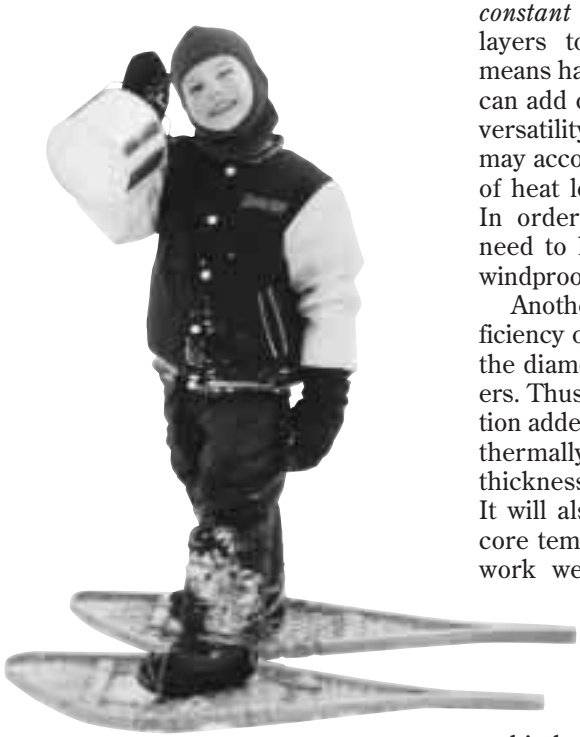

Photo: Charles Case

Example 3: You are standing on a windblown summit in a wool sweater; the wind will penetrate through the openings in the sweater and quickly carry away the warm layer of air next to the skin. Another convective factor is the "bellows action" of clothing. As you move a bellows action occurs which tends to pump your accumulated warm air out through openings in your clothing and sucks the cooler air in. In some conditions, this action can reduce your body's personal insulation by 50% or more. Thus, it is important that *all* layers have effective methods of being "sealed" (i.e. buttons, zippers etc). Openings in layers allow you to ventilate, to open the "chimney damper" if you are beginning to overheat, without having to actually remove a layer. So opening and closing zippers on a jacket, or armpit zips will allow you to either ventilate if you are getting too hot or seal up if you are getting chilly; all without having to add or take off a layer. With clothes that are too loose, the bellows action pumps warm air out through the openings. You need to have clothes that fit properly but not tightly. Too tight, and the clothes compress and actually reduce dead air space in layers below as well as restricting body movement.

Thus, traveling in the winter is a *constant* process of adjusting your layers to keep comfortable. This means having a number of layers you can add or subtract and allowing for versatility within layers. Convection may account for the greatest amount of heat loss under most conditions. In order to properly insulate, you need to have an outer layer that is windproof.

Another general rule is that the efficiency of clothing is proportional to the diameter of the body part it covers. Thus a given thickness of insulation added to your trunk will be more thermally efficient than the same thickness added to your arm or leg. It will also help maintain that body core temperature. This is why vests work well to maintain body heat. There is an optimal thickness of insulation for each body part; beyond that the added bulk tends to be more of a hindrance in movement than the added insulation is worth.

Have you ever noticed that your hands feel colder after putting on a thin pair of gloves? This is because when insulation is wrapped around a curved surface, the cross-sectional area of the insulation through which the heat may flow is greater, as is the surface area from which the heat may be lost. This means that the total insulation efficiency of a given thickness progressively decreases as curvature sharpens over a surface. In addition, small cylinders, such as fingers, show a paradoxical effect. The addition of a thin layer of insulation actually increases heat loss until a thickness of about ¼ inch is reached. This heat resistance gains as additional thickness is added. However, added thickness beyond ¼ inch increases warmth very little

in proportion to its thickness. This is one reason that thin gloves don't keep your hands particularly warm.

The Body and Clothing

Head - because the head has a very high surface to volume ratio and the head is heavily vascularized, you can lose a great deal of heat (up to 70%) from the head. Therefore, hats are essential in winter camping. The adage - if your toes are cold, put on a hat - is true. A balaclava is particularly effective and versatile. A facemask may be required if there are high wind conditions due to the susceptibility of the face to frostbite.

Hands - mittens are warmer than gloves because you don't contend with the curvature problem described above. Also the fingers tend to keep each other warm, rather than being isolated as in gloves. It is useful to have an inner mitten with an outer shell to give you layering capabilities. Also "idiot strings" are important to keep you from losing mittens in the snow. However, gloves are always essential as well in winter because of the need for dexterity in various operations.

Feet - finding the right footgear depends a great deal on the activity you are involved in as well as temperature and environment. The two general modes of travel are skiing or snowshoeing (in areas with only a few inches of snow you can hike in just boots).

Cross-country skiing - you need a boot that has some ankle support due to the extra weight of a backpack. Also you may need a ski overboot to give you additional insulation over the ski boots.

Snowshoeing/Hiking - regular backpacking boots are *not* sufficient. They simply do not provide the necessary dead air space. The options for boots include:

- **Insulated Boots** - such as Sorels™ or "Mickey Mouse" boots. These are rubber or leather and rubber boots that use a layer of wool felt to provide dead air space. The Mouse boots can be Army surplus or modern copies (avoid the copies since they are often poorly made). With the true Army boots, the black boots are rated to -30 C degrees and the white ones to -40 C degrees. The one drawback with Sorels™ is that the wool felt liner is exposed. Breaking through a frozen stream may soak the liner which will be difficult to dry. They can be used with snowshoes, crampons and skis (with special bindings).
- **Plastic Mountaineering Boots** - plastic shell mountaineering boots use inner boots made with wool felt or a closed cell foam insulation. These can be very warm and easily used with ski bindings, crampons, and snowshoes. Depending on the inner boot, you may need insulated overboots to add enough insulation to keep your feet warm.
- **Mukluks** - one piece moccasins which reach to the knee. They are used with felt liners and wool socks. The Mukluk itself serves as a high gaiter. They are flexible and breathable. They work with snowshoe bindings and can be used on cross-country skis with special bindings (Berwin Bindings™) and with hinged crampons (not for technical ice). They are extremely comfortable, but since they are not waterproof they are best used in dry, cold winter settings where water and rain are not a problem (e.g. stream crossings, possibility of rain, etc.).
- **Heavy leather mountaineering boots** with an insulated overboot - this can be effective but the system still is not very thermally efficient and may lead to frostbite of the feet *(not recommended)*.
- **Socks** - one of the best systems for keeping feet warm is using multiple layers. Start with a thin polypropylene liner sock next to the skin to wick moisture away followed by one or two pairs of wool or wool/nylon blend socks. Make sure the outer socks are big enough that they can fit comfortably over the inner layers. If they are too tight, they will constrict circulation and increase the chances of frostbite. Keeping your feet dry is essential to keeping your feet warm (you may need to change your socks during the day).

Foot powder with aluminum hydroxide can help. High altitude mountaineers will put antiperspirant on their feet for a week before the trip.

WINTER WARNINGS

The greatest dangers in the winter environment are hypothermia and frostbite. Hypothermia results when the body loses heat too rapidly. At a certain point the body's heat producing ability cannot keep pace with the heat loss and the core temperature—the temperature of the internal organs begins to drop. Once core temperature begins to drop the body can no longer reverse this trend without aid—either food, warm clothing, fire etc. Generally it is impossible to self-diagnose hypothermia once it is past the beginning stages. Without recognition and proper treatment it leads to death.

Frostbite is the freezing of body tissue. It begins at the skin surface and can move to deeper tissues. Proper rewarming and treatment must be given or tissue may be lost. In extreme cases limbs are lost.

Winter camping is a great experience when you're really prepared.

Photo: Fredericton District Winter Scout Camp

The active ingredient, aluminum hydroxide, will keep your feet from sweating for up to a month. (Some medical research has suggested a link between aluminum and Alzheimer's Disease but small exposure, as of the original writing of this article, does not appear to be a problem).

• **High Gaiters** - are essential for winter activity. They keep snow from getting into your boots and keep your socks and pants legs free from snow.

• **Insulated Booties** - these are booties insulated with a synthetic fill that typically have a foam sole to insulate you from the ground. They are very nice to have to wear in your sleeping bag at night.

• **Camp Overboots** - are shells with an insulated bottom. These can be worn over insulated booties for traipsing around in camp; also for those middle-of-the-night visits to the woods.

• **Outer Layer** - it is essential to have an outer layer that is windproof and at least water resistant. In some cases it may be best to have the garment waterproofed. It also needs to be able to be ventilated. There is a big trade off between waterproofness and ability to ventilate. A completely waterproof item will keep the water that is moving through your other layers trapped, adding to weight and causing some heat loss. However, in wet snow conditions, if the garment is not waterproof, it can get wet and freeze. Gore-tex™ and other similar fabrics provide one solution. These fabrics have a thin polymer coating which has pores that are large enough to allow water vapor to pass through but too small to allow water droplets through. Nothing is perfect, however, and although Gore-tex™ does breathe, it doesn't breathe as well as straight cotton/nylon blends.

If you opt for a straight wind garment, 65/35 blends of cotton and nylon work well. The other approach is to have a waterproof garment with sufficient ventilation openings to allow water vapor to escape. This provides the ability to work in wet snow without worrying about getting the garment soaked. Part of the basis for making the decision is the area you are traveling in. If you are in the dry snow of the Rockies, you needn't worry so much about waterproofness. If you are in the northeastern mountains where freezing rain is a possibility or very wet snow, you need to be prepared to be wet.

• **Zippers** - are wonderful accessories for winter clothing. Having underarm zippers on jackets can greatly increase your ability to ventilate. Having side zippers on pants can allow you to ventilate and to add or subtract a layer without taking off skis or snowshoes.

At the end of the day, as activity decreases and temperature drops, you will need to add layers.

• **Miscellaneous** - knickers with knicker socks can make a good combination. You have the option of ventilating by opening up the bottom of the knickers and/or rolling down your socks. Also bibs are helpful (both pile and outer waterproof layer) because they prevent cold spots at the junction between tops and bottoms. Underwear is also available in the traditional union suit design which accomplishes the same thing. Snaps on clothing can be a problem because they fill with snow and ice and fail to work. Velcro™ works much better as a closure.

Clothing Techniques

1. When you first get up in the morning (and at the end of the day in camp), your activity level will be low as will be the temperature. You will need to have many, if not all, of your layers on at this point until breakfast is over and you have started to become active.
2. When you get ready to be active, you will need to take off layers since you will begin generating heat. A good rule of thumb is to strip down until you feel just cool, not chilled just before activity. Failure to do this will mean overheating, sweating, losing heat and you will have to stop ten minutes down the trail anyway to take layers off. Open or closing zippers, rolling sleeves up or down, taking a hat off or putting one on will all help with temperature regulation.
3. If you stop for more than a few minutes, you will need to put on another layer to keep from getting chilled. Keep a layer close at hand.
4. Whenever you get covered with snow, either from a fall or from dislodged snow from a tree, it is essential to brush yourself off to keep your clothing free of snow. Failure to do so often results in the snow melting into your clothing and refreezing as ice.
5. At the end of the day, as activity decreases and temperature drops, you will need to add layers. Once you start to cool down it takes a lot of the body's resources (calories) to heat up again so layer up ASAP before you get chilled. It may be good to put on more than you think you need; it will only get colder. If you are too warm, you can open up layers and ventilate to reach the proper temperature.

Be sure to read Winter Camping: The Complete Experience (Part Two) in the February issue of *Leader.*

Photo: Jeff Pennock, 1st West Rouge Group (B-Pack.)