

Vapor Barrier -- Wet Conditions

Vapor Barriers for Winter Comfort

This guide is designed to introduce the concept of vapor barriers.

Are you tired of your sleeping bag turning into a wet, soggy mess? Are you always cold in the outdoors? Do you have cold feet? Have you ever thought that is not all it is cracked up to be? Then read on!

History

Vapor barrier insulation has been used in homes for over 80 years, and in clothing since 1944. It took about 45 years for ignorance and stupidity to be overcome in the building industry and get vapor barrier recognized as an essential. The argument was that they needed porous walls to dry out water found in them, ignoring the fact that it was the porosity that let water vapor in to condense. Thus it is not too surprising to hear almost the same argument today against vapor barrier in clothing! The other argument is actually optimistic: they expect vapor barrier to always overheat you because high humidity contributes to summer overheat! Wouldn't it be nice if we could just get all needed warmth simply by controlling humidity! Unfortunately we can only get up to 22 deg. added warmth from humidity retention with VB.

During the 1950s mountain hiking and backpacking became more popular. In rain people wore their usual rain wear which worked well in other conditions, but that strenuous activity caused them to overheat and get wet with sweat. Most stopped the overheating by wearing less clothing under their rainwear. A few thoughtless ones blamed their rainwear for their overheat, ignoring their usual method to correct overheating by removing extra clothing. Knowing that

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the coated rainwear was warmer than open weave fabric, they started a quest for colder &quot;breathable&quot; rainwear.

During World War II, United States cold weather troops used vapor barrier socks to totally cure frostbite and trenchfoot. Those led to the vapor barrier Korean War &quot;Bunny Boots,&quot; still the standard for military cold weather use.

Stephenson Warmlite started promoting the use of vapor barrier socks (baggies, bread bags, etc.) in 1957, the gloves, shirts, and sleeping bag interiors in 1967.

Choinard made quite durable VB socks from his tough &quot;Sealcoat&quot; fabric. Black Diamond is now the brand name for this product.

### Breathability

Most rainwear and sailing foul weather gear is made of coated nonporous fabric. (Even Gore-Tex is only about 1/10 as breathable as uncoated fabric and most people say Gore-Tex makes a rain jacket warm not cool.) Most people know that raingear provides a lot of warmth if it is kept tightly sealed so wind cannot blow through! Most ski parkas, storm overpants, and snowmobile suits have a coating on the hidden inner surface of the outer fabric because coating works so well for warmth and waterproofness. Sealed fabric is warmer because it will not let cold air blow through to remove heat and it retains some humidity to reduce the evaporative chilling of your skin. This tends to confuse some people: your skin can feel dry and yet have high evaporative heat loss. Insensible sweat glands keep your skin moist for flexibility, even when cold.

We are falsely told that &quot;breathability&quot; to make rainwear cold will also make your clothing warm. But the slight porosity of &quot;breathable&quot; rainwear doesn't prevent overheat when

active, while highly porous clothes close a lot of heat through convection and evaporation. The "myth is a typical but dangerous mental reversal. It defies all logic and all known physics, yet writers believe it just because they have seen it repeated so often in ads.

When cold air is warmed to skin temperature the relative humidity next to your skin approaches zero. This causes rapid evaporative cooling of your skin. When insensible sweating cannot keep up with the excessive drying your skin gets dry and chapped. For example, when it is 32 degrees Fahrenheit outside, evaporative cooling can make it feel 22 deg. colder. (At lower temperatures there is only a small increase in evaporative heat loss since 32 deg. air is almost as dry as any colder air -- cold air just cannot hold much humidity.)

Your body constantly produces, and loses heat. If heat loss matches production you stay comfortable. If you are comfortable (clothed or unclothed) and then increase heat production, you will overheat. Your body responds with sensible sweating, to increase cooling by evaporation of sweat. If you lower the air temperature or remove or vent clothing you soon cool, sensible sweating stops, and your skin is soon dry. But even then, as long as the relative humidity in the air next to your skin is less than 100 percent moisture in your skin will continue to evaporate, cooling and drying your skin excessively. If humidity next to your skin reaches 100 percent (meaning it cannot hold more water vapor), evaporation stops, chilling stops, and insensible sweating stops. A humid summer day feels much hotter than a day with the same temperature and low humidity. Rain acts as a dehumidifier and that is what makes a rainy day feel much colder than an equal temperature sunny, dry, but humid day.

If that was all there was to the problem, simply adding more clothes

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(and using moisturizing skin creams) should take care of it, and that works fine for short periods of cold exposure. But usually the outside relative humidity is 100 percent so the air cannot accept more humidity, and thus most of the moisture evaporated from your skin condenses in the outer layers of your clothes.

If you sweat from overheat your skin gets wet and the sweat wicks into and soaks your clothing without cooling you more because the air cannot accept more humidity. That sweat only destroys the insulation of your outer clothes and chills you later when you need warmth! Wicking may keep the sweat comfortably away from your skin so you will not notice it, but that delays the intelligent action of venting or removing excess clothing to stop the overheat. Then when you finally slow down or stop, and you need your insulation, you find it is wet, and worse than having no insulation. Before you die of hypothermia from believing those false ads claiming their insulation is warm when wet, I suggest you soak your jacket in a tub of water, shake it out and wear it to experience just how cold it will really be!

Most of this is not a problem if you are just going outside for short periods, or not changing activity levels greatly. But for someone jogging, Nordic skiing, or hiking it can be a very serious, dangerous matter. Is there a solution? Yes!  
Warm when Wet?

What is warm when wet? A hot tub! But certainly not any porous insulation used in clothing or sleeping bags. All porous bulk insulators, such as polyester, Hollofil, Polarguard, Thinsulate, and even down are terribly cold when wet. To stay warm you must keep those insulations dry. It will not make you any warmer sitting in a freezing wet synthetic fill jacket, knowing it will only take 6 hours instead of the 8 hours that a down jacket would take, because you would have a severe case of hypothermia before then!

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The many insulations used will all keep you warm if you take the simple precautions to use the excellent rain gear now available and avoid soaking it with sweat, by wearing a vapor barrier shirt with proper heat loss regulation.

You may have noticed that down is worn by water birds, while dry land birds, like chickens or turkeys, do not wear down. But those water birds always keeps their down dry!

Foam insulation can keep you warm when wet. Open cell foams will not hold much water, and will maintain full loft when wet, although evaporative heat loss goes way up. Closed cell foam, such as used in wet suits, cannot absorb or pass water, so insulation is unchanged when wet, and as in a "wet" suit, you stay warm because you stay dry! (Note that in a wet suit that is not close fitting enough to keep you mostly dry will not keep you warm!) Closed cell foams will provide about twice the insulation per inch of thickness as porous insulations (Thinsulate comes close to matching that), but unfortunately are stiffer and heavier for the same insulation, and cannot be compressed for packing.  
Science

It has been reported that a person loses about four pounds of water through sweat and respiration during a night of sleep in dry winter weather when using a "breathable" sleeping bag. Weighing of porous sleeping bags in the morning usually shows two to four pounds weight increase, confirming that statement, and also showing that the sweat doesn't always make it out of the bag. Instead, it condenses in the insulation leaving your bag wet. It takes 1080 BTU of heat from you to evaporate one pound of sweat. It also takes 140 BTU to melt one pound of ice. Thus the heat to evaporate four pounds of sweat will melt 30.85 pounds of ice! ( $4 \times 1080/140 = 30.85$ ) Would you want to take 30.85 pounds of ice to bed with you? That is the effect you get by not using

vapor barrier interior in your sleeping bag.

If you lose four pounds of sweat during eight hours of sleep you can expect to lose much more during the sixteen hours you are awake and active. That is a lot of dehydration and heat loss, and can lead to serious impairment of circulation due to thickened blood, increasing risk of frostbite. You know that warm humid conditions decrease evaporative losses and you can create that warm humid condition around your body all day with vapor barrier clothing!

We normally tolerate overheating until we are bothered with wet skin from sensible sweat. Then we ventilate or remove excess clothing or, if nude, seek cooler location, a breeze, or cool water. If our clothing is absorptive it gets very wet long before we notice the overheat, and then it may take a long time to dry, which in winter can lead to hypothermia. If clothing is not absorptive (vapor barrier) we notice sweat from overheat almost immediately, so can then vent or remove excess insulation. Thus our insulating clothing remains dry and ready to protect us when needed. The vapor barrier preserves the insulating value of all our clothes as well as keeping us up to 22 degrees warmer when kept snugly closed!

During short term changes in activity level at work in a protected environment, it is nice to have clothing that soaks up sweat from overheat so we can ignore it (until washday). For that reason, we do not like nonwicking polyester or acrylic fiber against us, even though it is very "breathable." A vapor barrier fabric with very wickable nylon inner surface is much more comfortable since it rapidly distributes local sweat over a large area so it is not annoying; you will notice and correct for overheat, but wicking eliminates the wet feel. Thus modern wickable surface vapor barrier materials such as Stephenson's Fuzzy Stuff are far

more acceptable that the old coated vapor barrier fabrics.  
Heat, Humidity, Energy, Water

Water exists in three familiar states: solid (ice, snow, frost), liquid (water, the wet state), and gas (humidity, steam, vapor). Although most people are familiar with these forms, few are aware of the drastic differences between them, especially the very large differences in energy states. This leads people to mix up the relative characteristics, thus arriving at wrong, reversed conclusions.

You are all probably aware of the large amount of heat energy it takes to heat water, more than any other material (except hydrogen or helium). The basic units of heat are based on the energy needed to increase water temperature one degree. British Thermal Units (BTU) are commonly used in engineering, and I'll stick to them to avoid confusion. One BTU is required to raise the temperature of one pound of water one degree Fahrenheit. Water vapor takes about half a BTU, and air about 1/4 BTU for one degree Fahrenheit temperature rise. To melt ice or snow it takes 140 BTU/lb., or as much heat as it takes to heat one pound of air 583 degrees F! (A typical sleeping bag has 3/4 pound of air in the interior down compartments. Raising that air from an outside 0 degree to 70 degrees takes 12.6 BTU, or the same heat it takes to melt 0.09 pound (1.44 oz) of ice or snow.

Evaporation of water at typical skin conditions requires 1080 BTU/lb., or 7.7 times as much heat as it takes to melt ice, and 4481 times the heat to raise air temperature 1 deg./lb. From this you can see that humidity, or water vapor is very energetic, hot stuff. It already has a lot of heat energy, so won't take more from you. But liquid water has relatively low energy, so it can steal a lot of heat from you if you let it escape.

Most sleeping bag manufacturers will tell you that in their porous interior bags you will typically lose 4 pounds of water by evaporation every night. Think of what that means in unnecessary heat loss: you would lose 4320 BTUs, or the heat it would take to melt 30 pounds of ice, or the heat takes to make 87 cups of coffee! And worse, that water then condenses just inside the outer layer of the bag, decreasing the insulation, when you actually need more insulation to make up for that high evaporative heat loss.

Heat and air conditioning engineers have known the above for many years. To cool you they use dehumidifiers (condensers) so moisture can evaporate from your skin. To warm you they use humidifiers and vapor barriers in walls to block escape of humidity, so less evaporative cooling occurs on your skin. If you must wear clothing for work protection or modesty in summer, you wear porous, "breathable" clothes to promote the maximum evaporative cooling. Then obviously when you wear clothes to keep you warm, you start with a vapor barrier layer to prevent chilling evaporation. Yet somehow we are told repeatedly that the same porous, "breathability" we use to chill us in summer is a desirable and necessary feature of winter clothes and sleeping bags!

Benefits

1. Elimination of condensation in your tent. People who regularly overdress and rely on wickable clothing to carry away sweat, add much more humidity to a tent. If you have to change shirts due to sweat odors in less than four days you will also likely cause excessive condensation in any tent you use. Wearing vapor barrier clothing can help you to recognize and correct overheat.

2. Elimination of sweat odors on clothing and yourself. It is obvious how outer clothing is protected. Apparently quick sensing

and thus avoidance of sweating, plus blocking of air circulation that causes sweat to turn rancid, reduces or eliminates sweat odors on you and the vapor barrier clothing as well.

3. Prevent dehydration and thus reduces the amount of water you must obtain and drink. Dehydration is a major contributor to frostbite, hypothermia and altitude sickness. It thickens your blood, impairs circulation (thus decreases proper heat and oxygen distribution), and reduces oxygen intake. It is especially difficult to drink enough fluids when not wearing vapor barrier clothes and all your water must come from melting snow! In several days the weight of the fuel saved due to the use of vapor barrier can greatly exceed the weight of vapor barrier clothing.

4. When you start with vapor barrier you can then wear any kind of material for outer layers, no matter how uncomfortable or impractical it might be otherwise since you will have no concern about getting it wet. Your outer windbreak layer can be any coated or laminated fabric, preferably not "breathable" so you do not have to be concerned with dirt causing it to leak. When weight is an consideration, chose your intermediate layers solely on the basis of most thickness per pound. Use the lightest urethane coated nylon rainwear for the outer windbreaker, or wear ski parka and ski storm overpants with urethane coated outer layer and polyester fiberfill insulation, which is typically the lightest practical insulation per inch for clothing. Good goose down is much lighter, but weight of extra fabric used normally more than offsets the reduced insulation weight. Only in the very thick insulation needed for sleeping bags is the great advantage of goose down really important.

How to Use

Shirts

Vapor barrier shirts are extremely efficient and are warmer than most people would believe possible. Most people consider a vapor barrier shirt combined with a Polar Plus jacket to be as warm as a down sweater! With this in mind, it is apparent how easy it is to overdress when wearing vapor barriers. Thus, the first thing to remember to use vapor barriers comfortably is to not overdress.

This is not as easy as it sounds since most people prefer to be overly warm rather than comfortably cool. People will not object to overheating until sweat is rolling off their skin.

Coated nylon against the skin gives a very clammy feeling. There are two methods of getting around this problem. The first way is to wear a synthetic long underwear top under the vapor barrier. The synthetic long underwear will not absorb water. The second, better method is to purchase one of Stephenson's wonderful "No-Sweat" shirts. These are made out of a urethane film with a thin layer of nylon tricot bonded to the inside. The tricot disperses an localized moisture and virtually prevents any clammy feeling.

Socks

Socks are where most people first experience vapor barriers in use. Most everyone remembers their mothers wrapping their feet in bread bags before they put on their boots to go out in the snow. That is almost all there is to it! Remember to put on a thin pair of synthetic liner socks, then the bread bag and then a pair of thicker socks (like ragg wool).  
Not convinced? Try this test!

For those of you not convinced of vapor barriers, try this approach.

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Use the above bread bag approach on one foot, and just wear your standard sock on the other foot. Next go out and play in the cold and see which foot is more comfortable!

In a Sleeping Bag

When you are awake and active it is easy to adjust insulation to avoid overheat without venting vapor barrier clothing. When asleep, the normal reaction to overheat is to push the covers away. With vapor barrier built into the bag, pushing the top open to cool reduces the warmth of the vapor barrier while still maintaining protection from condensation in the bag. (Sleeping bags rarely get wet from the outside, but bags without vapor barrier interior almost always get wet from the inside due to condensation and sweat!) If you wear vapor barrier clothing in the bag the automatic response doesn't defeat the added warmth, so temperature will be no better (or worse) than in non vapor barrier bags, but you will protect the bag.

Vapor barrier in a sleeping bag causes no added warmth when vented, and always protects the insulation from condensation and sweat soaking, thus it is advisable to have vapor barrier in your bag for all seasons.

The most common excuse we hear from manufacturers and salespersons for not selling vapor barrier lined bags and vapor barrier clothing is that they do not want to take the time to explain it to their customers. Mighty inconsiderate, I think!

High humidity greatly reduces evaporation of sweat and keeps you much warmer. In summer you use a dehumidifier to lower humidity and cool you (at 86 deg. F. 100% relative humidity feels 30 degrees hotter than 10% relative humidity). In winter, when air is dry you use a humidifier indoors for warmth (20 deg. F. outside air

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with 100% relative humidity has only 9.2% relative humidity when heated to 85 deg. F., typical skin temperature). Outdoors you can't use an indoors humidifier, but can get the same effect if you block the escape of humidity that escapes from you skin. You will notice an almost immediate increase in warmth when VB clothing is put on and all openings closed tightly. You will also notice immediate cooling when it is vented even slightly, since water vapor (humidity) is a very energetic fast moving gas, and its escape promotes the immediate evaporation of more sweat to replace it. Thus VB clothing has the ability to provide a greater increment in warmth, with quicker regulation of that increment than any other type of insulation (but it, like radiate heat barriers, has a single increment in warmth; you cannot double the gain with double barriers!)

Conditions

We applaud Wil Steger for his North and South Pole dogsled trips. The North Pole trip succeeded despite failure of the special Quallofill sleeping bags. Within a few weeks the bags weighed 52 pounds, filled with ice, (condensed body humidity due to no vapor barrier). To survive they squeezed three people, with all their clothes and parkas on, into each pair of bags zipped together! Can you imagine trying to backpack and survive with a 52 pound ice filled bag instead of a nice dry compact down bag using a vapor barrier?

About the same time a Canadian-Soviet team skied across the pole (to and from, no airlift out) using purchased Stephenson Warmlite sleeping bags which stayed warm and dry for the whole trip.

Steger bought Stephenson Fuzzy Stuff vapor barrier liners for their sleeping bags for their much longer Antarctic trip, and thus kept their bags warm and dry.

Wet Conditions (The Down Advantage)

Synthetics are promoted for wet conditions. That is okay since when it is wet, it is warm, above freezing, suitable for heavy synthetics. The weight and bulk penalty is not too bad for thin summer bags. If a bag gets wet (almost always from inside due to the lack of a vapor barrier lining), synthetic bags lose insulation much faster than down bags until added water is about three times the insulation weight, then the synthetic bag is miserably cold and down is still warm. Water fills up spaces between synthetic fibers and conducts away heat, while down absorbs moisture within fibers and keeps insulating air spaces open. Much more moisture is needed to collapse down, and that happens only if the bag is carelessly dunked in water!

Down dries much faster, for a similar reason: interior moisture wicks to the surface where it absorbs heat and evaporate rapidly. Synthetic fibers do not wick water, thus all the heat needed to evaporate interior moisture is blocked by insulation. Claims of quicker drying only refer to lightly surface damp jackets or to washing when it is completely immersed, and is then based on comparing drying of bags with all the down left in a big lump instead of being distributed, thus is like comparing drying of one inch thick synthetic to ten inch thick down.

If you foolishly wear a non waterproof parka in the rain with no rain protection you may approach that immersed condition. In that dumb case lack of wicking initially slows soaking of the synthetic, while down soaks faster and may even collapse. If you are that silly then use a synthetic insulated parka, not down. Since you do not walk in the rain in your sleeping bag, that has nothing to do with insulation selection for your bag. Use synthetics (or low loft down) for thin insulation where the extra weight and bulk is not a problem. Use good down for thick insulation

anytime weight and bulk must be reduced. In either case always keep your insulation dry; that means using vapor barrier to block the main water source, and proper rain wear and tent for protection.

Gore-Tex has been "improved" many times with increased glue coverage and decreased porosity until humidity goes through about the same as coated fabric. They learned that "breathability" is not important but waterproofness is. Simple water repellents can be better. Spray-on fluorocarbon or silicone repellents work well on tightly woven nylon, polyester, and cotton. None are long lasting; like "breathable waterproofs," dirt and oils can cause leaks. You need to spray it again every month, but it can make leaky but tightly woven gear highly rain resistant. Repellents will not make wool or other coarse fabrics rain tight, but will slow down water absorption somewhat. Once wet though, wool is very slow drying and very cold to wear. If you wear wool in wet conditions, be sure to wear good coated waterproof rainwear over it and vapor barrier under it.

Polarguard, Hollofill, Quallofill, Kodafill, etc. all weigh about the same as typical Chinese duck down. The advantages of down are greater compactability, longer life, and faster drying (not that this should mean anything to you who are careful and are not going to get your gear wet). Surprised? Go test it for yourself! The wool industry is not the only one advertising their weakness as a strength, although in this case, the synthetic fiber industry has been trying to make a non-issue into the only thing they hope to be able to claim over down! Compare two identical thickness jackets, with the same fabrics, one insulated with polyester fiber, the other filled with down. Sprinkle each with water at a slow rate (similar to rain wetting). Eventually the polyester collapses to about 1/3 original thickness and insulation almost disappears, while the insulation of down barely changes. A while later the down collapses to almost nothing but fabric thickness. Then lay

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them out to dry. Soon the polyester picks up a bit more loft, but then seems to take forever to dry because the lofted surface insulates the interior and blocks needed to evaporate water, and water will not wick to the surface. Meanwhile the down seems to do nothing for awhile; as fast as water evaporates from the surface, more interior water wicks to the surface. Eventually, long before the polyester fully dries, the down dries and lofts to original thickness. Some people have washed thick down bags, let all the down lie in a big clump, and observed the clump taking several days to dry (like drying a sixteen inch thick bag!). They have also gotten their thin polyester insulated jacket wet in a rain storm, observed that the surface was totally wet (and thus assumed that the jacket was saturated), and then noticed that it took only a few hours to dry. By totally ignoring the differences in thickness' and wetness they conclude that polyester dries faster than down!

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A catalog is available for \$1.00

(And a tip o' the hat to Dave Novy)

Date: Mon, 13 Nov 1995 11:38:31 -0500  
From: Robert Sheneman <rsheneman@PPPL.GOV>  
Subject: Staying Warm & VB Clothing

Following the thread of cold weather clothing and staying warm, Paul Brown and I have been conversing off-list about this topic. He was particularly interested in vapor-barrier type clothing and my suggestion that he experiment with different ideas before using them on a trip. At Paul's suggestion, I'll share my \$0.02 with the list. I've added some background info. [in brackets] to help folks follow the conversation. This is by no means the definitive word on vapor barrier clothing, keeping warm, etc. I'd certainly like to hear what others have to say.

\*\*\*\* Extracted Text \*\*\*\*

I'm sure you've got a pretty good handle on winter camping, but my experience comes from a number of years with backcountry skiing, ski mountaineering, snow&ice climbing and other cold weather activities (my hands and feet are still a little sensitive after a brush with frostbite).

I think what you're trying to achieve with plastic bags is the vapor barrier effect. This is where a thin vapor-proof layer is placed near the skin and insulative clothing is worn on top. The theory is that:

- a) much water and heat is lost through evaporation, and
- b) by reducing the evaporation you reduce the heat loss.

It works very very well in really cold situations. The key, in my experience is to get the vapor barrier close to the skin. I've used a thin polyolefin or polypropylene sock inside the vapor barrier and then wear heavy wool socks outside. Be careful of wrinkles in the bag as this can cause blisters. I'd experiment a few times when out for the day before banking on anything too much for a winter camping trip, and always carry

spare dry socks.

Also, much of the heat loss from your feet is through the sole of boots that are too light (nothing different than your sleeping bag situation). Finally, be very careful not to make to boots too tight, you need all the circulation you can get down there when the mercury plunges.

BTW, I think a vapor barrier system also works very well for sleeping in extremely cold weather.

\*\*\*\* Follow-up Message \*\*\*\*

I've tested various clothing options when shoveling snow, walking the dog, sledding with the kids, or otherwise close to home in a cold setting. Day trips are also good time to try something new. This enables me to fine-tune the layering without risking myself on a backcountry trip with unfamiliar gear. Your proposed approach sounds okay to me [...as an experiment I might try a latex glove on one hand under my mittens and a plastic bag on one foot under my sox and see if I notice a difference...]. I've not used latex gloves myself, so can't really tell you from direct experience. The use of thin liner socks helps to avoid the feeling that your feet are swimming in sweat.

I think my vapor barrier socks came from Campmor or maybe REI. They're very thin neoprene rubber with a fairly comfortable fleece lining. They fit snugly so I don't have to worry about blisters. Again, I caution against trying to cram extra socks (even VB type) into boots that are too tight. My winter boots have a felt liner (I always carry spares so they can be changed out when wet). Ski boots, etc. are sized to fit over the appropriate socks. My cold weather clothing system consists of synthetic long underwear (weight

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varies w/ expected activity level, temps, etc.), fleece or pile mid layers (vest, jacket, and pants, all w/ vent zippers), and Gore-Tex top layer (wind/water protection). I've moved to the synthetics because of their performance to weight ratio. They also dry quicker (NOT NEAR THE FIRE!) and keep you warm even if wet. Rather than VB gloves, I usually wear thin thermax or polypro gloves, then either wool or fleece mittens, and some sort of outer shell mitten (Gore-Tex or similar).

This gives flexibility in the layering and dexterity as required (try working a camera or surveying instrument with big mitts on). I recognize that this type of outfit is pricey, but I think you can assemble a similar outfit without spending a fortune. It's really a matter of what your needs and budget are.

The sleeping bag liner is thin coated nylon. It's made by North Face and fits inside my mummy bag (700 fill goose down with a Gore-Tex outer layer). The theory here is to protect the down insulation from vapor on both the inside and outside and to allow any moisture that does get in to evaporate through the Gore-Tex (driven by the temp. differential). Needless to say, this arrangement is not on the cheap, nor is it appropriate for everyone (probably overkill for most folks, but vital in a snow cave or high-altitude bivouac). It is really warm and about as lightweight as I could make it for the temps encountered. I wear thermax long undies and a good thermax hat to sleep in. If it's really cold I'll include the fleece pants and vest, but the danger is that they become too wet to wear the next day. I take the gloves in with me too, but most other clothing will go under the bag. I use both a ThermaRest and a thin closed cell pad beneath my bag if its really cold (also more comfortable on tired bones). We also keep smaller pieces of closed cell foam to sit on, put the stove on, etc.

To tell the truth, I also have a synthetic fill bag which gets

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a good bit of use, because the system described above is too warm for some trips (even in "winter"). I've tried a number of different systems and found the VB liner best in really cold weather (single digits and below), and a good synthetic fill bag better in moderately cold temps. I don't really have a good explanation for this, but I suspect it's because I end up feeling too "clammy" in the VB liner when it's warmer. No good idea why.

I tend to agree with much of what was posted about staying warm (especially NOT sending a kid back to bed without determining the situation and getting him stabilized first), taking a leak just before bed, and having water/snack readily available. I often store water bottles inside my bag (double ziplocked), because when you've got to melt snow and fuel is scarce, you don't want to waste any. I use white gas exclusively during backcountry trips, especially in cold weather, and only have a propane stove for "car camping." I think one of the biggest dangers with sending the kid back to bed is turning him off from winter trips all together. As a young scout I spent some very cold miserable nights feeling sorry for myself before getting it together with the help of a great ASM. He showed interest in me, and that made a big difference in my entire scouting experience.

BTW, I like Jim Sleezer's post about educating the parents (and boys) at a fall meeting so they can be better prepared for cold-weather trips. We used to do those kinds of pre-trip demos and give handouts for many kinds of trips (backpacking, caving, canoeing, ski touring, rock climbing, etc.), a practice that I took with me when president of my college Outing Club. I think it's all part of Being Prepared.

Let me know if I can share more...sorry about the length, but I hope it helps some.

Yours in Scouting,

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Rob Sheneman, Tiger Cub Coach  
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