



**APPALACHIAN
SEARCH AND RESCUE
CONFERENCE**

Essentials for Search and Rescue

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Appalachian Search and Rescue Conference

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Preface

The Appalachian Search and Rescue Conference has adopted a four-level system of credentialing for members who go into the field to do search and rescue tasks: Field IV (Trainee), Field III, Field II and Field I, Field I being the top level.

Field IV (Trainee), which used to be known as Callout Qualified, is the most basic level of credentialing. If you're credentialed as Field IV (Trainee), you've basically been vetted to be able to participate in training. We expect that members who are credentialed to Field IV (Trainee) to participate in training, including on-the-job training during actual or simulated operations, under close supervision.

You need to learn about common hazards in the mid-Appalachian area, how to recognize them, and how to mitigate them with knowledge and equipment.

You need to learn enough about a GPS that you can report your position if you're lost (or just because Base wants to know where your team is). You need to learn how to use a handheld radio well enough that you can get basic information across, and that people won't laugh at you. You need to learn how to carry a litter, so that you can carry your own weight, or for that matter, a bit more than your own weight. But mostly you need to know how

to carry a litter properly so you don't hurt (1) the patient in the litter, (2) your teammates, or (3) you. Carrying a litter wrong, or getting confused while toenailing down a steep slope, is a great way to wreck your back, break a leg, break a teammate's leg, or turn the litter into a toboggan.

You need to learn enough about the Incident Command System that you understand the basics, at least how we use it for search and rescue. You also need to learn how to behave properly during a search and rescue operation, which may not be obvious to the uninitiated.

In simple terms, if you're a Field IV (Trainee), then we trust that you are unlikely to kill yourself or anyone else on your team. Or to lose a limb or an eye. Or to acquire some avoidable illness. Or cause major political problems for your Group or the ASRC as a whole.

Once you're done with Field IV (Trainee), there is still a lot to learn, but now you are qualified to learn some of it during actual search and rescue mission.

The official educational objectives are on the next page. Good luck with your SAR training!

—Keith Conover, M.D., FACEP, July 2018

Educational Objectives

If you are studying for your Field Level IV credentialing, this test is all you need to meet the educational objectives:

1. Learn the major life-safety and health hazards and risks for wilderness travel and wilderness search and rescue activities in the mid-Appalachian area. These include:
 - Subjective hazards, including lapses in judgment such as in risk assessment and not compensating from the mental effects of sleep deprivation and physical stress.
 - Hazards from the area's continental climate and changeable weather, including cold and heat exposure and lightning strikes.
 - Hazards from the area's terrain, including slips and falls, rockfall, and streams and lakes.
 - Hazards from pedestrian-vs-vehicle accidents including trains, and from falling asleep at the wheel.
 - Hazards from bees and wasps, ticks and poison ivy.
2. Learn how to use the basic controls and functions of a team handheld radio, basic ASRC radio protocols, and enough of the phonetic alphabet and numerals to communicate standard field team status reports, including USNG/UTM location.
3. Learn enough about a personal GPS device or smart-phone GPS app to be able to make sure the datum is set properly and determine WGS84 USNG/UTM location. Learn the concept of safety direction and when to use it.

4. Learn how to serve as a member of a litter team, including:
 - Carrying a litter on non-technical terrain (non-technical evacs).
 - Following standard ASRC procedures for litter team positions including Litter Captain, Medic, and Speaker
 - Properly using and responding to standard calls for:
 - Lifting and setting down a litter.
 - Dealing with vomiting.
 - Using load straps.
 - Laddering.
 - Toenailing.
 - Litter bearer rotation.
5. Learn the basics of the Incident Command System (ICS), as applicable to wilderness search and rescue as practiced by the ASRC. This may be learned via the FEMA free online course Introduction to the Incident Command System, ICS-100.c: <https://training.fema.gov/is/courseoverview.aspx?code=IS-100.c&lang=en>. Field Level IV members should have a working knowledge of critical ICS concepts, terms and principles, and how they may be modified slightly for wilderness search and rescue. While the ICS-100.c course incorporates additional material that may be helpful during a disaster response, disaster response ICS is not expected of a Field Level IV member, and will not be part of performance standards or tests.
6. Learn the essentials of SAR operation procedures and good behavior.

Safety, Health and First Aid

MID-APPALACHIAN SAR HAZARDS AND RISKS

SUBJECTIVE HAZARDS

Objective hazards are the environment itself, whereas subjective hazards are mental shortcomings in dealing with the environment. Examples include overestimating one's physical or mental fitness, underestimating the hazards, and allowing goals (such as finishing the task so as to not look bad despite major hazards) to overcome good judgment.

Field team members may have to function while cold, sleep-deprived, dehydrated, or have poor nutrition with hypoglycemia. To help prevent injury from subjective hazards, SAR teams emphasize best practices such as:

- Having knots and rigging, and other important decisions, **double-checked** by another member, and
- Always **practice** these checks during training to develop good habits; good habits are hard to break.

Subjective hazards have parallels in the search and rescue sayings "they say you have to go out there, they don't say you have to come back" and "a dead rescuer

never did anyone any good," emphasizing the need for careful risk assessment and management.

Members, when **assessing risk**, must think about the effect an ill or injured field team member can have on the effectiveness of the team and the overall operation (not to mention the embarrassment attaching to the ill or injured member).

CLIMATE AND WEATHER HAZARDS

We have a **continental climate** in the mid-Appalachian area. In a continental climate, temperatures differ widely from summer to winter, from day to day, and sometimes temperatures drop very quickly particularly with cold fronts approaching from the west, often with increasing wind and precipitation, creating a major hypothermia risk.

Hypothermia is a four-season danger, and **frostbite** is a hazard during deep-winter tasks. Several of the following sections detail how to use knowledge, clothing, other personal equipment and supplies and portable or improvised shelter to deal with the ever-present danger of hypothermia.

Heat illness is a constant danger from heat/humidity exposure with strenuous work in the mid-Appalachian summer, and is covered in a subsequent section.

Lightning strikes during thunderstorms are a rare but potentially catastrophic hazard, and to some degree preventable.

- Avoid exposed ridges and cliffs, wet ropes, and isolated trees.
- Shelter in deep but not shallow caves or in a metal vehicle with rubber tires.
- If unavoidably exposed to lightning risks, crouch on insulating materials such as a coil of rope if possible, and keep your feet together to avoid a "step potential" voltage between your feet.
- Thunderstorms may move fast, up to 70 miles per hour; keep an eye and ear out for them.

As the burgeoning use of smartphones and increasing cellphone-tower access have decreased the number of lost-person searches, there are also many smartphone apps that (when you have a signal) let you look at real-time **radar weather maps** to track storms that might be heading your way. The smartphone app Weatherbug and some others offer access to a map that plots, in real time, lightning strikes in your area. You can set this or other storm apps to provide audible severe weather alerts, which is probably appropriate for trips in the wilderness, whether recreational or as a search and rescue task.

If you don't have a cellphone app to consult, and if you are in deep forest without a view of the sky, there are other clues to an approaching storm:

- Thunder is nonspecific; in a quiet forest, you can hear thunder from far-away storms.
- A darkening of the sky, visible even thorough the forest canopy, might warn you that a cloud is passing overhead, but it could be just a sheep-like fair-weather cumulus cloud.
- More specific is a change in wind direction: the updraft of an approaching thunderstorm usually reverses the prevailing wind direction a few minutes before the storm arrives. In the forest, you can detect this by noting that you can suddenly see the pale undersides of some trees' leaves. Trees gradually adjust their leaves' direction so that, given the prevailing wind, the leaves are positioned to receive maximal sunlight. When the wind changes suddenly, there isn't time for trees to adjust, and a sudden change in wind direction bends the leaves so their pale undersides are visible.
- A sudden drop in temperature usually soon follows, from the downdraft at the center of the storm bringing down cool air from high in the atmosphere.

In the winter, and often in spring and fall, our area is cold and wet and a great place to get **hypothermia**. Subsequent sections deal with using personal clothing, equipment and knowledge to prevent hypothermia.

TERRAIN AND VEHICLE HAZARDS

Falls

Falls down slopes, or simply tripping and falling over the edge of a cliff, are much more common causes of fatal or major-injury falls than falls while doing ropework on a cliff. For this reason, it is a best practice during vertical training and rescues to rope off a safety zone at the top of a drop, and have everyone in that area tied in securely.

Falls from equipment failure are very rare, but improper rigging sometimes causes falls, hence, the standard best practice of having a second person check *all* knots and rigging.

Rockfall is always a risk near cliffs, and though head injuries from falling rocks (or carabiners or the like) are very rare, they can be devastating. Short falls while on a rope may also cause significant head injury. This, combined with the desire to serve as a good example to the outdoor public, leads to the best practice of wearing helmets whenever on or around a cliff.

The standard call of “**ROCK!**” whenever anyone sees a falling object; everyone within earshot echoes “**ROCK!**” and everyone on the litter hunches over the patient, using their helmets and perhaps packs to help protect the patient. If you hear “**ROCK!**” it is *not* a good idea to look up.

Water

Drowning from falling in water with a pack on, or from crossing big or flooded streams, can be a significant risk to SAR team members. Best practices recommend not trying to cross a stream of any significant depth, or searching right along a steep edge of a lake, without flotation vests. Teams can call back and recommend a team with flotation vests be sent to complete such a task. However, sometimes it may be safer to cross a fairly-large stream without a flotation vest to escape a worse danger, and in a downpour most trails turn into small streams, so rigid rules about water and flotation vests don’t make sense.

If you have to ford running water, best practices include:

- Unsnap your pack’s sternum strap and hipbelt, and loosening the shoulder straps; that way you can ditch your pack easily if you go underwater.
- Face upstream and place trekking poles or an improvised walking stick upstream; that the force of the flowing water pushes the tip into the bottom of the stream.

Vehicles

Getting **hit by a vehicle** while walking along a rural road, especially at dusk or at night, is a major hazard for search and rescue team members. Having high-visibility colors and reflective material on clothing (including safety vests or Velcro type armbands) and packs are essential ways to manage this risk. Remember too that if you have dogs with your team, they tend to not be as aware of traffic hazards as humans and require extra attention.

Trains in the mid-Appalachian region travel at up to 80 miles per hour (130 kph). And, as far as hitting people on the tracks, high-visibility clothing doesn’t really help. The train simply can’t veer away from you or stop in time. Maybe the engineer might see you and sound the horn, but don’t count on that. And it is hard to hear them approaching when they’re coming that fast. And at least one non-ASRC SAR team member (in western Pennsylvania, in the 2010s) was hit by a train and killed.

- Look both ways before crossing tracks
- Do not walk on or near tracks

SITUATIONAL AWARENESS

Related to weather, terrain and fatigue, but also to other hazards, is *situational awareness*. You need to be conscious of the hazards around you and within you. The ones inside you are the hardest to monitor.

We who venture into the great outdoors for fun tend to be dismissive of those urban people whose lives move between climate-controlled houses, cars and offices, and pay little attention to the weather. But even if you have some outdoor experience, you too may not **be** paying enough attention... not so much to the weather, or even the weather forecast, but to the interaction of fatigue, exhaustion of energy, dehydration or mild hypothermia.

When we are out hunting, fishing, hiking, climbing or the like and the weather gets bad, we can (as we’ve always been told) seek shelter. But for search and rescue tasks, sometimes you have to keep on going. Finding and/or rescuing someone takes precedence. And in such situations, we have to carefully monitor our internal condition, and that of our teammates.

When you’re out to walk the dog or take a short dayhike, be conscious of whether your body is getting just a bit chilled, a bit overheated, a bit dehydrated, or a bit energy-exhausted. It’s good practice for when this self-monitoring may become a matter of life or death.

FATIGUE KILLS

The [ASRC liability release](#) says, *I understand that I am subjecting myself to situations that may encompass a variety of natural and man-made disasters and/or events in which I may be subject to illness, injury or death. I understand that these situations may lack proper water, food, shelter, sanitation and medical care. I further understand events may expose me to death or disability caused by diseases, direct and indirect assault by humans and wild beasts, attacks by venomous creatures, exposure to environmental hazards (including but not limited to fires, high temperatures, flash floods, swift water, mud slides, landslides, rock slides, blizzards, ice storms, snowstorms, bitterly cold temperatures, tornadoes, high winds, lightning strikes, hazardous plant life), electrical shock, serious or deadly falls, hazardous terrain, and injury or death from a technical rescue system failure.*

But in addition to this “lions, tigers and bears” clause, it goes on to say, *I understand that all the modes of transportation available to me may pose a risk both at the event and transportation to and from the event.*

Falling asleep while driving has likely killed more SAR team members than anything else. It caused the ASRC’s only line-of-duty death in over 50 years and hundreds and hundreds of SAR operations. Lisa

Hannon, one of our Incident Commanders, was killed driving back from a search while sleep-deprived.

People say that driving while sleep-deprived is as dangerous as driving drunk, and the evidence supports this. Of all the hazards we expect the Field IV to learn about, this is the most deadly.

We don't know precisely why, but sleep is essential for our health and safety; as Shakespeare wrote in *Macbeth* Act 2, Scene 2, Page 3:

...the innocent sleep,
Sleep that knits up the ravell'd sleeve of care,
The death of each day's life, sore labour's bath,
Balm of hurt minds, great nature's second course,
Chief nourisher in life's feast, ...

There is now evidence that lack of sleep makes you fat* and makes your muscles weak.[†] But the main problem is that lack of sleep makes you sleepy (duh), and falling asleep at the wheel will probably kill you. We drive all the time and discount the dangers, but you should learn as much as you can about this terrible danger: fatigue + driving.

For details on this topic by an ASRC member, read Bob Koester's scholarly but readable monograph: Koester, R. J. (1997). *Fatigue: sleep management during disasters and sustained operations*. Charlottesville, VA, dbS Productions.

We will cover the most important points here.

Sleep and Fatigue Basics

We all need 4.5-5.5 hours of "core sleep" (deep, uninterrupted sleep) every 24 hours to keep functioning physically and mentally. However, to keep our emotions working properly, we need another three hours of sleep, though that can be in the form of scattered naps.

Sleep is affected by humans' circadian (circa = about, dian = day) rhythms. While these rhythms are slightly different for different people, and in different situations, they are remarkably similar in all humans. We all have an internal clock which is how many of us, at least some of the time, can start waking up five minutes before the alarm goes off. There are several distinct rhythms that are tied to this clock:

- Sleep
- Mental alertness
- Temperature
- Visual alertness

* Cappuccio, F. P., et al. (2008). "Meta-analysis of short sleep duration and obesity in children and adults." *Sleep* 31(5): 619-626.

† Cedernaes, J., et al. (2018). "Acute sleep loss results in tissue-specific alterations in genome-wide DNA methylation state and metabolic fuel utilization in humans." *Science Advances* 4(8).

These rhythms repeat every 24 hours, though they can be stretched to 25-26 hours fairly easily, or compressed to 22-23 hours with more difficulty. Trying to adjust more than 1-2 hours gets these normally-synchronized rhythms out of sync: jet lag.

Many things affect these rhythms:

- Bright daylight (though subdued indoor light does not)
- Bright bluish light from staring into cellphone, tablet or computer screens
- Certain drugs
- Timed social contact

It is very hard to adjust to working a night shift, as even a little exposure to bright sunlight or blue screen light can reset your internal clock back to a daytime rhythm.

Alertness and Temperature Rhythms

There are two separate alertness rhythms, mental and visual, and they are not tightly linked to the sleep/wake cycle and they work differently.

If you are sleep-deprived, the mental alertness rhythm becomes more pronounced: higher highs and lower lows. Minimum mental alertness is worst at 8 AM, which is why so many single-driver motor vehicle accidents occur right around 8 AM. No matter when you slept last, 8 AM is a very dangerous time to drive. Starting at 8 AM, mental alertness increases until a peak at 4-6 PM, and then drops sharply at 10 PM decreasing until the 8 AM minimum.

If you need to do something that requires a burst of concentration, you can usually do it even around 8 AM. But vigilance tasks – monitoring a nuclear power plant, doing a long belay, or staying awake while driving – are very dependent on your mental alertness cycle.

If you miss a night's sleep, your alertness will increase after 8 AM the next morning, but at 10 PM, your alertness will tank (a technical term meaning "decrease precipitously").

Visual alertness, as with mental alertness, is lowest at about 8 AM, another reason to fear driving around 8 AM. Visual alertness peaks later though, at about 8 PM.

Temperature varies about 3.6°F (2°C) throughout the day. It peaks about 4-6 PM and hits a minimum at 4 AM; once it starts increasing at 4 AM it makes it much harder to fall asleep. Pulse and blood pressure track along with the temperature cycle. It's normal to have a pulse of 50 or lower, and a blood pressure of 70/40, are normal at the 0400 temperature minimum.

Many different prescription medications may cause sleepiness, including narcotic (opioid) pain medications, as well as some psychiatric medications. Of

over-the-counter medications, the main sleepiness-causers are the antihistamines. They are marketed as allergy remedies, and are in many common cold medications. Diphenhydramine (e.g., Benadryl) is particularly well-known for making almost everyone sleepy. It is sometimes used as a sleeping pill. However, *ten hours* after taking 50 mg of Benadryl, many people are still driving worse than if they were legally drunk.

All over-the-counter antihistamines, with one exception, are known to make at least some people sleepy.

Some over-the-counter 24-hour antihistamines say they don't cause sleepiness, but all of them except for fexofenadine (e.g., Allegra) *can* cause sleepiness. Some people can take loratadine (e.g., Claritin, Alavert) without sleepiness, but it makes most people at least somewhat sleepy. Cetirizine (e.g., Zyrtec, Xyzal) makes almost everyone sleepy; pilots are not allowed to fly for 2 days after taking one.

Larks, Owls, and Sleep Gates

Some are morning people: "larks." Some are not: "night-owls" or simply "owls." Morning people reach their peak body temperature and alertness a couple of hours before night-owls. Morning people have a hard time sleeping when switching to a night shift, compared to night-owls. Morning people are therefore more likely to be sleep-deprived when they have to work an overnight shift. A few people are extreme night-owls and adjust well to working overnight. Questionnaires are available online to assess yourself to figure out your degree of lark-ness or owl-ness.

Being able to switch to night shift is not only a function of night-owl-ness but also of age. At age 25, even night-owls' ability to work overnight decreases, and this gets much worse by age 40-45.

Sleepiness, and the ability to fall asleep, are triggered by a change in signals from certain parts of the brain. Morning people have a sleep gate that normally opens from 9:30 PM to 11:30 PM, and another that opens in the mid-afternoon. Night-owls' sleep gate opens at about midnight, and they have less of an afternoon sleep gate. Whether you're a morning person or night-owl, though, you have a "forbidden zone" about 8 PM \pm 40 minutes, making early evening the safest time to make a long drive.

Effects of Sleep Loss

Lack of sleep won't kill you directly, but it certainly has lots of ill effects. Being conscious of these and working around them will make you more effective and less likely to make errors. Ill effects include:

- Mood changes such as irritability (take a break to go

do some breathing exercises or have a good cry)

- Impaired vigilance, inattention (use caffeine to boost alertness, make up mental and physical exercises to keep up your alertness)
- Impaired short-term memory (keep a small waterproof notebook in your pocket and write down *everything*; ask for instructions to be repeated at least twice and reply with a rephrase of the instructions to make sure you understood them)
- Increased appetite (try to eat healthy; or just go with it and diet when you get home)
- Problems with communications (take time to rehearse what you're going to say on the radio)
- Sleepiness (nap when you can)
- Increased sexual drive (watch your behavior!)
- Decreased performance (recognize your increasing mental and physical limitations)
- Microsleep: "nodding off" or "zoning out" for a second or two, sometimes up to 15 seconds, (recognize for the major safety hazard it is)

After two days without sleep, you may see illusions or see or hear hallucinations or become paranoid. One note of relevance to SAR: working in Base, where your work is mostly mental, is actually *more* tiring than working in the field.

The typical sleep-deprived error is not so much doing something wrong, as simply forgetting to do something important. You can use your pocket waterproof notebook to make checklists, for instance, of things you need to do when you get back to Base. ("turn in radio and spare battery" "eat" "fill up CamelBak" "call home")

Assessing and Treating Sleepiness

It's not all that hard to know that you are sleepy, but you may gradually get to a dangerous level of sleepiness without really recognizing it. You can even fall asleep, at least microsleep for a second or two, with your eyes open. If you find yourself dozing off while driving, *stop and nap*. One study showed that after 16 hours in a flight simulation trying to stay vigilant, your loss of reaction time is the same as someone with a blood alcohol of 0.05%. **Driving sleepy is as bad as driving drunk.** Another good bit of advice is to not drive sleep-deprived during open sleep gates such as 8 AM or mid-afternoon.

There are many tests for sleepiness, but only one seems relevant for checking if you're OK to drive. It is a variant of the Mean Sleep Latency Test. The basic idea is that the sleepier you are, the less time it takes to fall asleep. Before driving back from an operation, you simply lay down in a quiet area with your eyes closed for at least seven minutes; if after this you are awake, you are OK to drive.

If you fail the Mean Sleep Latency Test, and since main cure for sleepiness is... wait for it... *sleep*, you get a nap. Koester (author of the monograph referenced above) recommends at least half an hour, and then you should be OK to drive.

Regardless of whether you pass or fail your sleep latency test, you certainly may get sleepy later on during your drive. There are many things that are recommended to help keep you awake: driving with the windows open, especially in winter; listening to loud music; pinching yourself on the thigh or biting your own arm. Caffeine works, unless you're tolerant to it, but when it wears off it causes rebound sleepiness.

Some find that a really interesting podcast or audio-book helps them stay awake. But the best cure, is again... sleep. If you even suspect that you're nodding off, *pull over and take a nap*.

All of the states in the ASRC's region allow you to park at a highway rest area for up to two hours (as long as there is not a posted shorter time limit) which is long enough to get in a good nap. Remember to lock your car doors.

- Ohio: up to 3 hours
- Pennsylvania: up to 2 hours
- Maryland: up to 3 hours
- Delaware: up to 4 hours
- West Virginia: unlimited but no overnight parking
- Virginia: unlimited but no overnight parking

If you're not traveling on a major highway, many Walmarts allow even overnight parking, and parking at a WalMart for an hour or two to catch a nap should not be a problem.

If you really need to, just pull off on the side of the road, as far from travel lanes as possible, and nap for 15 minutes or so. If the police stop to see what is going on, just explain that you were so tired that you thought you were a threat to yourself and others due to fatigue.

Sleeping and Napping Skills

Sleeping and napping are skills that can be improved with knowledge:

- Avoid caffeine for 6 hours before trying to go to sleep
- Don't use nicotine at all; nicotine withdrawal tends to occur in the middle of core sleep, interfering with sleep
- Alcohol before going to sleep makes it easier to fall asleep, but it results in poor quality sleep, and some mild withdrawal interferes with the last half of the night

If sleeping during the day to work overnight, or for a daytime nap to supplement core sleep:

- Find a place that is safe, comfortable, dark, and quiet; a sleep mask over the eyes and earplugs may help
- White noise or similar soothing noise may help you sleep; a fan provides white noise, as do smartphone apps such as White Noise, as does a handheld radio tuned to a frequency not in use with the squelch turned off
- Don't eat or read in bed, especially on a phone or tablet, even with a blue light filter turned on

Napping at any time will help improve your overall alertness. Nighttime/early morning, at the 8 AM alertness minimum, and in the mid-afternoon are the easiest times to fall asleep for a nap as your sleep gates are usually wide open then.

One-minute naps have been found to be useless; at least 10 minutes of real sleep is the minimum for a nap to help. The most effective short naps last for 20 minutes, though even longer naps can be more refreshing.

There is one problem with napping: "sleep inertia" or "sleep drunkenness." For a short period after a nap – usually just a few minutes – you awake groggy and worse than if you'd taken no nap at all. If, however, you are awakened from short-wave sleep, also known as deep sleep, Stage 3 and 4 Sleep, or non-REM (rapid eye movement) sleep, which usually occurs between 4 and 5 AM, your sleep inertia is worse and longer. Recognize sleep inertia, and don't start driving or doing other critical tasks until you've recovered from it.

Napping is important for the health and safety of members, and for their effectiveness. There's a military saying "Eat when you can, pee when you can, and sleep when you can, because it might be a long time until you get to do it again." If you are tired and you have an opportunity to nap, take it! It's not a lack of machismo, it's a sign you really know what you're doing.

There is evidence that, even in those over age 60, exercise improves sleep.* However, there are recommendations to avoid strenuous exercise for six hours before bedtime as it may interfere with going to sleep. As far as a remedy for tiredness and preventing microsleep, a military study showed that exercise does increase alertness in sleep-deprived aviators, but only for about 30 minutes, and that there may be a rebound effect of increased tiredness after the effect of exercise wears off.† But for something to get you through half an hour until you can reach a safe place to nap, some sort of exercise is reasonable.

* Montgomery, P. and J. A. Dennis (2002). "Physical exercise for sleep problems in adults aged 60+." Cochrane Database of Systematic Reviews(4).

† LeDuc, P. A., et al. (2000). "The effects of exercise as a countermeasure for fatigue in sleep-deprived aviators." 12(4): 249-266.

HAZARDS FROM FLORA AND FAUNA

Just as altitude high enough to cause illness is **not** found in the mid-Appalachian region, poison oak, poodle-dog bush, scorpions, grizzly bears, moose, timber wolves, buffalo, wild boars and wolverines are simply not found in the mid-Appalachians. Knowing about them is important if you're going to areas where they are found, but not for search and rescue in the mid-Appalachians.

Lions & Tigers and Bears, Oh My!

Mountain lions are so rare in the mid-Appalachians that they are almost never seen. True, 28 people in North America have been killed by mountain lions, but that's over the past *hundred* years. Far more people than that die from slips and falls in their bathtubs. And we don't have wild tigers in the mid-Appalachians, so no point in worrying about them attacking you.

Black bear attacks are a big concern, mostly among those who don't know much about dangers of the great outdoors, like perhaps some of your friends or a parent, so we will look at these closely.

These are vastly overrated as dangers, and are far, far less likely than auto accidents, falls or anaphylaxis to beestings. From 1960 to 2017 (that's fifty-seven years), in the US *and* Canada, there were a total of 54 deaths due to black bear attacks – and that included those feeding their “pet” black bears. For all the people hiking, hunting, fishing and working in the North American backcountry, that's a very small risk, less than one a year throughout all of North America. Only one of these attacks was in the ASRC's mid-Appalachian region, and that was someone in Ross Township, PA, just outside Pittsburgh. But the woman was killed, not outdoors, but while cleaning her “pet” bear's cage.

Snake attacks likewise are an overrated concern.

As regards venomous snakebites: Ken Iserson, an emergency physician with the Mountain Rescue Association's Southern Arizona Rescue Association, was puzzled as to why, if snakebites are such a problem in their area (and they are) SARA members never got bit, over at least a 30-year period. He published a letter with the observation about the lack of SAR snakebites in JAMA (Journal of the American Medical Association) in 1988 titled “Incidence of snakebite in wilderness rescue.” He once said he looked at the data for those treated in the local ED for rattlesnake bite **and he once told the editor of this document, “They were all drunk. Or stupid. Or drunk *and* stupid.”**

This is a rhetorical exaggeration, but if you look at the list of fatal venomous snakebites on Wikipedia, about

1/3-1/2 of fatal snakebites were from things most reasonable people would consider are stupid. People who handle poisonous snakes as a religious ritual and refuse medical care when bitten. People who keep venomous snakes as pets. People who were trying to kill or otherwise handle a venomous snake. (A favorite example of “stupid and/or drunk” was the man who was bitten on the tongue while trying to kiss his pet rattlesnake.)

Advice: don't do any of these things.

Venomous snakebites *do* occur in the mid-Appalachian region on a regular but infrequent basis, from rattlesnakes or copperheads, and people out hiking sometimes get bitten on the ankle and **a few people** who get bitten sometimes die. A good estimate is that there are ~ 7500 venomous snakebites a year nationwide, and that about **five of those people die from their snakebites**.

In the ASRC's mid-Appalachian area, there were only two known fatal backcountry venomous snakebites since 1940. One was in Elk County, PA, in the north central part of the state, in 2015. The other one was in Bradford, PA, just north of Elk County. Before you start worrying about hiking in that very nice wild area, consider that the Bradford fatal snakebite was in **1941**.

However, venomous snakebites can make people quite ill, and can cause significant local tissue damage, and so first aid for venomous snakebite will be covered in wilderness first aid training, just not in *Essentials for Search and Rescue*.

To put this in context, in 2017 alone, **37,133 people died in motor vehicle accidents in the US**. And even in the backcountry, other than beestings, the most dangerous animals are the two-legged hominids. Just along the Appalachian Trail, over the past 45 years, there have been 10 murders.*

These very rare, minor or nonexistent hazards are not covered in *Essentials for Search and Rescue*, though they may be included in higher-level training.

Insects & Arachnids

Black widow and brown recluse spiders are fairly common here, but bites are also very rare, and their toxicity is nowhere as bad as their reputation.

Bee and wasp stings are common in the mid-Appalachian area, particularly in the late summer and fall. Those with a particular kind of allergy to beestings may get hives, which is a type of immediate hypersensitivity reaction (allergy): wheals like large mosquito bites. That can progress to full anaphylaxis: wheezing, shortness of breath, lightheadedness, swelling of the lips, tongue and throat, and sometimes airway obstruction leading to

*New York Times, May 12, 2019: “Hikers Take to the Appalachian Trail to Escape the Real World. This Time, They Couldn't.”

death. Most people who have anaphylaxis have a history of an immediate hypersensitivity reaction to a bee sting in the past, but some people can get an “anaphylactoid reaction” from a first bee sting. This is a vastly under-rated danger, much more important than snakebite or bear attacks: both more common and deadlier.

The treatment for all bee and wasp stings consists of first, gently scraping the skin with a credit card or knife blade held perpendicular (90° angle) to the skin to remove any possible embedded stingers without compressing any attached venom sacs. Second, an over-the-counter local anaesthetic preparation such as **Sting Eze** or **Sting Kill** will decrease the local pain.

If a person suffers a bee sting and immediately develops **hives** (wheals like large mosquito bites), that person is at risk for anaphylaxis. However, anaphylaxis may also occur without hives. Often the earliest sign of anaphylaxis is hoarseness; anyone getting hoarse after a bee sting should be treated for anaphylaxis. Swelling of the lips, tongue and throat may also occur. The patient's blood pressure may also drop, requiring you to treat for shock by lying flat and elevating the legs. Those with anaphylaxis may also develop wheezing and shortness of breath. An albuterol inhaler like those with asthma carry can be helpful for this.

The essential treatment for anaphylaxis is an intramuscular (IM) injection (“shot”) of **epinephrine (adrenaline)**. Anyone with a history of an immediate allergic reaction to bee stings, or any other substance, should have epinephrine in his or her pack. Autoinjectors are easy to use and effective, but expensive. They require training to be used effectively.

Some SAR team members are trained to give intramuscular injections and carry vials of epinephrine and a syringe and needle to give the injection, instead of using an autoinjector.

Epinephrine injections relieve the symptoms of anaphylaxis but wear off in about 15 minutes. The patient may need further injections, which can be a problem if you don't have lots of epinephrine.

However, an longer-acting oral antihistamine at the same time as the epinephrine injection may prevent the need for more epinephrine injections.

Diphenhydramine (e.g., Benadryl) is the most well-known antihistamine. However, Benadryl and other older antihistamines tend to make people think, walk and drive like they're drunk, sometimes up to 10 hours after taking it. That can be a problem with getting out of the backcountry and deadly if driving home.

Most things we think of as “antihistamines,” like Benadryl, are **H1 antihistamines**, used for things like nasal allergies (“hay fever.”) There are many newer and better **H1 antihistamines**, but the only one that is

guaranteed not to make *anyone* effectively drunk is fexofenadine (e.g., Allegra).

There are also **H2 antihistamines** such as famotidine (e.g., Pepcid) that are primarily sold to control excess stomach acid. They don't make anyone sleepy. They help a bit with hay fever, though not as much as Allegra. However, they are *excellent* for treating anaphylaxis, and the chewable Pepcid Complete or equivalent is recommended for personal wilderness first aid/medical kits, as you can take it without water.

Ticks

Blacklegged ticks (deer ticks, *Ixodes scapularis*) are common in the mid-Appalachians and many are infected with Lyme Disease. As a result, Lyme Disease is common here. There are other tickborne diseases, such as Rocky Mountain Spotted Fever, but they are *much* less common in this area.

You can help prevent tick bites by putting **insect repellent** on your skin. The Sawyer 20% Picaridin spray is our top pick. Brand name is important because the “inactive ingredients” are what help it last longer on your skin. Sawyer 20% Picaridin:

- Like DEET, is *highly* effective against ticks, mosquitoes and black flies.
- Unlike DEET, doesn't dissolve plastics and nylon
- Unlike DEET, doesn't feel greasy on your skin.
- Unlike DEET, doesn't smell bad.

You can easily repackagie picaridin spray in a sturdy dropper bottle suitable for a pocket and/or SAR pack. (A 15 mL bottle seems ideal; they available cheap online but you usually can't order just one. Use a spare for sun cream and share extras with your teammates.)

Don't get the Sawyer Picaridin *lotion*; Consumer Reports says it works very poorly, only providing protection for about 2 hours.

You can treat clothing, especially socks, with **permethrin**. It is not a repellent, it's a fast-acting insecticide that's safe for mammals (as long as they don't *drink* it). Permethriin-treated socks decrease tick bites by about 75%. That's because ticks get on you by crawling up from the bottom. Do-it-yourself permethrin spray or liquid on your socks will last seven washings, and then you have to reapply it.

You can also send socks to Insect Shield in Greensboro, NC, and they will bond permethrin to your socks, which lasts 70 washings, the life of the sock.

You can apply permethrin to other clothing. But, if the clothing, like most gaiters and many outdoor pants, has a durable-water-repellent (DWR) treatment, you have to dry clean them first to remove the DWR treatment.

Checking for ticks and removing them after coming out of the field helps prevent Lyme Disease transmission. Small green plastic twist devices are best for removing ticks.

The nymphal blacklegged ticks that are the main transmitters of Lyme Disease are so small they are almost invisible, so even with the best attempts at prevention, Lyme Disease still happens. **Symptoms** of acute Lyme Disease include a red plaque-like rash at the site of a tick bite (such a rash less than 2" in diameter is likely an allergic reaction, but if larger than 2" is treated as acute Lyme Disease), or target-like red patches. Sometimes, without a rash, people with acute Lyme Disease get fevers, chills, sweats, muscle aches and stiff neck, headaches without the sore throat or runny nose of most viral syndromes. Any member who gets these symptoms should consult a physician, either the Group's medical director, a personal physician, or a physician at an urgent care or Emergency Department, as treatment requires a prescription antibiotic. The diagnosis of Lyme Disease is based on the above symptoms; blood tests are useless for diagnosing *acute* Lyme Disease which is what we're worried about. Lyme Disease, if untreated, can cause chronic joint, heart or brain problems.

Poison Ivy

Poison ivy is common in our area. There is no poison oak in the mid-Appalachian area, though it does occur in North Carolina. Poison sumac is very rare in the mid-Appalachians, mostly in swampy areas in northeast Ohio, eastern Pennsylvania, and a few rare scattered areas elsewhere. But poison ivy is *everywhere* in the mid-Appalachians: along trails, off trails, in fields, in backyards, along rural roadsides. Poison ivy, poison oak and poison sumac are related and all contain an oil called **urushiol** in their leaves and stems. That's true even in winter when there are no leaves.

For some reason, about 3/4 of humans and great apes – but not monkeys, cats, or dogs – quickly get violently allergic to urushiol. This is not like the immediate hypersensitivity that causes anaphylaxis to bee stings, but *delayed hypersensitivity* that results in an intensely itchy, red and sometimes blistering skin rash that tends to last for up to six weeks.

It's important to recognize poison ivy and avoid it if at all possible. Poison ivy can grow as ground cover, as a vine on a tree, or as a bush. Browsing images from an Internet search will help. It's also helpful to use the mnemonic "leaves of three, let it be!"* Also know that it's actually *leaflets* of three; if you look at where the leaf

* There are plenty of plants with "leaves of three" whose leaves look quite different and which you should *not* avoid, for example, wild strawberries.

joins the stalk and will fall off in the fall, you can see that the three leaflets are part of one compound leaf. This makes it easy to distinguish poison ivy from the common climbing vine Virginia creeper (sometimes called woodbine), which occasionally has some leaflets of three when young, but almost always has leaflets of five. Poison ivy leaves also come off the stem *alternately*, as opposed to immature sprouts of the boxelder tree, which have leaflets of three that look very similar to the leaflets of poison ivy, but come off the stem *opposite* each other.

As with any hazardous material, the first step in dealing with urushiol exposure is decontamination. If you're back in civilization, a long hot shower with lots of soap should get it off your skin. Washing your clothes



Poison Ivy: Leaves Alternate
The leaf stems attach to the reddish main stem, not directly across from each other, but alternating on the main stem



Boxelder: Leaves Opposite
The red leaf stems attach to the green main stem directly opposite to each other. Red leaf stems are sometimes seen in both poison ivy and boxelder. Some of these leaves have five leaflets, and poison ivy *never* has five per leaf.

in hot water should get the urushiol out of the clothing; for waterproof-breathable shells, softshell garments and down, special cleaners such as the Nikwax line and warm water should remove the urushiol.

In the field, though, decon is more problematic. Since urushiol is an oil, cold water probably does nothing to remove it. Cold-water backpacking soap (Dr. Bronner's is traditional) along with cold water will probably help remove it. Alcohol-based gel hand cleaners such as Purell do a good job, as will alcohol. Alcohol-based hand cleaners are available in small plastic bottles as well as foil-wrapped wipes, and are also useful for cleaning off blood and many SAR team members carry some in their wilderness first aid kits. There are expensive cleaners designed for poison ivy that work very well, but the degreasing cleaners GoJo and Goop work just as well and are much cheaper. Those highly allergic to urushiol often keep a can of one of these degreasers in their vehicles for decontamination.

Two brand names of poison ivy decontamination products are widely found in the US, and you might want to put one or more of these in your wilderness first aid kit: *Tecnu* and *Zanfel*. Both brand names apply to multiple products. *Tecnu Original Outdoor Skin Cleanser*, *Tecnu Extreme Poison Ivy Scrub*, *Zanfel Poison Ivy, Oak & Sumac Wash* are effective if much more expensive alternatives to GoJo or Goop. But once the urushiol is off your skin, these cleaners do nothing.

The "homeopathic" *Tecnu Rash Relief Anti-itch Spray* contains menthol that is an effective and non-sensitizing (unlikely to cause allergy) local anesthetic. However, a cream such as the original *Gold Bond Medicated Rapid Relief Anti-Itch Cream* with both menthol and

pramoxine, which is also a non-sensitizing local anesthetic, is a more effective addition to your wilderness first aid kit. Anti-itch cream ingredients lidocaine, benzocaine and diphenhydramine (Benadryl), when applied to the skin, are famous for causing local allergic reactions; avoid them. For example, the widely-found *Tecnu Calagel* has diphenhydramine in it, and there is a version of *Gold Bond* with lidocaine in it, so avoid those.

A highly-effective field expedient is to use the flowering plant jewelweed (*Impatiens capensis*): if you crush the stem and use it and its sap as a scrub brush, it works quite well to remove urushiol. Jewelweed grows in areas similar to poison ivy, but prefers somewhat moister soils.

If you get a mild case of the rash, you may use over-the-counter 1% hydrocortisone cream to gradually shorten the allergic reaction. Unless there is some reason to avoid them, taking the over-the-counter non-sedating antihistamine fexofenadine (Allegra) 180 mg two pills twice a day (even though the usual dose for allergies is once a day) is recommended by dermatologists, and makes a good addition to a first aid kit. The supposedly nonsedating antihistamines cetirizine (Zyrtec) and loratadine (Claritin, Alavert) make many people groggy and are not as good as fexofenadine for a wilderness first aid kit. For example: pilots are not allowed to fly a plane for 48 hours after taking a Zyrtec.

A severe rash requires a potent steroid cream, like hydrocortisone cream but much stronger, available only by prescription. Or, if there is enough blistering to prevent the cream from soaking in, or the rash is over too large an area to reasonably treat with a cream, or on the face or genitalia where potent steroid creams should not be used, a *two-week course* of a prescription-only steroid pill such as dexamethasone is needed.

Stinging nettles are common here, but an irritant rather than a serious problem. It is worth knowing that crushed jewelweed leaves and stems stop the stinging from a nettle almost immediately.

PSYCHOLOGICAL HAZARDS

Search and rescue can be hazardous to your mental health. Dealing with the time pressures of a search or rescue, dealing with the stresses of interpersonal relations with others who are stressed out, dealing with finding dead people... it can all add up.

Most mental stresses of search and rescue you can shrug off or will resolve after a few relatively-sleepless nights. But sometimes, the stress will result in what we call an **immediate stress reaction**. Here are things that are particularly stressful, enough that we call these type of incidents critical incident stress and the process of



Jewelweed (*Impatiens*)

Juice from crushed stems and leaves relieves pain of stinging nettle stings. Juice also useful for decontamination from poison ivy. Note translucent stems.
Via Wikimedia Commons, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license, courtesy Phyzome.

dealing with them Critical Incident Stress Management (CISM).

- The serious injury or death of an emergency services worker in the line of duty.
- The serious injury or death of a bystander from an emergency services operation.
- Multiple deaths or serious injuries.
- Serious injury or death of a child or infant.
- Any situation that attracts an unusual amount of attention from the media.
- Any loss of life after extraordinary and prolonged search and rescue efforts.
- Any situation that is charged with emotion and that causes an emotional response that is beyond the normal coping mechanisms of emergency services workers.

It's important to recognize that **an immediate stress reaction is a normal reaction of a normal mind to an abnormal situation**. An immediate stress reaction is *not* sign of psychological weakness or chronic psychiatric problems. Simply knowing this helps prevent immediate stress reaction from progressing to post-traumatic stress disorder.

If an immediate stress reaction is severe or not improving, or lasts longer than a month, you should seek professional counseling.

Immediate stress reactions may include physical, emotional, cognitive, and behavioral components; any of the signs and symptoms listed below may be present.

An immediate stress reaction generally occurs at the time of the incident or within 24 hours.

Physical symptoms may include:

- Profound fatigue and weakness
- Fine tremor or muscle twitches
- Diaphoresis (sweating)
- Vasovagal orthostatic hypotension or vasovagal syncope (simple fainting)
- Nonspecific lightheadedness
- Nonspecific headache
- Difficulty focusing one's eyes
- Nonspecific difficulty hearing
- Palpitations (feeling of racing or irregular heartbeat)
- Dyspnea (shortness of breath) and chest pain with or without hyperventilation
- Nausea, vomiting, diarrhea, or abdominal pain
- Sensation of lump in throat (globus hystericus)

Emotional symptoms may include:

- Anticipatory or generalized anxiety (anxiety about the future, or unconnected with any present danger or fear)
- Strong fear or even panic reactions

- Psychological shock (described later)
- Survivor guilt uncertainty (guilt over surviving when others have died)
- Acute grief reactions
- Depression
- Intensified or inappropriate emotional reactions to normal occurrences

Cognitive symptoms may include:

- Blaming others (sometimes even those who are logically blameless) for the critical incident
- Generalized confusion
- Inability to concentrate
- Inability to perform simple calculations
- Poor attention span
- Memory lapses
- Anomia (inability to find the right words)
- Inability to distinguish the difference between serious and trivial concerns
- Inability to make decisions; and
- Greatly increased (or greatly decreased) alertness and awareness of surroundings

Behavioral symptoms are relative to person's normal behavior, and may vary widely; they include:

- Changes in normal activity patterns
- Changes in speech patterns
- Withdrawal
- Angry outbursts
- Hypervigilance (increased suspicion and attention to one's environment or even outright paranoid behavior)
- Changes in interactions with others (i.e., spouse, friends, team members)
- Increase or decrease in appetite or alcohol consumption
- Sleep disturbances, including early morning awakening, early insomnia, hypersomnia, and generalized fatigue
- Visits to health professionals for seemingly minor or even nonexistent problems

Again, the *very most important* thing about an immediate stress reaction that **an immediate stress reaction is a normal reaction of a normal mind to an abnormal situation**.

If an immediate stress reaction is severe or not improving, or lasts longer than a month, you should seek professional counseling.

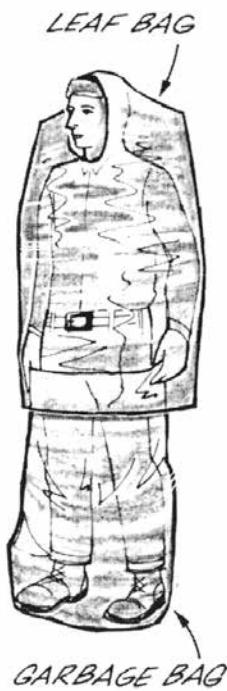
PERSONAL EQUIPMENT, CLOTHING AND SURVIVAL

Your pack is your wilderness life support system. The first rule of wilderness search and rescue is *Don't get separated from your pack!* To work as a life support system, though, your pack has to have the right stuff. The ASRC provides a list of minimum equipment you have to have, but the more you know about outdoor gear the better you can select the contents of your pack. Those contents may vary depending on the task you've been assigned, the weather, or other considerations such as the strengths and weaknesses of the members of your team.

Good outdoor gear can be expensive. But there are ways to get good gear cheaper. Membership in the outdoor coop REI gets you a rebate every year, regular special discounts, and REI also has regular sales. The online retailer [Sierra Trading Post](#) offers remaindered outdoor clothing, such as last years' models, at steep discounts.

Many manufacturers offer "pro deals" with significant discounts. ASRC members are generally eligible for such discounts, but signing up for them is handled by individual ASRC Groups, as it often requires submitting a list of members with personal information such as emails.

THE TEN ESSENTIALS



The Ten Essentials were 1930s-era advice about what to take when hiking or mountaineering, but in one form or another are still the basis of much outdoor-skills teaching. They have morphed over the decades since then, both in updated versions of *Freedom of the Hills* and in adaptations around the globe and across the Internet.

(Especially the choice of the "eleventh essential.") As with any advice, they need to be taken with a grain of salt, but those getting into search and rescue should at least read through them as they consider their SAR pack contents. This version from the 8th edition* adds three more possible "essentials." Our comments related to search and rescue are in *italics*.

The Ten Essentials, 1992 Version

- **Navigation:** Topographic map and assorted maps in waterproof container plus a magnetic compass, optional altimeter or GPS receiver. *For SAR: printed map print and/or map on smartphone with spare battery, with task marked; GPS, or smartphone GPS app like CalTopo/SARTopo, and spare battery not optional.*
- **Sun Protection:** Sunglasses, sunscreen for lips and skin, hat, clothing for sun protection.
- **Insulation:** Hat, gloves, jacket, extra clothing for coldest possible weather during current season.
- **Illumination:** Headlamp, flashlight, batteries. LED bulb is preferred to extend battery life. *For SAR: LED headlamp and spare batteries essential.*
- **First-aid:** first aid supplies, plus insect repellent.
- **Fire:** Butane lighter, matches in waterproof container.
- **Repair kit and tools:** Knives, multi-tool, scissors, pliers, screwdriver, trowel/shovel, duct tape, cable ties. *A Swiss Army knife or multitool is the minimum for SAR, but the others may also come in handy.*
- **Nutrition:** Add extra food for one additional day (for emergency). Dry food is preferred to save weight and usually needs water. *For SAR: also need plenty of quick-energy snacks for during tasks.*
- **Hydration:** Add extra 2 liters of water for one additional day (for emergency).
- **Emergency Shelter:** Tarp, bivouac sack, space blanket, plastic tube tent, jumbo trash bags, insulated sleeping pad. *For SAR: ASRC requires 5 large plastic leaf bags, so you have extra to use on patients or unprepared team members.*
- **Eleventh Essential:** portable water purification and water bottles
- **Twelfth Essential:** Ice axe for glacier or snowfield travel (if necessary)
- **Thirteenth Essential:** Signaling devices, such as a whistle, mobile phone, two-way radio, satellite phone, unbreakable signal mirror or flare, laser pointer. *Minimum for a SAR pack is a whistle, almost every SAR team member brings a smartphone, and we tend to issue Group radios to anyone heading out on a task.*

* Graydon, D. and Mountaineers (1992). Mountaineering: The Freedom of the Hills, Mountaineers.

The 2017 Edition of *Freedom* offers a concise summary of the base 10 essentials.*

To prevent emergencies and respond positively should one occur:

1. Navigation
2. Headlamp
3. Sun protection
4. First aid
5. Knife

To safely spend a night – or more – outside:

6. Fire
7. Shelter
8. Extra food
9. Extra water
10. Extra clothes

The book goes on with a more detailed discussion, and we recommend the book to anyone interested in mountaineering.

PERSONAL EQUIPMENT AND SUPPLIES

Selecting which equipment goes in your pack is not a simple matter of checking off everything on a required equipment list (though the ASRC has a list of gear you *must* have in your pack for your PTB = Position Task Book pack gear checkoff), or making sure you have all of the 10 (or 13 essentials.) For example, an ice axe and crampons are not something you often need in the mid-Appalachians, though it has happened on at occasional search tasks. You need to select the gear you put in your pack, based on what's appropriate for a particular task. This is especially true of food, water and spare clothing. But, taking too much gear will weigh you down and slow you down. You don't have to be like long-distance backpackers who cut the handles off their toothbrushes and cut the margins off their maps to save weight, but you do need to be selective.

When selecting what to take for any outdoor trip or SAR task, you should look at each bit of equipment and assess its usefulness-to-weight and usefulness-to-bulk ratios, and whether it has multiple uses. You should also judge each bit of gear in terms of how likely you will need it, and even if it's unlikely you'll need it, how important it might be in such an emergency.

There are certain minimums: you should never go out even on a containment task driving a rural road without at least some minimal gear in your pack. Yes, even when driving containment you ***don't get separated from your pack.*** What if you suddenly get a call on the radio that the subject is half a mile up the hill in the woods from your current location, and to head there right now to assist the team making the find?

The more survival-minded ASRC members insist that you should never go *anywhere*, even in a city, without two leaf bags in your pocket. One member even publicly posts a small Everyday Emergency Kit he keeps with him at all times: <http://www.conovers.org/ftp/Everyday-Emergency-Kit-new.pdf>

In *The Picture of Dorian Gray*, Oscar Wilde said, “Experience is merely the name men gave to their mistakes,” and what you select for your pack for each task will be based on your experiences (mistakes) in past tasks. And if you haven’t been out on many search and rescue tasks, then *pick the brains of those who have more experience*; that is, take full advantage of *their* past mistakes. After a certain amount of “experience,” go through your SAR pack gear; consider taking out some things you’ve added: maybe some were an overreaction to one of those “experiences.” Consider leaving those things in your vehicle until you have a task that really needs them.

One ASRC member has, for decades, kept his list of disaster and search and rescue equipment online, updating it from time to time, and it might be instructive to scan through it: <http://www.conovers.org/ftp/sar-gear.pdf>.

If you are picking extra clothing to put in your pack, in case it gets cold or you have to bivouac, consider the warmth-to-weight and warmth-to-bulk ratio. A “duvet,” a warm down or similar jacket, is always appropriate on a cold-weather task. For a warm-weather task, a thin balaclava-style hood/hat provides considerable warmth for its size and weight. A thicker one is always a good thing to carry in winter. Even for warm-weather tasks, a winter facemask can act as a rebreathe flap and retain heat out of proportion to its size and weight. In any weather, a thin breathable nylon windshirt with hood weighs very little and packs small. Even in winter, adding a layer of nylon provides additional insulation, but you may need a larger-than-usual size if you want it to go over many layers of insulation. As with any upper-body insulation layer or shell layer, a full-length zipper makes getting it on and off easier, and allows for better ventilation.

Selecting an appropriate **pack** will prevent sore shoulders and a sore back.

One of the most important things to make carrying a pack all day comfortable is a good suspension, including a hip belt and a sternum strap. Trying on a pack for a while in the store is essential, because, as with feet and boots, what's comfortable to one person is painful for another. People always argue about whether top-loading or zip-opening packs are better, and there is no clear winner, however, top-loading packs seem to have a wider range of load capacity.

* (2017). Mountaineering: Freedom of the Hills, Mountaineers Books.

A capacity of 1500-1800 cubic inches (25-30 liters) is about right for a SAR pack. A pack with compression straps to tighten when you're not carrying much gear is a good idea. These straps also keep the gear in your pack from shifting and maybe causing you to become unbalanced and fall whilst climbing.

Packs are water-resistant but never entirely waterproof. For hiking or doing SAR tasks in the rain, a separate rain cover or rain liner is a good idea. A plastic garbage bag inside your pack will work fine. A large drawstring liner of sil-nylon (very lightweight silicone-coated waterproof nylon) is more elegant and durable but also much more expensive.

Sometimes you get to a search and it's a long way from home, and it lasts for more than one day, and you end up having to camp there. Sometimes there is a building to sleep in, but sometimes not. It's wise to prepare for this by throwing some extra gear in your vehicle. Consider some extra clothing, food and water and a car-camping or backpacking sleeping bag and sleeping pad, and maybe even a small tent, is a good idea.

Food and Water

For your SAR pack, you need to pack **appropriate amounts of water and appropriate types and amounts of food** for while in the field.

For short tasks, you can get by with supplies of almost any quick-energy food, but sometimes short tasks turn into long tasks, or might even turn into an overnight bivouac. To prepare for such happenstances, you need to have extra food in your pack.

A standard tool for teaching short-term survival is to list basic needs and ask how long you can live without them:

Food:	3 weeks
Water:	3 days
Shelter in the cold:	3 hours
Air:	3 minutes
Will to survive:	?

While you can argue about the exact numbers, it is an effective teaching tool in emphasizing that, for short-term survival, shelter from cold is much more important than scavenging for food.

However, we expect ASRC members in the outdoors not just to survive, but perform at a high level. And, to *keep* performing at a high level. This requires not only quick-energy food to snack on during exertion, but also food for meal stops that provides sustained energy, and the essential amounts of fat and protein that are needed for proper nutrition, especially when exerting yourself. If you're just working in an office all day and not exercising much, 2000-2500 calories of food is adequate for a day, but military combat rations are 3,250 to 4,600 and

2,300 to 3,150 calories for men and women, respectively, varying based on body size and exertion levels. Figure 3000-4000 calories a day and you'll be close. However, this doesn't need to all be in your pack; you can keep some of it in your vehicle and eat it before you head out into the field. Carrying 1000-2000 kcal in your pack is reasonable.

Quick-energy food for when you need the energy to continue, or to combat cold stress, is very much a personal choice. Gorp (one part Virginia peanuts, one part raisins, and one part M&Ms, by number, according to the Intercollegiate Outing Club Association) is popular, cheap and good for this use. The raisins are high in glucose for quick energy, and the fat in the M&Ms and the fat and protein in the peanuts provide some sustained energy from the slowly-digested fat and protein to repair damage from exercise. Nuts keep well, and given their high content of protein and healthy fat, and ability to be eaten while moving with no preparation, they are a popular SAR pack food.

You also need to consider the weight of what you're packing related to its caloric food value; for example, a can of tuna in olive oil weighs the same as a can of tuna in water but provides twice as many calories. Fat has many more calories per unit weight compared with sugar, starch and protein, and olive oil is one of the "good for you" fats. Freeze-dried entrées require reconstitution with water, usually hot water, but a field expedient is to add cold water and put the packet in an inner pocket while moving, and then wait for an hour or so for it to rehydrate.

Often you'll find yourself at Base and want something to eat. MREs (Meals, Ready-to-Eat) containing a heater are hard to beat for a hot meal with minimal preparation. Most SAR people keep a few MREs in their vehicle. However, they are heavy to carry in a SAR pack given their high water content, as opposed to drier foods that you can supplement with water or rehydrate with water.

A one-liter water bottle is standard hiking gear, and you can use it to mix up Gatorade or similar electrolyte packets for hot weather. It's also traditional to use the water bottle as a spool for several yards of duct tape. A water bladder in your pack, such as a CamelBak, can hold more water, and having a drinking tube dangling invitingly in front of you makes you more likely to drink; also, drinking small amounts frequently has less impact on your performance than less-frequent large drinks. The larger bladders carry up to 3 liters/quarts of water. For a half-day task on a pleasant winter day, a single liter of water will probably be adequate. For a half-day task on a hot and humid summer day, though, plan on carrying 2-3 liters/quarts.

Hikers, especially backpackers, tend to rely on water purification pumps. For search and rescue, where the

typical search task is half a day, and only sometimes a whole day or longer, a pump is a bit bulky and heavy for something you rarely use. If you're on a large team going on a long task in a very remote area, a single pump for the team might make sense. But a small and light alternative is chlorine dioxide water purification tablets, which are a reasonable addition to anyone's SAR pack.

Personal Protective Equipment

Gloves and mittens are essential parts of your outdoor personal protective equipment (PPE).

Medical protective gloves are essential during rescues or first aid to protect your hands from blood and other body fluids. A fair number of people have severe and sometimes anaphylactic reactions to latex (natural rubber), but often you don't know someone's allergies before you start giving first aid. So, a plastic called nitrile has essentially replaced latex gloves for medical uses. You can usually obtain a few pair of nitrile gloves from people who work in the medical field or EMS at no cost. Not all nitrile gloves are created equal, and what one glove company considers medium may be nowhere near the size of another company's, and some are much stretchier than others: try them on before putting in your pack. Packaging pairs of gloves in a small snack-size ziplock plastic bag will protect the gloves in your pack. You can also buy thicker medical-grade nitrile gloves with textured fingers and palms, which make them tougher and grippier. You can also get them in extra-large sizes to wear over leather gloves.

Leather, leather-palm or similar ropework gloves are a standard part of SAR gear in warm weather. Hardware store gloves are fine, but if they don't have a loop to attach to a carabiner or carabiner, use a knife to cut a hole in the wrist area so you can attach them when not using them. Or, if they have a nylon pull tab, you can use a pair of pliers to grasp a large finishing nail by the pointy end, heat the flat end of the nail in a gas stove or other flame, and then use the red-hot flat end to melt a hole in the nylon tab. Even on search tasks, carry your leather gloves: they are great protection as you're trying to pull blackberry, multiflora rose or greenbriar brambles/sticker bushes/jagger bushes out of your way. Mechanic's gloves with padding on the back of the fingers and hand also protect the back of your hands from thorns.

For spring and fall, insulated gloves are essential. Given the increasing use of touchscreen smartphones in search and rescue, gloves that work with touchscreens are worth the extra cost.

Since winters in the mid-Appalachians can go below zero Fahrenheit, mittens are essential. In very cold weather, even thick gloves will simply not keep your

hands warm so you need mittens, as mittens have less surface area to lose heat. Some people like to wear thin liner gloves inside mittens, some like to wear thick touchscreen-capable gloves and put waterproof-breathable mitten shells over them.

Whatever insulating gloves and mittens you get, they should have palms and fingers that have leather or some similar material that will grip well on rope.

A **climbing helmet** is an essential piece of equipment, and any helmet that meets UIAA standards is acceptable. The Petzl Vertex Vent seems to be popular and reasonably light and relatively inexpensive.

Visibility enhancements are critical for SAR team members' safety, especially at dusk or after nightfall.

Bright-color and reflective vests may be lifesaving, and are particularly important in hunting season. They are also useful when working near a large search Base where there are many vehicles driving around. When carrying a larger pack that might obscure the high-visibility vest, you can put the vest on the pack.

Bright colors and reflective materials on packs and clothing are also good protection. Bright reflective armbands are light, so you can carry them all the time, only pulling them out when needed. If you have extras, you can share with spontaneous volunteers on your team. These can be lifesaving when you are walking back to Base along a rural roads at dusk or after dark.

Getting poked in the eye with a sharp stick is always a hazard when you're bushwhacking or searching off-trail. With good visibility during the day, wearing **safety glasses** isn't usually worth the hassle and decreased visibility, but at night, they may be a good idea. A pair of cheap lightweight safety glasses find their way into many SAR packs. Some older members are particularly fond of the kind with magnifiers at the bottom that make it easier to read a map, GPS or cellphone display in bad lighting. Wearing safety glasses during off-trail searching at night is certainly a best practice, but you need to use your judgment about the risks and benefits. If your safety glasses have major fogging from sweat or get covered in raindrops, the risk of not seeing a hole and breaking your leg may be worse than getting poked in the eye. In such a case it might be better to leave off the safety glasses and slow down, using your headlight to keep a close eye out for branches heading for that eye.

Too much **sun exposure** can cause painful sunburn, even sometimes second-degree burns with many small blisters: extremely painful and then severely itchy for a week. Too much sun can also, over the years, cause skin cancer. Clothing and hats with brims help prevent sunburn, as can today's high-quality sunscreen, which are widely available.

Sunscreen lotions or sprays can be effective. The Medical Letter (8/30/18) recommends a SPF of 15 or

greater (they point out that a SPF of 100 is not that much better than an SPF of 15) and to cover both UVA and UVB, they recommend one of the following:

- avobenzone + octinoxate
- avobenzone + octocrylene
- avobenzone + ecamsule
- zinc oxide
- titanium dioxide

A small bottle of sunscreen in the top flap of a SAR pack, or in a hipbelt pouch, is a standard summertime addition to most people's SAR packs. Brands that are water-resistant last longer and are available at many outdoor stores. Eyes can get sunburnt as well, and eyestrain from bright sun, especially on winter snow, means that sunglasses should be part of everyone's SAR gear.

Survival Gear

A **bivouac shelter** is probably the single most important piece survival gear in your pack.

Leaf bags are part of the required equipment for Field Level IV. These are the heavy-duty disposable lawn and leaf bags you can get in any grocery store. Step into one and pull it up around your legs and lower torso. Pull one over your head and rip a small breathing hole for your face. Now you're in a very cheap, disposable bivouac shelter that protects from windchill and rainchill. A number of past ASRC members say they are alive today because they learned to carry a couple of leaf bags with them even on short dayhikes.

The ASRC Training Standards specify a supply of five leaf bags (or equivalent). Why? As with anything designed by a committee, there are probably many different reasons. One is that you might be leading a team of firefighters or spontaneous volunteers who might not have raingear, get caught out in a rainstorm, and have some hypothermic people to deal with; if you just have people use them on their upper bodies, you've got enough to supply five other people. Another is that you can fill a couple of them with leaves and bark to create an improvised insulating pad under an injured team member or search subject.

If looking online for good leaf bags for your pack, try searching for "Plasticplace 55-60 gallon Trash Bags, 22 Microns."

If you want something more upscale than leaf bags, you might consider a European-style **bothy bag**. Bothy bags are basically lightweight waterproof tents (the lightest but most expensive are of sil-nylon) for a few people, usually 2 or 4 people, but larger ones are available. They're designed for short-term shelter for a group when someone's ill or injured, or the group is trapped by bad weather. Your heads are the tent poles, and your

butts on little flaps at the bottom serve as the tent stakes, although you can also flip it over a group that's standing. Body heat quickly warms the inside. They have small vents to keep the condensation down, at least a bit. If your team has to stop for lunch and it's cold and rainy, one of these can provide some welcome warmth and shelter for the group.

European style bothy bags are sometimes called bivouac sacs, but in the USA we tend to use "bivouac sac" for what can also be called a sleeping-bag cover, even if you use it without a sleeping bag. You can certainly use two leaf bags as a sort of sleeping bag cover, but it doesn't work all that well. You can also use an aluminized "space" blanket held together along the edges with duct tape, but that doesn't work so well and crinkles **VERY LOUDLY** all night long. You can get aluminized plastic bags shaped like a sleeping bag for \$10-20, and they work fairly well, but they don't breathe so you tend to get wet from condensation during the night. A more expensive alternative at about \$60 is the *Adventure Medical Kits SOL Escape Bivvy*; it is as waterproof as Gore-Tex, but more breathable. It is reasonably sturdy and relatively light. You can get much fancier sleeping bag covers with hoods, poles to keep the top off your face, and mosquito netting and the like, and they work better, but these are heavier, bulkier and cost hundreds of dollars.

Given importance of GPS and other smartphone apps these days, you may want to have a spare cellphone AC charger in your vehicle, as they tend to get lost during long searches, or even sometimes on short searches or rescues. You also may want to have a DC charger in your vehicle as well. Perhaps most importantly, you want an external cellphone charger power pack in your pack for when (not if) your cellphone's battery dies. Many recommend the brand name Anker.

Personal First Aid Kit

Personal medications for existing medical conditions are essential. Especially if you have a history of an allergic reaction to bee stings or other allergens like tree nuts. If so, it is essential that you carry an epinephrine autoinjector (or vial of epinephrine and syringe if trained and credentialed to use it) and a H2 antihistamine such as chewable famotidine (e.g., Pepcid Complete) for your own safety. However, the ASRC does not require this. Indeed, a single Band-Aid could be your first aid kit: the ASRC doesn't specify what should be in it.

However, here are some items that have been recommended for a SAR team member's personal wilderness first aid/medical kit:

- Medications:
 - Aspirin

- Acetaminophen (e.g., Tylenol)
- Naproxen (e.g., Aleve)
- Salonpas or equivalent menthol/methyl salicylate patches
- Loperamide (e.g., Imodium)
- Fexofenadine (e.g., Allegra, but not Allegra-D or equivalent)
- Pepcid Complete (famotidine 10 mg, mixed with a traditional antacid)
- Injectable epinephrine
- Sting-Kill (or Sting-Eeze)
- Equipment & Supplies
 - Nitrile exam gloves
 - Hand sanitizer
 - Cold-water liquid soap
 - CAT tourniquets and/or Slishman Pressure Wraps
 - QuikClot gauze pads/gauze roll
 - Coban, Vetrap, or extra Slishman Pressure Wraps
 - Hydrocolloid band-aids
 - Pocket mask or CPR shield
 - Duct tape flat pack
 - Splints made from bits of plastic sheeting:
 - Ready-Heat one-panel (four hot-pack) warming blanket.
 - Alcohol preps
 - Sawed-off partial roll of cling wrap
 - Disposable “space blanket”
 - Twist-type tick remover

Miscellaneous Gear

If you ask a random sampling of five ASRC members if a Swiss Army knife or multitool is essential to bring on any SAR task, you will probably get an emphatic “yes.” If you ask the same random sampling of five ASRC members which Swiss Army knife or multitool you should get you will probably get five equally emphatic but completely different answers.

Cellphones do have a compass-ish function. But even if you follow the advice about moving your phone in a figure-8 pattern to reset it? It’s still sometimes 10-20° off. Don’t trust it except for a general direction.

A compass suitable for orienteering-type navigation is a standard part of any SAR team member’s gear. The kind with a rectangular clear plastic base and a fluid-filled needle housing that can be rotated is standard. Compasses that allow you to adjust the declination (difference between map north and magnetic north) cost more but most SAR team members advise that it’s worth the money.

Compasses with sighting mirrors seem to get used as more as aircraft signaling devices than for sighting, but not often at all even for that. If you plan to travel to the southern hemisphere and want to use your compass

there, make sure that you get a model that works both in the northern and southern hemispheres, as the magnetic needle dips differently in the different hemispheres. You can use a military style lensatic compass for SAR navigation, but it needs to be the kind with a straightedge on one side.

Experienced ASRC members will tell you that the most important tool for navigation is your ability to read a map and plot a route on it using orienteering concepts. But, there is no denying that a GPS app or unit excels at providing a precise location of you and your team. Almost any GPS unit or smartphone can provide your GPS location. GPS apps and units add features such as the ability to view maps on them, to track your course and show it on the map and share with others, to put waypoints on the map for things like clues or the subject’s location and share *them* with others. While dedicated GPS units by companies such as Garmin have been popular, GPS apps, particularly CalTopo, are becoming more popular.

Handheld lights just don’t cut it when you need both hands free, for instance to clamber over rocks or fallen trees. Those who use headlamps on a regular basis, such as cavers, prefer more expensive lamps with many features, so take their advice with a large grain of salt. If looking for a budget headlamp suitable for SAR, consider a Petzl Actik Core from REI for about \$75. It comes with a rechargeable battery; get an extra Core battery for about \$25. Or, you can sign up for the Petzl Pro program through the Petzl website, and order them directly from Petzl for \$62 and the extra Core battery for the same \$25.

If you want a *really* good headlamp for SAR, consider the Petzl Swift RL Pro for \$87 with the Pro discount through the Petzl website; a spare battery there is \$56. (These were of 2025 prices.)

CLOTHING

When picking clothes to wear on a task, and picking extra clothes to put in your pack or keep in your vehicle, you need to select appropriate clothing for the potentially rapidly-changing weather conditions found in our area. The following information will help you choose good clothing. As the traditional proverb goes, “There is no such thing as bad weather, there’s only the wrong clothing.” Hint: cheat by checking the weather forecast for the next couple of days.

Another thing to consider when deciding which clothing to put in your pack, and how much clothing: hurry up and wait. If you’re in a small group on an outdoor recreation trip, you can keep going to keep warm. But in search and rescue, you often get told to wait for further instructions. And you don’t want to take

the time to set up a bivouac, as you might have to start moving again at any minute. So pack a bit more extra clothing than you would for a dayhike.

Use the **layer principle** for clothing: multiple layers instead of a single thick coat. The advantages include flexibility for changing temperature and exertion levels, and trapping air that serves as weightless insulation. Full-zip midlayers and shells also make it easier to adjust to changing conditions, for example when coming up onto a wind-exposed ridge just as the sun goes behind a cloud. Or, even when the weather or terrain don't change, since search and rescue, just like the military, has a lot of "hurry up and wait": when you're hurrying you get hot and sweaty and when you're waiting you then quickly get cold. Given we perspire all the time ("insensible perspiration") and sweat when we exert ourselves, breathability is important for staying dry. Not only is this important for helping keep your insulating layers dry and more effective at insulating, it makes you feel more comfortable.

Baselayer is designed to be worn all the time, best if thin and highly-wicking, and a zip-neck will aid in ventilation when adjusting for changing conditions. Wool, Patagonia Capilene or equivalent and silk are popular. Avoid cotton, it holds water against your skin and sucks the heat out of you.

Insulation layers (midlayers) include knit wool, which ventilates very well and keeps you drier during exertion. Polyester fleece breathes less, but still fairly well (especially versions such as the Patagonia R1 Air), and down or artificial-fiber batting jackets don't breathe much at all, except for some (expensive) versions such as the Patagonia Nano Air Hoody and the Arcteryx Proton Hoody.

A shell garment is an outer garment that is wind-resistant, and can be both tops (jackets and parkas) and bottoms (rainpants). A windbreaker or windshirt is generally thin, light and wind-resistant, but not water-resistant. Softshell garments tend to be soft and wicking on the inside, stretchy, and variably wind- and water-resistant. Waterproof raingear is seldom used as a shell garment for outdoor pursuits due to the problem of condensing perspiration inside. Most outdoor raingear is made of a "waterproof-breathable" material such as Gore-Tex. In this context, "waterproof-breathable" really means "waterproof-and-slightly-water-vapor-permeable-but-only-when-you're-already-sweaty-and-the-material-is-not-wet-on-the-outside." So, some carry a separate, lightweight, very-breathable but very-wind-resistant windshell for when it's not raining, as it keeps your insulation layers much drier, especially when you're active. If you're just sitting somewhere in your windshirt, getting colder, you're probably not sweating

much. Even if it's not raining, you can put your rainshell over your windshirt for a bit more insulation.

When picking pants, don't forget that you'll want some rainpants as well as thick, warm pants for winter, and thin, tough pants for summer. (Tough to resist thorns when you're forcing your way through a thicket of blackberry or multiflora rose.)

A belay jacket, also known as a **duvet**,^{*} is a very warm jacket, usually down-filled. You keep it in your pack for when you're out in the cold and have to be stationary. Like belaying. Or standing there lowering a litter. Or caring for an injured team member. Or at the scene of a find waiting for other teams to arrive. Or just standing there waiting for Base to figure out where they want you to go.

Experienced outdoorspeople pull out as soon as they stop and before they chill. It's generally down or artificial down. Even if you're small, consider getting such a duvet in size XL or XXL. That way, if a large teammate or patient is getting hypothermic, you can offer your belay jacket/duvet.

The various layers can be made of different materials.

Polyester (e.g., Capilene) is commonly used for baselayers, is lightweight, dries quickly and retains much of its warmth when wet. If wearing for a week or more, it's not as smell-resistant as wool.

Wool (often merino wool, which is expensive but soft and comfortable against the skin) is good for baselayers and highly-breathable but heavy knit midlayers. It is not as light as polyester, nor does it dry as quickly, but ventilates better, is more stretchy, and it will take at least twice as long to smell bad compared to polyester. Wool is still the go-to material for socks, because unlike cotton or artificial fibers, it does not mat down under your feet, and continues to provide padding underfoot to prevent sore feet. Experienced outdoorspeople tend to wear wool socks even in the summer. Wool does retain a lot more water than polyester fleece, but it's easy to squeeze out the water, or in the case of socks, spin around your head to get out the water.

Down provides the lightest warmth, and is very compressible. However, it becomes essentially useless when wet, and even so-called "waterproof down" loses some of its insulating properties when wet. (There is a controversy: you can buy down treated specifically to "waterproof" it, but high-quality purveyors of down gear insist that high-quality down has natural oils that resist water just as well if not better. Experience bears this out.)

Most down garments and sleeping bags have outer fabric that is waterproof-breathable which does help

^{*} A duvet in non-outdoorsy British English is a down-filled quilt you put on your bed; Americans call it a down comforter. Perhaps early British climbers and hikers actually put their down duvets in their packs.

somewhat in keeping it dry. Unlike artificial fibers, down is a natural product and varies considerably in quality. High-quality down has high loft (= warmth) per unit weight, high compressibility, and the ability to re-expand quickly after being tightly stuffed. Connoisseurs of down clothing recommend high-end suppliers of down gear such as Feathered Friends or Western Mountaineering. Many think the Feathered Friends Helios Hoody is a perfect winter duvet, however it costs \$500.

“Artificial down” (e.g., Primaloft, Patagonia FullRange) batting is heavier than down, not as compressible as down, doesn’t last as long as down, but retains much of its warmth when wet. In 2018, after years of research, Patagonia released its version of artificial down called PlumaFill, which is in its Micro Puff line of jackets. They claim it is a light and compressible as down, and retains 80% of its warmth when wet, which seems to be borne out in reviews. However, it is about as expensive as down when compared inch-for-inch of loft (thickness = warmth). For a summer duvet, a Micro Puff Hoody is ideal; the Pro pricing was \$265 at the end of 2025.

“Cotton kills!” is a traditional mantra of survival instructors. Hard-woven cotton is tough, which is important in summer bushwhacking (off-trail travel), due to immature forests and open areas filled with thorn-bearing blackberry, multiflora rose and green-briar (variously referred to as brambles, sticker bushes, or jagger bushes). Cotton may be appropriate for hot, humid conditions, provided conditions don’t change, or you have backup clothing if a cold front comes through.

Cotton wicks well, meaning that it sucks sweat off your skin well, which is a good thing for a baselayer. Cotton holds lots of water next to your skin, and thus loses all its value as insulation once it gets wet, which is a bad thing for a baselayer if it gets even mildly cold. Cotton clothing such as blue jeans or cotton flannel shirts will soak up a massive amount of water, even if only a small portion is exposed to rain, and become very heavy. The cotton holds the water against your skin, sticking to and abrading your skin, and feeling cold, clammy and generally yucky.

Treated polyester, silk and wool also wick well, but unlike cotton, they don’t hold onto much water, they transport it out away from your skin to evaporate, which means they also dry quickly. Cotton is never appropriate for cold-wet conditions, even for underpants. You can get polyester briefs and boxers from multiple manufacturers including REI and Ex-Officio.

Nylon material is used in shell garments, either as the outer layer of waterproof-breathable garments, or by itself for a lightweight windshell, often with a durable water-resistant treatment (DWR) without sacrificing

breathability. Nylon can be treated to make it waterproof (and also not breathable at all), and then used for tents or bivouac shelters. Sil-nylon is the current lightest and thinnest, but also most expensive, type of waterproof nylon for such shelters; Sil-nylon is short for silicone-treated nylon.

Softshell materials are widely used in outdoor gear, and for good reason. Unlike hardshells (waterproof-breathable shell garments) softshells generally are somewhat stretchy. They have an inside that feels soft due to a wicking layer of polyester or wool baselayer-type fiber, and an outside that feels hard, usually from nylon fibers. Compared to hardshells, softshells are not as windproof or waterproof, but much more breathable. For active (=sweaty) activity in mixed conditions with small amounts of rain or even fairly heavy snow, they often keep you drier than a hardshell, even a hardshell with pit zips. Softshell pants are particularly prized by wilderness enthusiasts. Softshells vary widely in terms of stretch vs wind/water resistance; there is a trade-off, and those that are stretchier are less wind/water resistant and vice versa. Some are thick, and fuzzy enough on the inside, that they provide significant insulation; others are thinner and don’t provide any significant insulation.

Waterproof-breathable shells, also known as hardshells, generally have a nylon outer shell and an inner layer of expanded polytetrafluoroethylene (Teflon) or similar. That inner layer has microscopic holes that pass water vapor, as from sweat, but are impermeable to liquid water. These garments excel at keeping water out, but despite manufacturers’ efforts ever since the introduction of the first Gore-Tex parkas back in 1970, still have far less breathability than softshells or nylon windshells. And, when the outside of one of these materials is coated with water, they don’t breathe water vapor at all. Thus, high-end hardshells designed for strenuous activity in the rain include pit zips (armpit zippers) or other ventilation devices to cut down on condensation inside them.

Consider spending extra for clothing that is easy to adjust for changing conditions. Zipping and unzipping layers, pulling up or pulling off a hood, or hat or gloves or facemask, can make a big difference in your temperature. Parkas with big exterior pockets are great for storing hat, gloves and facemask. A full-zip fleece or sweater allows you to ventilate better, and get it on and off easier, than a quarter-zip one that you have to pull over your head. For that matter, a half-zip instead of a quarter-zip will allow you to ventilate better. Fleeces or baselayers with sleeves that you can push above your elbows help you adjust to changing conditions. Parka pit zips do a lot to help adjust your temperature.

Being closely conscious of changes in your body temperature, and adjusting your clothing for them, are a

best practice. Changing your clothing for every change in the wind isn't necessary, but you should routinely make adjustments that don't slow you down. When your body temperature is just right, that gives you more leeway to get hotter or colder if something bad happens.

For more information on this topic, see: www.conovers.org/ftp/Clothing-Materials.pdf

FEET

One of the major medical problems that impact performance in military boot camps, and with "tenderfoot" new outdoor enthusiasts, is **blisters**.

The military, under the direction of Dr. Murray Hamlet, has researched the problem in detail, and designed "Hamlet Socks" that help prevent blisters. Originally they considered thick socks with a thin liner sock, as was the tradition for some hikers and climbers, but abandoned this after they found that a single-layer sock, if designed properly, works as well to prevent blisters.

Hamlet socks are made of wool, but as Murray Hamlet confided, the military was unable to afford the fine merino wool that would make them better. They have a plush pad of terry-knit wool, similar to the terry-cloth of a bath towel, but with the terry loops on the outside of the sock; having them on the outside seems counterintuitive but worked significantly better than with them on the inside.

For a commercial equivalent, softer and more comfortable but made from more expensive merino wool, Hamlet recommended SmartWool or similar socks, but turned inside out so the plush terry pad is on the outside (he said they sold better with the plush on the inside even though not as good for preventing blisters). Or, even better, Darn Tough Full Cushion Boot Socks worn inside out; they are expensive but have a lifetime guarantee.

One problem with socks with terry loops on the outside is that they are even better than regularly-worn socks (which are pretty good themselves) at picking up lots of burs, burrs, hitchhikers, whatever you call those Velcro-like seeds that like to stick to fuzzy clothes. The solution is to wear a pair of gaiters over your socks; gaiters are things you wrap around your bootlaces and at least part of your lower legs. Not only do they keep prickly things from sticking to your socks, they keep water, dirt and pebbles from getting between your boot and sock.

As with Swiss Army knives and Leatherman tools, there seems to be a competition amongst members of both sexes to get the tallest, heaviest and manliest-looking gaiters, with Outdoor Research Crocodile Gaiters being particularly popular among ASRC members.

However, even a small, lightweight pair work pretty well.

Boots are important for wilderness search and rescue. Quality is important, fit is very important, and weight is also important: it's said that a pound on your foot is like ten pounds on your back.

Wilderness search and rescue is not like a through hike on the Appalachian Trail, where some recommend soft neoprene toe shoes. Or, like Grandma Gatewood, who recommended and used cheap tennis shoes to hike the entire Appalachian Trail. (Three times, the last time at age 75.) For search and rescue, you are often off trails, and you can't watch your footing while carrying a litter. You need more ankle protection from rocks and ankle support to prevent sprains. For summer tasks lightweight non-leather trail-running shoes may work, as long as they are high tops, but they don't provide as much ankle protection against rock bruises as a thicker leather boot. Some hiking boots are not waterproof, and breathe better, but waterproof boots are recommended for search and rescue.

Hiking boots generally come with a fairly high-quality removable OEM ("original equipment manufacturer") insole. Many experts, however, recommend using a more expensive after-market insole, such as SuperFeet insoles, sold by REI and other outdoor stores. These high-end insoles are expensive, but are significantly better than OEM insoles at preventing sore feet. There are versions for high and low insteps, so it's important to get the right one to fit your foot. There are also low-volume (thin) ones that are a one-for-one replacement for most OEM insoles. The high-volume (thick) insoles, such as the Trailblazer, however, are best bought and fitted at the same time as getting a new set of boots, so that the boot fits well with the thicker insole.

If you find that your boots don't have enough room at the toes, you can always trim a bit off the toes of your insoles to make more room there. SuperFeet Trailblazer insoles – a favorite of many – are high at the back of the heel, so stay in place even if you trim off some of the toe end of the insoles. If your boots don't have enough room for your toes, you may get sore toes and maybe blisters there. If you don't keep your toenails trimmed, and you don't have enough room in the toe of your boots, your toenails will hurt and maybe even fall off from the damage. If you do notice pain in your toes, make sure you tighten your laces before any long downhills to keep them from ramming into the toe of your boot. Keeping your toenails trimmed also helps prevent that kind of toe pain.

Especially for "weekend warrior" type SAR personnel, sore feet can limit members' time in the field. Having

high quality wool socks and after-market insoles can allow you to stay in the field longer.

One trick for preventing and treating sore feet is to simply elevate your feet. During a rest stop or when waiting, propping your feet up for even a few minutes. It may look silly, but it may help you stay in the field longer. And after you have done it once or twice your feet will feel so much better that you won't care if you look silly. Dipping feet in cold water for a few minutes will help, too.

Another way for preventing both toe blisters and sore toes: at the beginning of a long downhill, tighten your bootlaces to prevent your toes from sliding too far forward in your boot and jamming up against the toe of your boot.

HYPOTHERMIA

Hypothermia = low (hypo-) temperature (-therm-) condition (-ia). It's also known as *Killer of the Unprepared*. Hypothermia is when the body gets chilled – not just the skin and muscles, but **deep inside**.

Heat Balance: Your body produces heat continuously; your heat production must be balanced by an equal heat loss to keep your body temperature from going up or down. You must keep your body temperature within a narrow range for vital chemical processes to work. Use clothing and knowledge to keep your body core near $99^{\circ}\text{F}=37^{\circ}\text{C}$, even in hypothermia weather.

You **lose heat** from your body several ways:

- **Cold Temperature:** **radiation** (like heat radiating from a hot stove) and **conduction** (like sitting on a cold rock).
- **Windchill:** **convection**, as body-warmed air blows away.
- **Wet chill:** you lose heat when you are wet. By **conduction** into and through the cold water in your clothes, and by **evaporation**. (Like alcohol on your arm cools by evaporating.)
- **Respiration:** your lungs only work if the cold air is warmed to body temperature and humidified to 100% humidify; your nose, throat and breathing tubes humidify cold, dry air for your lungs. However, this means that even if you're not wet outside, you're losing heat from lots of evaporation *inside*. (Think of the clouds of condensation when you breathe out in the winter.) A scarf or mask over your nose and mouth ("rebreath flap") will retain some of this water and heat and decrease your respiration heat losses.

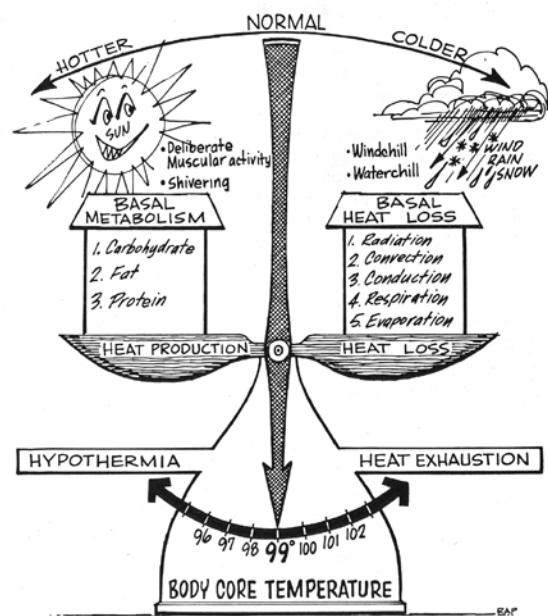
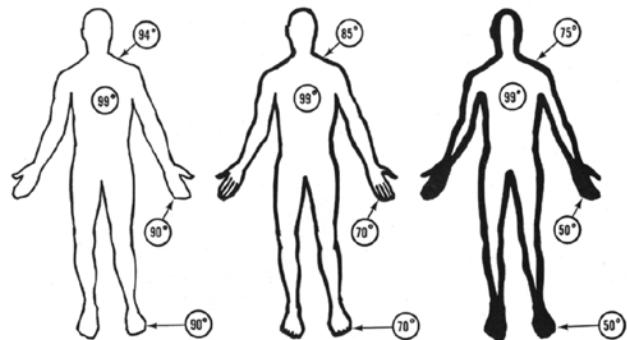
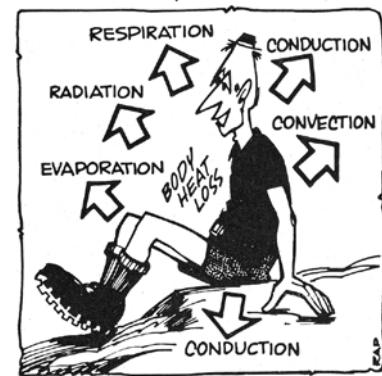
Hypothermia is a particular problem at temperatures around freezing ($32^{\circ}\text{F}=0^{\circ}\text{C}$) with wind and rain: **cold**

temperature, windchill, and wet chill combined. This is called **hypothermia weather**, because so many underestimate it. Even in the summer, sudden storms with the combination of wind and rain may cause hypothermia at temperatures as warm as $60^{\circ}\text{F}=16^{\circ}\text{C}$.

In bad weather, clothing is your **life-support system**.

Waterproof raingear protects you (somewhat) from wet chill. But even in truly waterproof raingear you will get wet. We all perspire, and clothes get wet from condensation, even in "waterproof-breathable" parkas.

Most clothing, when it's wet, conducts heat like water. How many times



Hand-drawn cartoons courtesy of Gene Fear's estate.

does water conduct heat than dry air? **240x!** Therefore your clothes must be **warm when wet!**

So, when going out, remember the **Three W's**.

- **Waterproof Clothing**
- **Warm-when-Wet Clothing**
- **Windproof Clothing**

Always carry at least **two large plastic leaf bags**.

These are light, cheap, and provide quick protection against wind and rain. Just stick them in your pocket or pack.

If someone in your team is getting hypothermic, or worse if you are all getting hypothermic, take action immediately. Let Base know if you can reach them. Quickly try to get to a sheltered location. Check with team members to find extra bits of clothing to put on the hypothermic team members. Get the hypothermic people into shelter, with leaf bags if nothing better is available. Make sure you insulate under hypothermic people as well. Get food and water into hypothermic people, even if they don't feel hungry: food is fuel for the warming fire in the center of our bodies, and digesting it

makes you warmer. **To learn how to assess for and treat hypothermia without a thermometer, see the pocket card on this page.**

FROSTBITE

Frotnip, also known as **superficial frostbite** or **first-degree frostbite**, is freezing of the superficial tissues, but sparing the deeper tissues. This is seldom a problem in your rescue patients, but may be a problem in team members involved in winter operations.

Frotnip commonly affects your and your teammates' **fingers, toes, ear lobes, and noses**. You can recognize it by a sudden blanching of the nose, ear, or fingertip. Although the part is pale or yellowish, it is still soft to the touch, not hard and "woody" as in deep frostbite. Numbness is not a useful symptom for diagnosing frostnip. A frotnipped area may feel numb, but cold skin gets numb *well* before it becomes frotnipped.

Stage	Clinical Findings
Mild (Green)	Stage 1: AVPU: Alert
Moderate (Yellow)	Stage 2: AVPU: Verbal (arouses to voice)
Severe (Red)	Stage 3: AVPU: Pain (arouses to pain) or Unresponsive and vital signs present
cardiac arrest (Black)	Stage 4: AVPU: Hypothermic Unresponsive and cardiac arrest NO vital signs present

Revised Swiss Hypothermia Grading

- For when you can't measure a core temperature with a thermometer
- Stages grade into each other, classification is approximate
- Other factors may affect level of consciousness
- Check for vital signs (pulse, respirations) up to a minute

From Appalachian Search and Rescue

Hypothermia Pocket Card: Grading

Stage	Treatment
Mild (Green)	<ul style="list-style-type: none"> • shelter/clothes • food & water • exercise • bivouac vs forced march
Moderate (Yellow)	<ul style="list-style-type: none"> • insulate • hot packs chest then armpits, not against skin • no standing • no exercise • evacuate, flat or head-up if can do • food & water if can tolerate
Severe (Red)	<ul style="list-style-type: none"> • same as Moderate but no food or water • Same as Severe • CPR: can do 5 min CPR and 5-10 min no CPR • evac/transport to cardiopulmonary bypass hospital
cardiac arrest (Black)	

Hypothermia Treatment

From Appalachian Search and Rescue

Hypothermia Pocket Card: Treatment

The wind-chill temperature does not represent a good index of hypothermia danger. However, it is a good index of the danger of frostnip and frostbite. Face masks and goggles or sunglasses are a necessity for windy deep-winter search and rescue operations. If you don't have face masks in bitterly cold weather, or when the wind is very strong, it is a good idea for team members to check each other's faces regularly for the blanching that is the first sign of frostnip, and to stop and rewarm immediately.

Treatment of frostnip is simple: rewarming by a warm hand over the nose or ear, or by placing a frost-nipped finger in the mouth, in an armpit, or in a warm pocket. On rewarming, the affected part tends to turn red, painful, and possibly slightly swollen, but no permanent damage results. Providing a warm armpit for a someone's frostnipped toes is supposedly a mark of true friendship.

Deep frostbite is different from frostnip: the deep tissues are also frozen.

In deep frostbite, the subcutaneous tissues are frozen solid, and the affected part feels hard, like a piece of wood or frozen meat.

Freezing causes great tissue damage, but the effects are postponed until the part is re-warmed. Once the frozen parts are rewarmed, the damage becomes evident, with excruciating pain and blistering.

Trauma to frozen tissue may push sharp ice crystals into cells, rupturing them. Napoleon's battle surgeon, Baron Larrey, suggested rubbing the affected parts in snow to increase circulation. We now know this will cause much more damage than it cures.

It is said "you can walk on frostbitten feet, but you can't walk on rewarmed feet." True, but walking on frostbitten feet is a really bad idea unless it's the only way to save your life.

Unless circulation is impaired, for instance by too-tight boots, or from dehydration or hypothermia or exhaustion, the human body is highly resistant to freezing. Note that wearing two pairs of socks with a pair of boots fitted for one pair of socks is a common cause of frostbite ("two-sock frostbite"), even appearing in the military medical literature.

Even a vigorous, healthy person may get frostbite if it is very cold and the wind is very strong across an unprotected nose or ear. It is also possible to get frostbite by touching a bare hand to a piece of supercooled metal, or by spilling sub-freezing stove fuel on a hand. (Gasoline and alcohol are still liquid at temperatures below the freezing point of water.)

A secondary phase of damage occurs after rewarming. The frozen and thawed tissues become inflamed, with damage to the inner lining of blood vessels, which leads to small clots, and go into spasm, cutting off blood

supply to the tissues. Blood vessels also leak, causing swelling. This all causes more damage and loss of tissue.

A major goal of management is to prevent this additional damage after rewarming.

The proper definitive treatment, in the hospital or in the field, is **rapid rewarming** in hot water, 99-102° F (37-39°C). If you don't have a thermometer, dip your elbow in the water; if the water feels hot but you can keep your elbow in, it's probably about right.

However, don't rewarm until there is no danger of re-freezing. Refreezing causes severe damage.

Frostbitten limbs are numb, so don't cook them in too-hot water, or burn them by rewarming in front of a fire.

There is some evidence that non-steroidal anti-inflammatory drugs (NSAIDs) like ibuprofen (Motrin, Nuprin, Advil) or naproxen (Aleve) or aspirin, if given early, will help prevent some of the additional tissue loss after rewarming. Ibuprofen is preferred but only based on shaky evidence, and any of the three is better than none of them. The sooner the person takes a NSAID the better.

HEAT-RELATED ILLNESS

Dehydration is a common problem on SAR tasks, even in the winter, when you lose lots of water by your airways humidifying the dry air you breathe in, and then lose that water when you breathe out. In the winter, a "rebreathe flap" across your mouth and nose, either a scarf or a commercial neoprene/fleece face mask, can decrease this water loss and also decrease the heat loss from evaporation from your airways.

But dehydration is much more common in hot weather.

Signs and symptoms of dehydration include thirst, but thirst does not always occur when you're dehydrated. Instead, you may develop lightheadedness, weakness, tunnel vision, or headache. Producing no urine, or small amounts of dark urine, is also a sign of dehydration. Lack of urine or dark urine is probably the most reliable way to tell you're dehydrated.

Dehydration can make members so weak they cannot continue with the task, or in extreme cases they may not be able stand without losing consciousness. With advanced dehydration comes nausea, and this may overwhelm any feelings of thirst. Even mild dehydration decreases aerobic and muscular performance, and recent evidence shows that, although it doesn't decrease reaction time, it does decrease mental performance.

Prevention involves having enough water to drink. That means taking enough with you, especially in hot weather. A single liter/quart water bottle is not nearly

enough for a long task on a hot day. Water bladders (e.g., CamelBak) can hold multiple liters of water, and the ease with which you can drink from them encourages sipping, and likely improves your physical and mental performance.

When appropriate, monitor yourself and your teammates for dehydration. Team leaders will sometimes even schedule pee stops, and ask about the amount and color of your urine.

Treatment of dehydration seems simple: drink more water. However, dehydration from sweating involves loss of water *and salt*. If you don't have enough salt to hold the water in you, any water you drink will pass right through and you'll stay dehydrated. This is important particularly at the beginning of hot weather when people aren't acclimatized to the heat. One part of heat acclimatization is that your sweat glands switch to producing less-salty sweat. It takes about two weeks of moderate exercise in the heat to acclimatize. So, especially if you're not acclimatized to the heat, you need to increase your salt intake. Salty snacks will help, and you can carry some fast-food salt packets in a plastic bag to add to your food. Salt tablets are not a good idea because they can really mess up your stomach.

Heat exhaustion is basically just very bad dehydration, bad enough that you almost pass out. There's no real dividing line between dehydration and heat exhaustion.

When you get dehydrated, your body temperature will rise a bit, so a person with heat exhaustion may be a bit on the warm side if you feel the skin or use a thermometer. However, the skin should still be at least a bit damp.

The treatment is rest in a shady area, if needed, and salt and water repletion.

Heatstroke is qualitatively different from dehydration and heat exhaustion. In a hot environment, heatstroke may come from heat exposure in someone who is taking a medication that interferes with heat regulation, without much exertion. It can also come from aerobically-fit

people who, in a hot environment, can create heat faster than they can get rid of it ("exertional heatstroke").

The person's core body temperature rises so high that it starts damaging vital organs. Heatstroke can cause lifelong medical problems or death.

There's no way to tell in the field if there is liver or kidney damage, but damage to the brain is easy to spot. If a person are in the right setting for heatstroke, their skin is very hot and maybe dry (maybe not dry in exertional heatstroke), and they are confused or comatose, you should assume that they have heatstroke and treat them for it.

Treatment for heatstroke is fairly simple: reduce the person's temperature to near-normal. Cold or even cool water on clothing is the best technique for in the field; fanning to increase evaporation will help.

Immersion in cold water works, but there may be risk of drowning. And some say that icy water on the skin causes the blood vessels to constrict by reflex, and that evaporation, at least if it's not too humid out, cools faster.

The "TACO" method of heatstroke cooling is likely best. (TACO = Tarp Assisted Cooling with Oscillation).

- Put a tarp on the ground.
- Four people hold the corners of the tarp up.
- **Pour** your available water on the patient.
 - Rock the patient back and forth to circulate the water. **No need to hold the patient up off of the ground.**

An ultralight disposable mylar "space" blanket or two work well for this and weigh and bulk almost nothing in your pack. A "space" blanket can also be used as an improvised binder to splint an unstable pelvic fracture.

Make sure not to over-cool, people with heatstroke can't regulate their own temperature, so if you cool too much, hypothermia is also a risk. If you have a thermometer, cool to 104°F (40 °C) as a good target, try not to get below this.

Communications

You need to provide accurate, clear, and effective reports over a radio during a SAR operation. To do this, you need to take time to organize, and maybe rehearse under your breath, a succinct message. *Before* you speak on the radio. And you should use basic ASRC radio standard operating procedures. There are three “one-pagers” on the ASRC website (<https://www.asrc.net/>) that you should download and use):

- *ASRC TYT Handheld Radio Basics*
- *Radio Best Practices and Common Prowords*
- *ASRC Radio Channel Zones*
- *Phonetic Alphabet*

The *TYT Handheld Radio Basics* applies to the most common ASRC radios, but other brands and models of ASRC radios exist. Most of the principles for using those other radios are similar, and you may end up being issued a TYT radio for a large search, so you should learn about them.

For Field Level IV, the expectation is that you can use the ASRC Phonetic Alphabet one-pager or equivalent rather than having the entire phonetic alphabet memorized. However, you do need to memorize the radio best practices and common prowords.

Number of Coordinates

The first four numbers are sometimes called an “Easting” as they reflect the distance from the zone boundary west of you. The second four numbers are sometimes called a “Northing” as they reflect the distance north of the equator. Even if you’re using something different than our recommended 4x4 format, the Easting always comes before the Northing: the standard mantra for those reading grid coordinates off a map is “read right, then up”: read the Easting first and then the Northing. You may also use a more capable smartphone app, such as CalTopo/SARTopo or BackCountry Navigator or Gaia, or a dedicated GPS unit, which will also give you GPS coordinates.

However, with such a GPS app or dedicated GPS unit, you will need to first make sure that in your GPS settings, your datum is set to either WGS84 or NAD83 and not NAD2; if you don’t set this properly your GPS position will be tens of meters off. And then you will have to make sure in the Settings menu that the coordinates are set to USNG, or, if that isn’t an option, UTM, which for our purposes are essentially the same.

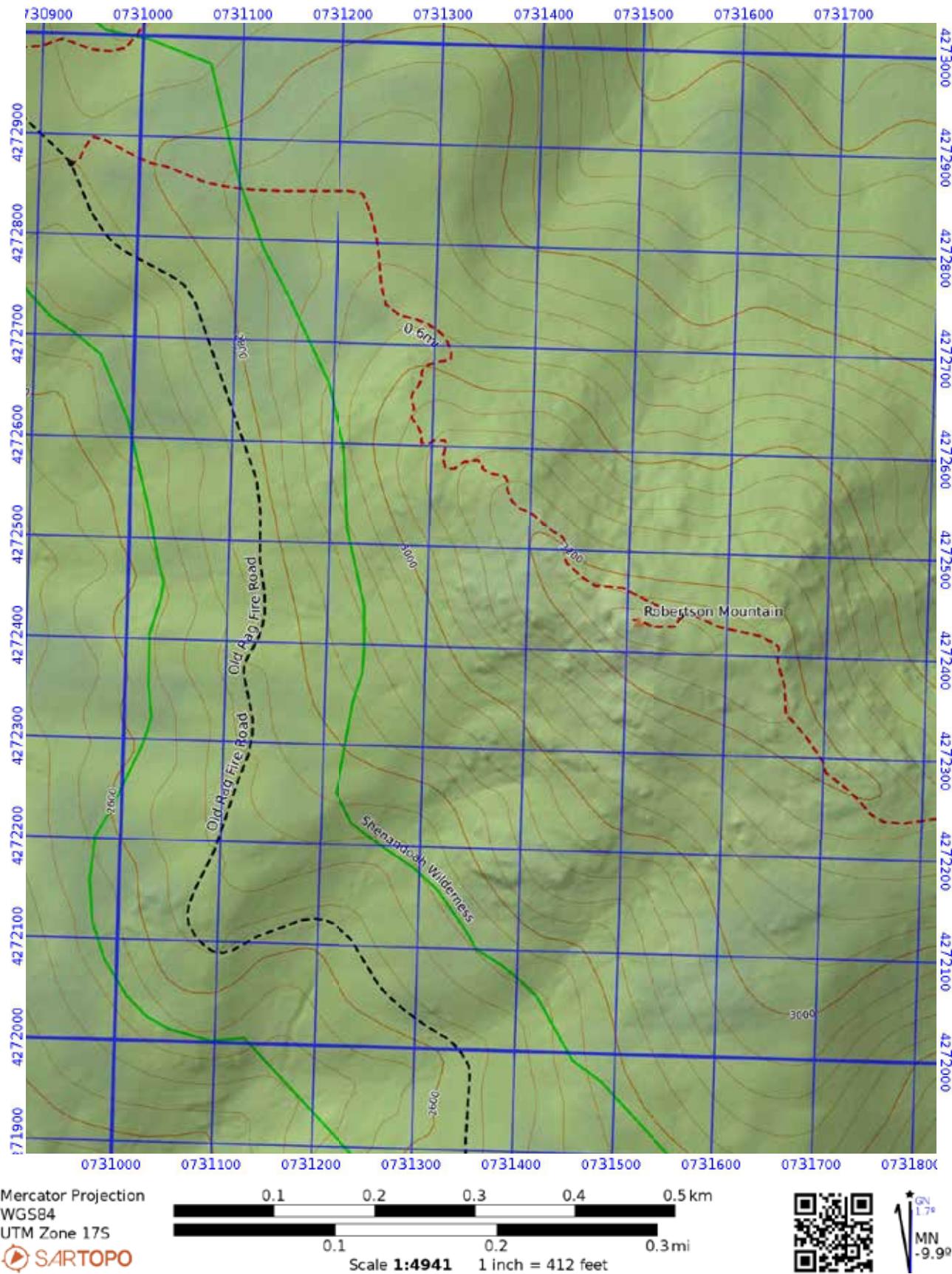
These units give more numbers than the simple 4x4 coordinates that are our standard for communicating position, so you will need to learn how to parse those long numbers as follows. And, unfortunately, unlike UTM grid numbers on maps which have the first two of

your 4x4 coordinates in larger numbers, most GPS units and apps give the numbers without any emphasis on those two numbers.

If your GPS shows **17 T NE 578791 4472822** (for USNG) or **17 T 578791 4472822** (for UTM, which except for the NE is otherwise the same) you first strip **17 T NE** or **17 T** off the front of the number, resulting in **578791 4472822**. Next, you strip off the last digit of each string, resulting in **57879 447282**. Finally, you use just the last four numbers of each string: **7879 7282**.

If this sounds like too big hassle to go through every time Base asks for your location, then just read off what your phone or GPS says and let Base figure it out.

Psychological Hazards



Land Navigation

There are different ways to specify your position, for example, latitude and longitude, or bearing and distance off a VOR aerial navigation beacon. However, the system used almost exclusively for wilderness search and rescue is the Universal Transverse Mercator (UTM) or the similar but newer United States National Grid (USNG). The CalTopo/SARTopo app will give you your USNG grid coordinates, as well as show you maps and where you are on them and allow you to track yourself and share position or track with others. We *strongly* recommend you download and put CalTopo on your smartphone. If your Group has a group account (extremely likely), ask to connect your CalTopo app to this. **This turns your app into SARTopo which has many more features.**

A USNG coordinate consists of three parts:

- **A Grid Zone Designation** specifies one of sixty vertical slices that cover the globe. A search in the mid-Appalachian area will be in UTM Zone **17S, 17T, 18S, or 18T**, but for a particular lost-person search, the entire search area will be in only *one* of the zones, so we don't usually report or record the zone.
- **A 100,000-meter Square Identification;** for regional areas. Again, we will not need to use this for lost person searches, so we don't usually report the square.
- **A Grid Coordinate**, which we *do* report and record.

The UTM system is exactly the same but without the 100,000-meter Square Identification.

Numeric USNG/UTM grid coordinates may be to an arbitrary precision, but it's standard to report your position to a 10 meter precision, using four digits. That number is a certain number of meters east of your Zone 17S, 17T, 18S, or 18T western zone boundary, and a certain number of meters north of that zone's southern

border. The standard mnemonic for this is "read right, up." Others say "read from left to right, then from bottom to top."

For example, if you were standing at the Newcomb Hall Post Office at the University of Virginia, which is the ASRC's official mailing address, look at CalTopo/SARTopo and see "17S QC 1880 1269." You would ignore the "17S QC" as it would be the same for everyone in your vicinity, and report your position over the radio like this: "Base, this is team Bravo. Our location is, figures, WUN, AIT, AIT, ZE RO, [pause] WUN, TOO, SIX, NIN er. How copy, over?"

The map on the previous page has UTM grids on it. Note that grids on maps give one more digit than we and the USNG app use; you strip off the last digit of both the *easting* and the *northing* (other terms for the "read right, up" principle), and then give the remaining last four digits. If you were reading your position off a map instead of a GPS, and you were at the top of Robertson Mountain, you would report your position as "We are at the top of Robertson Mountain, which is, figures, TREE, WUN, FIFE, WON, [pause] SEV en, TOO, FOW er, WUN. How copy, over?"

For training and search tasks, Base or a Field Team Leader may give you a compass *safety direction*, such as northeast. If you get separated from your team, and you go this direction, you will come to a feature, such as a road or stream, that will allow you to get back to civilization. It's a good idea to look at the map yourself and pick a safety direction, if possible, before heading out on the task.

* Note for those preparing maps like this from SARTopo: we print to PDF using the **UTM** option rather than the **USNG** option as it provides the requisite amount of information for each gridline, which the **USNG** option does not.

Operations, Management and Leadership

ICS AS ADAPTED FOR SAR

Communications: the Incident Command System (ICS) is the national US standard for organizing multi-agency operations. The ICS says that you should only use plain English and position titles or last names. Per the ICS, don't use non-ICS abbreviations or 10-codes or the like. For the ASRC, we do use standard radio prowords in the one-pager Radio Best Practices and

Common Prowords at asrc.net, including Status 1, Status 2, and Status 3, but everything else is in plain English.

Task Assignment Form (TAF): this is a form, somewhat similar to the ICS Assignment Form (ICS 204), that the ASRC's Yorke Brown and Keith Conover, with input from other ASRC members, originated in the early 1970s. The TAF is used in variants nationwide for assigning tasks to search Field Teams; TAFs are covered in detail for Field Level III; for Field Level IV you only

need to know that a TAF is a wilderness search and rescue add-on to the ICS, is commonly used, and that the Field Team Leader is responsible for carrying out the task specified on the TAF.

For purposes of ASRC Field IV (Trainee) testing, we do not expect you to memorize the names for the various supervisory ICS positions (Officer, Chief, Director, Supervisor, Leader) nor the differences between ICS Branches, Groups, or Divisions. Or the various units that may be parts of a Section, Branch, Group or Division. Or the definitions or standard sizes of Strike Teams or Task Forces, as in wilderness search and rescue it is a best practice to hand-craft variable-size Field Teams for specific tasks. However, you *may* need to memorize these long enough to pass the NIMS/ICS classes required of emergency responders by the Federal government, and as you progress in your SAR training, these ICS terms *will* become more important.

OPERATIONAL PROCEDURES

You must learn how your Group alerting process works, and how you are expected to respond when alerted.

You must learn safety best practices, including

- **Double-checking** knots and rigging by a separate person.
- **Wearing a helmet and gloves** when appropriate,
- Carrying some semblance of the **Ten Essentials** and the ASRC required gear list, given the task and the weather and the terrain.

You must learn best practices for conduct during a search and rescue operation, including

- How to **sign in and out** of the mission. And, why it is *so* important: you don't want to be in trouble because people are out searching for you when you're really on your way home. It has happened
- What a **staging area** is. (It's where you rest, eat, drink, and mostly wait for an assignment. You need to understand the common problem of having to wait patiently for a field task, and why it's important to *not* bother the incident staff.)
- The **chain of command** and why it is important to observe it, although with the option to refuse an unsafe task at any time.
- **Accountability** including Personnel Accountability Report or PAR ("we have PAR" meaning that

everyone on our team is here or otherwise accounted for).

You must, despite the stress of SAR operations and the egos involved, know how to **conduct yourself appropriately**, and how to manage difficult interpersonal relations, including

- Conduct when **approached by the press**: give general information on what it's like to be involved in SAR, but refer all specific questions about the operations up the chain of command or to the Public Information Officer (PIO).
- Observe **communications security** by turning down your radio when near people other than your team, and turning volume way down if you hear **Secure the Net**.
- Understand how interpersonal/interagency **conflicts** may be as dangerous to the mission as incompetence, and the importance of trying to defuse them.
- Understand the importance to avoid even the *appearance of publicly criticizing other persons* or organizations involved in the mission. If you must do so, do so **privately** one-on-one with your superior in the command chain, or in a secure debriefing. As your mother used to say, "if you can't say anything nice, don't say anything at all."
- Understand the importance of avoiding even the *appearance of freelancing/self-deploying*: responding to a situation without the approval of the Agency Having Jurisdiction/Responsible Agent, or responding to the field or deviating from your assigned task without coordinating with Base. Freelancing/self-deploying can be by individuals, field teams, or SAR organizations. Freelancing/self-deploying can disrupt search operations, such as not knowing that another team is in a segment being searched by an air-scenting dog. Freelancing/self-deploying can be disruptive in political terms: a reputation for freelancing/self-deploying is bad both for people and teams and interferes with getting called out when needed. Freelancing/self-deploying can be deadly: in the 2010s, a non-ASRC SAR team self-deployed to a search area after the search had been officially concluded. **Without** letting the Agency Having Jurisdiction/Responsible Agent (AHJ/RA) know. So, the AHJ/RA told the railroad company to let the trains start running through the area again. And one of those trains hit and killed a SAR team member.

Rescue

Carrying a litter is easy. Well, no, it's not really, it's pretty hard work, but *learning* how to carry a litter isn't very hard.*

The first rule is to not get hurt. The easiest way to get hurt is to pick up the litter wrong and mess up your back.

Some people and teams insist that anyone carrying a litter, even along a level forest trail, wear a helmet, just in case they fall. From an injury prevention standpoint, a fall from standing without a helmet is very unlikely to cause any significant brain injury. Even if you're on a blood thinner, and the rule is “if you're on a blood thinner and hit your head you need a CT scan of your brain,” the vast majority of those CT scans are fine and those patients get sent home. There's nothing wrong with wearing a helmet when carrying a litter, and if you're using a rope, it certainly is a best practice. But for a nontechnical evac, it only makes slightly more sense than wearing a beanie with a propeller on top. But back injuries, sometimes serious ones, are *much* more of a concern.

You have probably heard all the hype about “lift with your legs, not your back.” It's all true. Bending over a litter and then lifting is a great way to give yourself pain and misery for a week or so. Or maybe the rest of your life.

PICKING UP THE LITTER

With a litter, though, it's hard to get close enough to lift with your legs. There are a few tricks.

The first trick works like this.

1 Face the litter.

2 Squat down on one knee. Keep the other knee up. (Some obsessive-compulsive people insist that everyone get down on the same knee. Ignore them.)

3 Put both hands on the litter rail. Lean away from the litter. This keeps your back reasonably straight and upright.

Here's the second trick. When it's time to lift the litter and you hear the **LITTER CAPTAIN** say “**READY! [PAUSE] LIFT!**” don't lift. Right. *Don't* lift.

Instead, *pull out*. Pull directly away from the litter bearer across from you. The litter will lift slowly and smoothly. (Slowly and smoothly is good for preventing bad things. Like back strains. Like dropping the litter.) It seems like magic, and maybe it is, but try it, you'll like it.

* The Rescue section was copied almost verbatim, leaving out footnotes, sidebars and references to other parts of the textbook, from a draft of *Appalachian Search and Rescue*, under a Creative Commons by-sa license.

Here's the third trick, from Sean McEligott of the ASRC's Shenandoah Mountain Rescue Group. Insist that all litter bearers look the litter bearer across from them in the eye... the whole time they're lifting. That forces them to keep their heads up and their butts down.

Whatever combination of these tricks you use, make sure that they're working as you're training people to pick up a litter. Keep an eye out for butts sticking out.

Now for a joke.† (Bear with us, it'll be relevant in a bit. Well, a little bit relevant.) It goes like this:

Once I saw this guy on a bridge about to jump. I said, “Don't do it!”

He said, “Nobody loves me.” I said, “God loves you. Do you believe in God?”

He said, “Yes.” I said, “Are you a Christian or a Jew?”

He said, “A Christian.” I said, “Me, too! Protestant or Catholic?”

He said, “Protestant.” I said, “Me, too! What franchise?”

He said, “Baptist.” I said, “Me, too! Northern Baptist or Southern Baptist?”

He said, “Northern Baptist.” I said, “Me, too! Northern Conservative Baptist or Northern Liberal Baptist?”

He said, “Northern Conservative Baptist.” I said, “Me, too! Northern Conservative Baptist Great Lakes Region, or Northern Conservative Baptist Eastern Region?”

He said, “Northern Conservative Baptist Great Lakes Region.” I said, “Me, too!”

I said, “Northern Conservative Baptist Great Lakes Region Council of 1879, or Northern Conservative Baptist Great Lakes Region Council of 1912?”

He said, “Northern Conservative Baptist Great Lakes Region Council of 1912.”

I said, “Die, heretic!” And I pushed him over.

Now, about calls for lifting the litter.

Some insist that the One True Call is “**PREPARE TO LIFT!**” Or maybe “**READY TO LIFT!**” And then there are the Trinitarians who insist on “**ONE, TWO, THREE, LIFT!**” Fewer words are better, especially if you're doing something that will likely leave you short of breath. (There are a few that are non-starters: “**LIFT ON THREE! NINETY NINE! NINETY EIGHT!...**”)

And, in the early days of the Appalachian Search and Rescue Conference, “**READY! [PAUSE] LIFT!**” is what we chose as the standard.

So do it this way. Or get pushed off the bridge.

† This was written by comedian Emo Philips in 1985 and was voted best religious joke of all time by the website Ship of Fools.

Just kidding. The most important thing for the **LITTER CAPTAIN** is not what words he or she uses, but that little **[PAUSE]**. During that pause the **LITTER CAPTAIN** quickly scans all the litter bearers to assure they are ready. Yes, if you're a litter bearer and you hear "**READY!**" and you're *not* ready, a little enlightened self-interest suggests you say "**HANG ON A MINUTE!**" or "**WAIT!**" or something similar. "**STOP!**" is more official-sounding. But is simply being official-sounding enough to establish a new standard? You're standing right next to the person, so there aren't likely to be problems communicating. No, there needs to be no One True Call for this.

Even if the litter bearers are expected to respond if unready, still, it's the **LITTER CAPTAIN'S** job to make sure everyone's really ready.

It is very important to have one person on the litter, and *only* one person, who communicates with the Rope Team. If several different people are talking with the Rope Team, it gets confusing and perhaps dangerous.

THE LITTER CAPTAIN

Who, you might ask, gets to be the **LITTER CAPTAIN**? Options include:

- Whoever is senior in grade (this means the highest ranking person, e.g., an ASRC Field I outranks a Field II, and whoever has been credentialed at that grade



Litter Team
Front left is the **LITTER CAPTAIN**. Front right is the **SPEAKER**.
Illustration by Paul Jun of the ASRC's Allegheny Mountain Rescue Group. Modified by Keith Conover and used with permission.

longer is senior within that grade)

- Whoever wins a vote
- Whoever is tallest
- Whoever is shortest
- Whoever has the coolest helmet or hat
- Whoever really, really wants to be the **LITTER CAPTAIN**
- Whoever wins the fight

Long ago (circa 1974), the ASRC debated these sorts of things and finally decided *it's your position on the litter*. It's easy to remember: *whoever is in the driver's seat* gets to be the **LITTER CAPTAIN**.* Again: the litter bearer in the front left gets to be the **LITTER CAPTAIN**. There might be a bit of jostling to see who ends up in the "driver's seat" but really, everyone's supposed to be able to do the job. And, if you're switching off litter bearers (which is a really, really good idea; see below) then everyone eventually gets to be the **LITTER CAPTAIN**.

If you suddenly decide to move the litter backwards for some reason, then a litter bearer who was in the back may suddenly become the **LITTER CAPTAIN**.†

There is one exception: if you've got someone right at the head of the litter, as you're tipping it up to rotate it (not uncommon in small cave passages), the person at the head of the litter gets to be **LITTER CAPTAIN**. Similarly, if you've got someone at the head of the litter and you're picking up just the top of the litter and you're standing it upright, that person gets to be **LITTER CAPTAIN**. Why would you stand a litter (and patient) bolt upright? Sometimes in cave rescue, you have to do this to get the patient into another passage, or to let litter bearers get by. Or you may be getting ready to lift the Sked up a narrow pit in a cave.

You'll often want to check your tie-in and packaging with a brief time-out, by standing the litter up to see if the patient is still comfortable.

Pro tip: if you're at the head of a flexible Sked litter and you want to lift up the head, *do not pull up on the yellow bridle webbing*. The yellow bridle webbing is for pulling the SKED along a level gently sloping area. Even with an OSS/Sked-Ked in place, pulling straight up on the yellow webbing bridle can crank the patient's head forwards. Even if they didn't have a cervical spine injury before, they might at least get a muscle strain from your pulling straight up on the yellow webbing bridle.

Putting down the litter is almost the reverse of picking it up. The standard call is "**READY! [PAUSE] DOWN!**"

* The US Department of Defense standard is that *back* left is litter captain. This means the litter captain can see other litter bearers better which is good, but can't see and pick the path ahead which is bad. After due consideration, the ASRC decided to stick with front left.

† And yes, if you are in the UK, Ireland, or anywhere the driver is on the right side, then the person in the front right is the Litter Captain. Now stop it and get back to reading.

Again, you lean out and keep your head up and your butt down as you lower the litter. When training people to pick up and put down a litter, it is customary for the instructor to walk around the litter and litter bearers as they are practicing. Sometimes, to prevent back injury, urgent intervention is appropriate. If the instructor sees a litter bearer who is leaning over – as shown by the bearer's buttocks protruding from the line of litter bearers – verbal remonstrances are inadequate, and the instructor is expected to rapidly and forcefully place his or her boot on the lower back and top of the offending litter bearer's buttocks and forcefully push it in line. This is just as much a safety measure as a means of negative reinforcement. And, yes, this is where we get the phrase “kick butt.”* Actually, we don’t know anyone who does this, as kicking someone in the butt, even in a good cause, is probably a crime. But *threatening* to do so is pretty common.

However, there is one major difference between raising and lowering the litter. It’s possible to put the litter down on a punji stick (sharpened sticks left sticking up as a booby trap). Or a shrub someone has cut off with a machete to clear a helicopter Landing Zone (LZ) which is functionally the same. Back when we used to use *real* Stokes litters, which were also known as Navy Wire Basket Litters, this was a big deal. These original litters, which are still used in many places, have a steel frame with chicken wire in it. Punji sticks[†] left by well-meaning but incompetent machete-wielding landing-zone clearers (or trail maintainers) were a real hazard. You’re supposed to cut off right at the ground, and leave it cut flat, not diagonally-pointed.[‡]

With plastic Stokes litters, this is much less of a concern. However, putting the litter down on a sharp pointy rock can still crack a plastic Stokes, not to mention flexing the Stokes and hurting the patient. So that **[PAUSE]** allows everyone, prior to setting down the litter, to check underneath for *any* impediments, for example, wasp nests, mines, small furry animals or some picnicker’s watermelon. Many people like to use their legs to sweep under the litter to check for things you might have missed, but it’s not required. The even

* My 14 year old daughter, on reading this, made me put this in: “You can’t believe a thing he says.”

† https://en.wikipedia.org/wiki/Punji_stick

‡ The best machete for clearing a LZ is a Woodman’s Pal, made in Pennsylvania since the 1940s. It was standard issue in World War II. I favor the long-reach version. My wife and daughter and I do trail maintenance from time to time. Often when we go out for a hike we take along some trail tools to do a little clearing along the way. At my daughter’s 9th birthday party, the extended family was sitting around the table watching her open her two big presents. One was an American Girl doll. Family approved. When she unwrapped the second, though, family was horrified. It was her own Woodman’s Pal machete. “Now when we’re hiking, I don’t have to borrow yours all the time! Great!”

like to say “**SWEEP! READY! [PAUSE] DOWN!**” Unless you’re using an loaned wire-basket Stokes, you don’t have to, but if it makes the **LITTER CAPTAIN** happy, go with the flow.

It’s also very embarrassing when all of the litter bearers let go at the same time, and the litter then slides down the mountain like an out-of-control Olympic Luge sled. Unlike the wire-basket Stokes, which has lots of friction, the newer plastic Stokes are pretty slippery and this is not purely theoretical.

There are some simple solutions. Leaving a couple of people holding onto the litter (usually those on the downhill end) will work. However, this may not be favored by the people on the downhill end of the litter. In forested areas, a simple solution is to have a short (~20’ = 6 m) *tag line* attached to the head of the litter. (Even if you have a 200’ rope attached to the litter for a semi-tech evac, such a separate short tag line may be handy.) Tie a figure 8 loop with a carabiner about 5’ away from the litter. Whip it around a tree and clip it back into the litter and you’re secure. Or just pass the rope around a big tree 4-5 times.

There may be times when the **MEDIC** tells you that it’s important to keep the litter in a slightly head-down position (perhaps blood loss, dehydration, or hypothermia), or perhaps a slightly head-up positions (perhaps a head injury, or a breathing problem). In such cases some of the litter bearers will just have to suck it up and hold the litter in the appropriate position during a stop.

There is also the question of what to do when you have to tilt the litter. While it’s best for the patient to be flat, sometimes you really need to, if for efficiency of the rescue, tilt the litter either head-up or feet-up. Head-up is almost always preferred. Why? Well, if you tilt someone feet-up, that means their abdominal contents are pushing up into their chest, making it hard to breathe. And if the patient has a stroke or a head injury, it pushes more blood into the brain, which can make swelling there worse.

We discuss field team positions in detail in Chapter 9: *Leadership and Followership*. One of those is the **MEDIC**: whoever is designated to be take care of the team’s medical problems, and for a rescue, serve as the patient’s primary caretaker, whether physician, wilderness first aider, or in between. When carrying a patient in the litter, we generally try to have the **MEDIC** not carry the litter, but follow along beside the litter. That way, when we rotate litter bearers off the litter for a rest, the **MEDIC** can still stay with the patient.

There is also a position often used on litter teams: the litter bearer on the front right serves as the **SPEAKER**..

Shit happens. To litter patients. So does piss. Vomit also happens in litter patients. And despite the fact that litters are obviously design to carry people on their

backs, vomiting when you are on your back is bad. Especially if you have immobilized the neck so the patient cannot turn his or her head. This is a good argument against immobilizing the neck unless absolutely needed. It's also an argument for not packaging people on their backs, but using the on-the-side coma position/recovery position.

If you see a litter patient on his or her back vomiting, yell "**STOP! VOMITING!**" and rotate the litter away from the **LITTER CAPTAIN**. Why away from the litter captain? We just need a standard way to do this so litter bearers are not fighting each other to turn the litter different ways.

Sometimes in litter practice, litter bearers tilt the litter to about a 45° angle. *Not* enough. When someone is immobilized and vomiting, you need to turn the litter a bit more than 90° to actually prevent aspiration (vomit going into the lungs). Ideal is to turn the litter entirely upside down so the patient is facedown. So if you are doing litter practice, you hear "**STOP! VOMITING!**" and people just turn the litter a little bit, tell them that what they're doing is a waste of time and that they just killed the patient, and show them how to do it the right way. Tell them we told you to do it.

Speaking of stops: yes, the **MEDIC** may need a stop for some medical reason, or you may need to stop to change the litter rigging, or the patient may need to pee. But except for such mandatory stops, the litter should never stop moving; for a rescue team to accomplish this takes study and practice, which is why this section is so long.



Load Strap
Litter is on the right, behind litter bearer; litter bearer's right hand is on the litter rail. Load strap comes from behind litter bearer's right hand, up over litter bearer's left shoulder, then down to litter bearer's left. Twisting the load strap around the litter bearer's hand as shown is optional but commonly done. This photo is without a pack for clarity.

A packstrap does provide extra padding for that left shoulder.

Photo by Laurel Victoria Conover, modified by Keith Conover and used with permission.

CARRYING THE LITTER

It is said that "many hands make light work" and so it's standard to have six litter bearers; any more than six is a crowd, as you're always stepping on someone's heels. But 12 hands doesn't make carrying a litter exactly "light work." Actually, it's only 6 hands, because when carrying and facing forwards, you can only keep one hand on the litter.

There are things you can do to make carrying easier. The simplest is to have litter bearers who roughly match the height of the litter bearer across from them.

That way, it will be easier: you can keep your arm straight and let your bones rather than your muscles take most of the weight, rather than your muscles.

Another simple technique is to use **load straps**. A load strap is about 11-12 feet (~3 m) of webbing without any knots or hardware. You girth-hitch the middle of it to the litter rail just behind where your hand will be on the rail. You gently pile it on top of the patient before you use it.

Here's how to use a load strap. It sounds complicated, but it'll take you but one try for it to become second nature.

- Assume you're on the left side of the litter, facing forwards, with your right hand on the litter.
- With your *left* hand, reach across in front of you and, *behind* your right hand on the rail, grab both strands of the load strap, right next to the rail.
- Slide your hand out along the load strap until you've got about 2/3 of it stretched out from the litter rail.
- Lift your left hand up a bit over your head, duck your head and flip the load strap backwards over your head.
- The load strap is now running diagonally across from the bottom right of your back to the top left, and forwards across your left shoulder.
- Bring your left hand down in front of your chest.
- Wrap the load strap a few times around your hand, then pull down, hard. Now, some of the litter load is on your left shoulder, spread out by the webbing and padded by your packstrap. Really helps that right arm, doesn't it?

When you are ready to rotate litter bearers, you unwind your hand and then gently drop the load strap on the patient.

We've tried this with 1" nylon slings, which really cut into your shoulder painfully. We found 1.5" or 2" slings are much better. These don't need to hold a rescue load, so no need for that very heavy 2" seat belt webbing. Instead, we are starting to use thin, lightweight 2" slings of ultra-high molecular weight polyethylene, UHMWPE, available under the brand names of Dyneema, Dynex and Spectra.

If most of your evacuations are nontechnical, it may pay to keep a set of load straps pre-attached to your litter rails.

ROTATING LITTER BEARERS

Even with load straps, carrying a litter is hard work. And you get tired out quickly. Or your arms start hurting. (Just one arm if you stay on the same side of the litter.) So we talk about *rotating litter bearers*: getting fresh new litter bearers on the litter and getting the tired old ones off the litter so that they can rest, at least for a while.

Knowing how to rotate litter bearers the right way can really speed up a nontechnical evac (carryout). And, unlike the bit about calls for lifting the litter, there seems to be only One True Way to rotate litter bearers. The ASRC developed this in the early 1970s, but then as there's only one way that works best, this has probably evolved independently other places.

Here are things you want to happen with litter bearer rotation:

- The litter should not stop.
- Litter bearers should alternate using their right and left arms (unless they've got a bad arm or shoulder on one side, in which they and their partners can not switch sides as described below)
- Litter bearers should be in pairs roughly matched by height.
- Litter bearers should be ready to rotate in to carrying the litter whenever the **LITTER CAPTAIN** indicates a need for rotation by calling "**READY [GRUNT] TO ROTATE!**" (the grunt indicates that you *really* need to come off the litter **right now**).
- Relief litter bearers should not have to fight their way past the litter, or get bumped off the trail by the litter passing them before they've got their feet settled.

Rotating with Six Litter Bearers

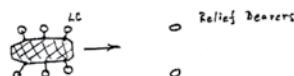
Let's start with the simplest situation: you have a team of six carrying a litter and no relief bearers, but you want to switch sides from time to time to rest one arm.

When the **LITTER CAPTAIN** calls "**READY TO ROTATE!**" the *rear* litter bearers shift forward a bit and tap twice on the middle litter bearers' hands (or arms or shoulders). Then, the *middle* litter bearers shift forward enough to briefly carry the litter just with them and

the back litter bearers. They then tap-tap or tap-tap-tap (it doesn't really matter which) the front litter bearers' hands (or arms or shoulders). (A double-tap is less likely to be confused with an accidental touch by something, either another's hand or a falling acorn. Somehow, people seem to like a triple-tap better than a double-tap; we're OK with that.)

The front two litter bearers then come off the litter, cross to the other side, and step off the trail. The two of them should walk briskly ahead a few feet to find a safe place for both of them to step off the trail. Assuming neither has a bum shoulder or arm, they step off the trail on the side opposite their previous side. The litter bearer that was on the left front of the litter will step off to the right, and the litter bearer that was on the right front of litter

The four remaining litter bearers move the litter forward (straining and grunting, and maybe briefly using both hands) until the litter is past the two litter bearers off to either side of the trail. They each grab onto the foot of the litter, and become the new back litter bearers, with the other four shifting forwards fully to the front and middle positions.



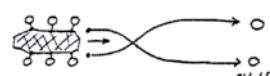
1: Relief bearers (for clarity, only two are shown, but there may be more) are walking ahead of litter on trail. Litter Captain calls "Ready to Rotate!"



2: One pair of relief bearers move off to either side of the trail. Litter passes between them.



3. Relief bearers grab the tail end of the litter and left rear bearer calls "Rotate!" All litter bearers shift forward on the litter. The litter does not stop.



4. The other litter bearers similarly shift forward. The front two litter bearers peel off the litter, cross over, and move to the front of the line of relief bearers.

Historical note: these and other sketch diagrams found throughout this essay were drawn by the ASRC's Yorke Brown in 1976, as the ASRC was developing its SAR doctrines.

Rotating with More Than Six

It's a *lot* nicer carry-out if you have even a few extra team members to allow people to rotate off the litter.*

Should the relief bearers be *behind* the litter or *ahead* of the litter? For many reasons, the answer is *ahead of the litter*. It's also worth noting that National Cave Rescue Commission doctrine is to have litter bearers ahead of the litter.

The principles are the same, but there are a few differences. Let's assume we have six litter bearers on the litter and a bunch of spare litter bearers out ahead of the litter along the trail, one of whom is you. And let's assume further that you are paired up with someone who's (very roughly) about your height. And you two are at the end of that column, tromping along right in front of the litter. "Right in front" in this context means within easy hailing distance: both visible and within easy earshot. It also depends on how tired the litter team is, how heavy the patient is, and whether you're doing this for real or for training in litter bearer rotation. And how noisy it is: in heavy rain or lots of crunchy fall leaves underfoot, you'll need to stay closer. If for practice, or a heavy patient or the litter bearers are tired, the next litter bearers are usually about 30 feet (10 m) in front of the litter: about 5 litter lengths. If you've got a light patient and the litter team is doing OK, it would be reasonable to range up to 60-90 feet (20-30 m), about 10-15 litter lengths, in front of the litter.

We'll assume that you and your partner relief bearer are the next to rotate onto the litter: just a bit ahead of the litter. Here's what you do.

When you and your partner hear that strained "**READY TO ROTATE!**" from behind, you both step off the trail on either side. If you're on a rugged trail or terrain, it may take a few paces forward or back to find a safe and stable place for both of you to step off the trail or litter route. That's OK. You set your feet so you're stable.

Then, as the litter passes, you both grab hold of the tail end of the litter, you on the left and your partner on the right, and quickly move out into the trail.

The litter doesn't stop. It keeps moving.

Once you and your partner have hold of the litter, you – since you're on the left like the litter Captain (some call this the **BACK SEAT DRIVER** position) – can call out "**ROTATE!**" And, you both tap-tap or tap-tap-tap the shoulder (or arm or hand) of the litter bearer in front of you on the litter. This tells the litter bearer

in front of you to shift forward one position. More and more people are just using tap-tap or tap-tap-tap instead of calling "**ROTATE!**": it seems to have mostly withered on the vine. We're OK with that, these things evolve. Those that are doing litter races at SAR Olympics (yes, that's a thing) tend to use the call "**ROTATE!**" as it speeds things up. Slightly: everyone is moving forwards at the same time instead of waiting for the tap-tap-tap, but the front litter bearers on a racing litter usually don't come off until they hear that "**ROTATE!**"

The litter doesn't stop. It keeps moving.

If you've been at the back of the litter and you hear "**ROTATE!**" and/or feel a tap-tap or tap-tap-tap on your hand, arm or shoulder, you shift forwards to the middle position. Since the foot end of the litter is the lightest part, fairness requires that you move forward fairly far, so you're not right at the tail of the litter, and take your fair share of the load.

As you do this, you use your free hand to tap-tap or tap-tap-tap the shoulder (or arm or hand) of the litter bearer in front of you, who then moves forward.

The litter doesn't stop. It keeps moving.

The front two litter bearers come off the litter and walk briskly ahead on the trail, crossing sides. This way you get to lengthen *your other arm* next time you rotate back onto the litter. (If one of you has a bum shoulder or an injury to an arm, you might not want to switch. That's OK.)

The litter doesn't stop. It keeps moving.

There often is a long line of potential litter bearers ahead of the litter, and the litter bearers who just peeled off the litter are supposed to head to the front of the line. (The closer you get to the roadhead, the longer the line tends to get.)

You might think that asking the people who were just on the litter and likely exhausted to basically do a quick-march to the front of the line is a bit much. But, whoever is at the head of the line is *last* to rotate back onto the litter, which provides motivation to quickly move to the head of the line.

If you have a bunch of litter bearers who don't know anything about this system (very common), and you've got anything other than a quite short carry-out, it's worth doing a one-minute explanation before setting out with the litter. This will likely save time in the long run.

It's not uncommon, during a nontechnical evacuation, to run across some hikers or cavers who offer to help carry the litter for a bit. There is nothing wrong with letting them, from the back, watch the litter team rotation, or if at the front of the line of relief bearers, get a minute or two of just-in-time verbal training, and then help out a bit.

* For one night vertical rescue off the west face of Old Rag Mountain in Shenandoah National Park, in freezing rain, after a multi-day search, the trail was right at the bottom of the face. We had a quarter-mile line of litter bearers along the trail to pass the litter for a litter pass. This was probably some kind of record.

Now, what if you are the **LITTER CAPTAIN** and you run into an object that you can't carry the litter across in normal fashion?

You can call out, not "**READY TO ROTATE!**" but "**READY TO LADDER!**" which is similar to rotating litter bearers, and which we explain in the next section, on:

LADDERING FIELD III

Carrying a litter down a nice, wide flat trail is all well and good. For the five feet of it you will do over your entire SAR career.

Often there are obstacles, narrow trails, trails that go straight up or down, or no trails at all. And there are time-tested techniques for dealing with these problems. And you need to learn these techniques. Or you will flail, waste time, and get litter bearers hurt. Not to mention looking very non-heroic.

This is not rocket science. Once you understand the rationale, and practice it a few times, you'll have it down.

Let's say it's right after an ice storm, and you and your litter team are tooling right along, when you come to a four-foot diameter downed tree across the trail, with no reasonable way around it on either side, at least for the litter and full litter team. Everything grinds to a halt.

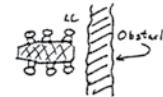
No, it doesn't. Because you already know how to rotate litter bearers, and you have a couple of litter bearers who've gone on ahead, clambering over that downed tree, and are on the other side of the log, eagerly awaiting their turn to lengthen their arms by carrying the litter.

This is sort of like a brief interruption in litter bearer rotation. You stop, and then plant your feet solidly. You think to yourself "At this point, I am going to move the litter. I am not going to move my feet. **I am not going to move my feet.**" If you're new to this, maybe you should say it out loud. And this relates to why we call this laddering: we only move the litter ahead each time a certain amount. And that amount is about the length of one ladder rung. So, "laddering" means "moving the litter across the obstacle, one ladder-rung's length at a time." That's also about the length between litter bearers on the litter, so this makes a lot of sense. So, calling it "laddering" is a way to try to counteract the overwhelming desires to (a) slide the litter forwards as fast and as hard as you can (so that the two front litter bearers now have to hold *all* the weight) and (b) to move your feet forwards as you ladder, thence falling and taking the litter and entire team with you. Teach it as "the litter moves only one ladder-step at a time."

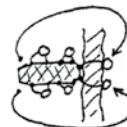
Once everyone has their feet planted well, you shift the litter forwards as far as you can without anyone

letting go of it. If you can, you set the head down on the downed tree. Once you've got the litter where you want it, the **LITTER CAPTAIN** calls "**READY TO LADDER!**"

Then, the back two litter bearers peel off, and work their way around to just above the head of the litter, and



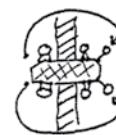
LITTER CAPTAIN: "STOP! READY TO LADDER!" Middle bearers reach back, accept rear load; they do *not* step back.



Two rear bearers peel off, go to front. New **LITTER CAPTAIN:** "LADDER!" Team passes basket forward.



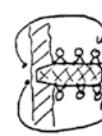
LITTER CAPTAIN: "READY TO LADDER!" Middle bearers reach back to accept the rear load. They do *not* step back.



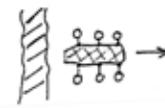
Two rear bearers peel off, go to front. New **LITTER CAPTAIN:** "LADDER!" Team passes basket forward.



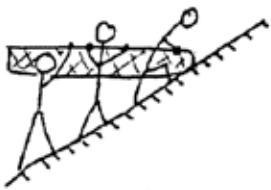
LITTER CAPTAIN: "READY TO LADDER!" Middle bearers reach back to accept the rear load. They do *not* step back.



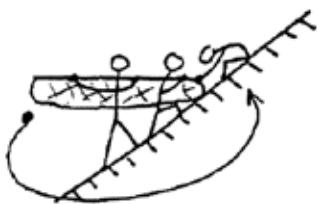
Two rear bearers peel off, go to front. New **LITTER CAPTAIN:** "LADDER!" Team passes basket forward.



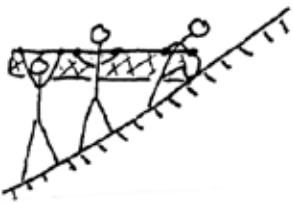
LITTER CAPTAIN: "FORWARDS!" The litter is again under way. This may be done with more than 6, as with rotation.



Toenailing 1: LITTER CAPTAIN: "READY TO LADDER!" Peel off and head to top.



Toenailing 2: New LITTER CAPTAIN: "LADDER!" Pass the litter up. Don't jerk!



Toenailing 3: Process is repeated as many times as necessary.

find secure footing, and then bend down and each grab the top of the litter with one hand.

The new litter bearer to the front left of the litter will receive the litter and become the new **LITTER CAPTAIN**. He or she grabs hold of the litter, and then does a quick visual check of the litter bearer across from him or her. As long as that other litter bearer looks ready, the new **LITTER CAPTAIN** calls "**LADDER!**"

Then, without anyone moving their feet – again, **without anyone moving their feet** – the litter bearers shift the litter forwards a couple of feet. The back litter bearers peel off, and just like rotating litter bearers, they hop over the log, and head around to the front of the line, ready to take the litter when it's their turn.

You repeat this simple process over and over until you're past the obstacle. For a single downed tree, this only has to be repeated three times. But, if you've got a bunch of downed trees right together, you may do it quite a few more times.

If you had some relief bearers on the trail ahead of you, you're lucky, and there will be two bearers on the

other side of the tree, eagerly awaiting their turn on the litter. In which case things move even faster, using the same calls and procedure. There is a bit of a scramble to get the litter bearer peeling off the back of the litter over the tree and around to the front, and depending on how many litter bearers are on the other side of the tree the entire old litter team may end up heading out to the front of the line of relief bearers. But it's usually not a major problem.

You can use laddering for any obstacle, including rocks or crevices, and you can use it to get up or down short, steep slopes, in which case we call it...

TOENAILING

FIELD III

The term toenailing is derived from carpentry.

Toenailing, also known as skew-nailing, is when you are nailing an upright 2x4 end on to a 2x4 flat on the floor. Carpenters do this all the time, over and over, to create studs for a house wall. You drive the nail in at an angle, through the end of the upright into the 2x4 on the floor.

When you have to go up a short, steep slope, you can ladder up the slope. Except that you hammer the head of the litter into the ground – well, no, you actually *gently* place the head of the litter up against the slope, then the the **LITTER CAPTAIN** calls "**READY TO LADDER!**" and the back two peel off and work around to the front and if you're the new **LITTER CAPTAIN** you call "**LADDER!**" once your partner is ready. And then everyone lifts the litter a bit – it takes a bit of practice not to lift it too much – and the slides it forwards, and toenails it into the slope again.

OK, this is when you really neLed to say it: "**I am not going to move my feet.**" Because if you move your feet while toenailing, then you can lose your balance and fall, dragging the litter and the whole litter team down with you. Well, maybe not, but it seems to happen enough when people try to move their feet that thou shalt recite: "**I am not going to move my feet. I am not going to move my feet.**"

When you're laddering across an obstacle, at least on the far side, you can start getting sloppy and moving your feet, and nothing bad will happen. Usually. But if you develop this bad habit, the next thing you know, you're toenailing on a slope, and then you move your feet and kablooey, down you all go.

Say it: "**I am not going to move my feet. I am not going to move my feet.**"

Further Reading

There is textbook in preparation called *Appalachian Search and Rescue* (AppSAR for short), which reflects much of the wisdom generated by ASRC members over the past 50+ years. As of the 2025 update to this

document, it's about 3/4 done in draft form, and is usable as-is. It is available at: <http://www.conovers.org/ftp/AppSAR-Drafts/Individual-Chapters>.

Change History

Old versions are posted in the ASRC Archive at <http://archive.asrc.net>.

???? (VERSION 1.2)

- New Table of Contents style
- Educational Objectives
 - Changed ICS 100 from B to C in accordance with the latest version.
- Safety, Health & First Aid: Hazards & Risks
 - Added call "Rock!"
 - Added dangers from trains.
 - Updated section on bee sting anaphylaxis to make it both more readable and more up-to-date.
 - Updated information on insect repellents.
 - Deleted old picture of poison ivy, added pictures of poison ivy alternate leaves and boxelder opposite leaves.
 - Added picture of jewelweed.
 - Updated recommendations for poison ivy rash treatment.
 - Added material to reflect fall 2019 Board of Directors mandated move of recognition of immediate stress reactions from Field II to Field IV.
 - Added leaf bag recommendation.
 - Eliminated recommendations for Benadryl and added cautions.
 - Recommended CalTopo/SARTopo app, with cautions about inaccuracy of cellphone "compass."
- Safety, Health & First Aid: Personal Equipment
 - Added recommendation to have spare cellphone charger and DC car charger as well as portable power pack charger.
 - Eliminated references to Dri-Release as they quit making it (the name now is no longer the wicking, warm-when-wet cotton treated with PTFE but just another brand of polyester)
 - Minor changes to section on waterproof-breathable raingear.
 - Added information on Patagonia PlumaFill artificial down and expanded discussion of "waterproof" down
 - Expanded discussion of duvet and introduced

equivalent term belay jacket.

- Updated recommendations for helmets and headlamps.
- Expanded the discussion of aftermarket insoles
- Added a paragraph about gear and supplies to bring in case a search turns into a multi-day operation.
- Added the TACO method of cooling for heatstroke.
- Land Navigation
 - Replaced map illustration with one with more gridlines.
 - Eliminated references to the USNG app which is no longer available and recommend CalTopo/ SARTopo.
 - Added sidebar on number of coordinates
- Operations, Management and Leadership
 - Minor change to section on freelancing/ self-deploying.
 - Updated the litter handling section by simply copying and pasting from the latest draft of *Appalachian Search and Rescue* Chapter 13, including the diagram of a litter team showing the litter captain and speaker. However, left out paving and lap pass sections; also removed them from the educational objectives because they really didn't need to be there.
- Rescue
 - Updated section on using load straps, with a picture; corrected length of load strap

JANUARY 2019 (VERSION 1.1)

- Fixed problem where one page was covered up by the topographic map.
- Minor edit to indicate how leather gloves are handy in the summer to deal with thorns
- Mentions of Darn Tough socks and Outdoor Research Crocodile gaiters.

DECEMBER 2018 (VERSION 1.0)