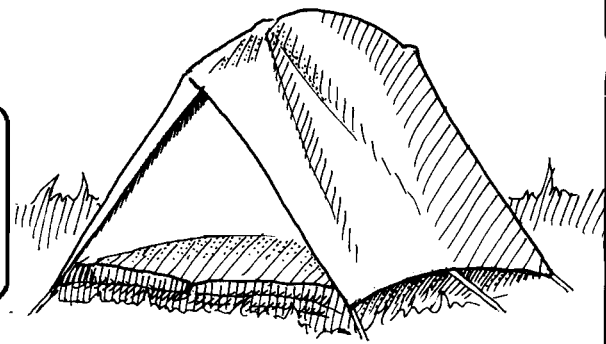
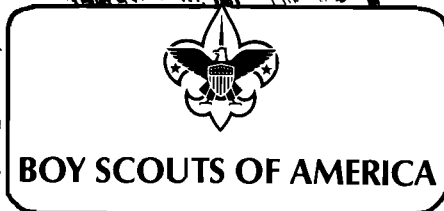
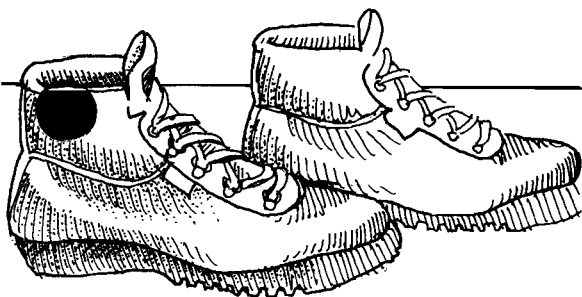
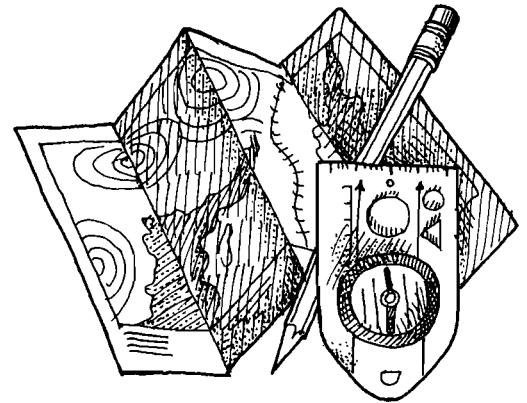
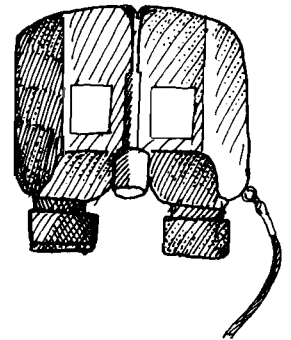
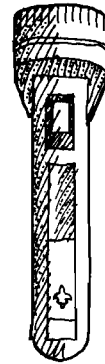
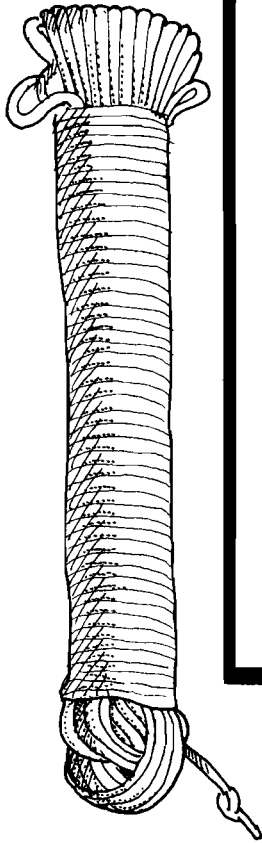
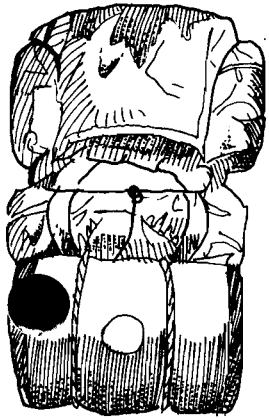


OUTDOOR SKILLS INSTRUCTION

BACKPACKING



OUTDOOR SKILLS INSTRUCTION
BACKPACKING

Introduction

This seminar is designed to assist leaders in planning quality backpacking experiences for their units. Both basic and advanced techniques are presented. Before conducting the seminar, it would be advisable to recruit someone with expertise in this area. There are many resources available, including the *Backpacking* merit badge pamphlet, No. 3323; the *Fieldbook*, No. 3200; *Orienteering* merit badge pamphlet, No. 3385; *Backpacking* Venture pamphlet, No. 3442; *Orienteering* Venture pamphlet, No. 3441; and *Backpacking Magazine*.

Note to the user of this manual:

This manual is one in a series of skills manuals. Each manual may be used separately, or sessions may be mixed. Each manual covers a broad spectrum of topics. You will note that there are no time schedules listed. The training should be conducted according to the ability of the participants to complete the topics. These sessions may be conducted by any qualified Scouter. You are encouraged to recruit experts to assist in instructing. Use the outlines as guides to create a hands-on learning experience.

Outdoor Skills Instruction Manuals

Aquatics, No. 33026
Backpacking, No. 33035
Camping, No. 33003
Cooking, No. 33567
Rappelling/Rock Climbing, No. 33027
Survival, No. 33029
Team Building, No. 33004

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SESSION 1

PREPARING TO HIKE

Learning Objectives

As a result of this session, participants should be able to:

- Hike properly
 - Set a reasonable pace
 - Get into hiking condition
 - Recognize the ten essentials of backpacking
-

Setting the Pace

How fast is too fast? Too slow? Just right? Some experts have often stated that two miles an hour is the proper rate for some circumstances and three to four miles per hour for others. They also state that a thousand-foot elevation gain per hour is quite acceptable. *Walking is done at the pace that best suits you and your crew.* How fast you *can* go and how fast you *want* to go are two different things. You shouldn't be out to set records, but to enjoy the scenery.

In setting the pace you must understand many things about your crew. What is the physical condition of all the members of the crew, and what are the physical characteristics of each person? Does someone have shorter legs, which may cause them to have to work a little harder than a person with long legs?

Legs, lungs, and heart are the best judges of pace. When your legs get that "heavy" feeling, slow down. Comfort is important so that a tolerable pace can be sustained. Going top speed until completely breathless and then collapsing is for inexperienced hikers.

Walk the first section of trail at a deliberate loiter; your body, if it has just gotten out of bed or a car, will react more favorably than if it is put into high gear. Give time for your muscles to loosen and your body fluids to start flowing freely and easily.

How Long Do I Walk?

The beginning hikers must also find out how far they can walk. You must consider not only the mileage but also the gain in elevation. For example, walking five miles with a rise of five thousand feet demands more energy than walking fifteen miles on flat land.

Each crew member must learn his or her own potential. Once this is done, you can plan future trips. How many hours can you travel a day, regardless of pace? Again, that depends on your condition and the terrain to be walked.

Hiking Uphill

The best way to handle an incline is slowly, constantly adjusting your pace to maintain uniform, comfortable energy output, by observing the signals from your legs, lungs, and heart. For very steep grades, especially when you are tired, the rest step will help make the climb.

- The Rest Step:**
1. One foot advances.
 2. Motion halts momentarily while the forward leg rests, unweighted, knee bent, the body entirely supported by the rear leg with knee locked.
 3. The rear foot advances to rest.

Occasionally as low as seven thousand feet, and commonly above nine thousand feet, oxygen shortage may cause "mountain sickness." The symptoms of mountain sickness include lack of appetite, nausea, and debilitation. The immediate remedy is to get more oxygen into the lungs by using the rest step, and at each pause taking a deep breath or two. This is best done by forcible, total exhalation, which results automatically in full and complete inhalation. **Warning:** If a bad headache or cough develops and persists, descend to richer air.

Hiking Downhill

Downhill travel is simpler. However, though some muscles and organs can relax on a steep and rough downhill trail, other parts of the body work even harder.

One alternative is a semi-run, letting gravity have its way; but the jolt of each hard landing may move up the spine and hit your head like a club.

It is on the descent of a trail that many blisters appear. Before starting a sustained drop, tender places (such as the fronts of toes) should be taped, an extra pair of socks added, and the boots laced double-tight. When the first sensation of hot spots on the soles or toes appears, you should stop and make needed corrections.

Rest Stops

Hiking is two separate actions—moving and not moving. Rest stops do not advance you toward your destination, but they are key parts of your hike.

You should rest when it is necessary. The larger the group, more rest stops will be needed.

Many things will affect the number of rest stops and their duration. These include weather conditions, age and physical condition of hikers, and trail conditions.

Getting into Shape

The best conditioning for hiking is hiking, and the ideal schedule is hiking every week. You should start with short hikes on easy paths, gradually increasing the length and difficulty. You can also get into shape by swimming, bicycling, canoeing, playing handball or tennis, and exercising. These activities expand your lungs and toughen your muscles. The bottom line is that walking is the best possible exercise to get you ready for backpacking.

Water, Food, and Salts

Water is as essential to life as air. At rest, an adult may require two quarts of water a day, and even more when working hard. In hot or dry climates, you may need four quarts a day.

Drink water frequently, but in moderation. Gulping too much cold water can shock the stomach; also, you may need extended rest after dumping pounds of liquid into your body.

On long, hard hikes, you may want to eat lunch over a long period of time to provide a steady flow of energy. Even though you may not want to, you should take a bite of candy or a drink of fruit juice when your energy begins to drop.

While hiking you will lose water through perspiration. You will also lose sodium chloride and other salts that are essential to your inner chemistry. Nibbling and drinking fluids constantly are not enough to replenish the salts. Drinking sports drinks that contain essential salts can restore those items.

Ten Backpacking Essentials

Back in the 1930s, when mountaineers began presenting an annual climbing course, individual participants could not carry all the equipment they needed for climbing. Each person carried different pieces of essential equipment. When they were separated, people would be missing flashlights, maps, etc. Depending on the circumstances, you may not need for each person to have all these items, but if you are separated from the group, you might need one of these items to survive. The following is a list of the ten essentials for packbacking. (List these items on a flip chart.)

1. **Extra clothing.** To be prepared for weather changes, include rain gear, and warm clothing for cool weather and protection from the elements.
2. **Extra food.** High-energy munchies should be carried on all day trips and longer hikes.
3. **Sunglasses.** Sunglasses may not be necessary in forested areas, but they are important in areas where the sun is strong. These glasses should filter out 65 percent of the available light. Glass lenses are recommended because they filter out infrared rays; some plastic lenses are virtually useless, and even the best, made of CR-39, don't filter infrared rays.

Except in fog, where yellow lenses improve contrast and help you distinguish holes from bumps, green or gray-green lenses are best because they don't alter the color balance of visible light. If you wear prescription glasses, be careful to buy sunglasses that fit comfortably over your regular lenses. Clip-on sun shades need to be dark enough or have side shields.

4. **Knife.** All hikers should carry a knife. Uses include eating, opening a can, first aid, and whittling kindling for fires.

No backpaker needs a "hunting knife." The backpaker also has no business hauling an ax or hatchet; they are heavy and unnecessary.

5. **Fire starter.** Even where a wood fire is obsolete or prohibited, it continues to have a role in emergencies. To be able to start a fire when one is urgently needed, as in a rainstorm or when you are lost, could save your life.
6. **Matches.** Matches will be needed to start the fire. In addition to those carried for routine purposes, each person should have an emergency supply, either waterproofed or in a waterproof container. Windproof matches can be lifesavers in foul weather—so can a butane lighter.
7. **First aid kit.** Ideally, every hiker hiking more than a few miles and hours from civilization should have first aid training and a complete first aid kit.

At the very least, you must be equipped to handle common ailments on the trail. The following list is a minimum, one-person first aid kit.

- Small paper or plastic bandages (several, for minor cuts)
- Gauze pads (3" and 4" square, for deep wounds)
- Adhesive tape (1" roll, for holding larger bandages in place)
- Aspirin (for relieving pain and reducing fever)
- Needle (for opening blisters, removing splinters)
- First aid manual (a booklet discussing diagnosis and treatment)
- Moleskin (for blisters)
- Single-edge razor blade (for cutting tape)
- Gauze bandage (2" roll, for large cuts)
- Butterfly bandages (for closing cuts)
- Triangular bandage (for large wounds)
- Large compress bandage (to hold dressings)
- Water purifier (for drinking water)
- Antacid (for settling upset stomachs)
- Wire splint (for sprains and minor fractures)
- Elastic bandage (3", for sprains)
- First aid cream (for sunburn, itches, scrapes)
- Antihistamine (for allergic reactions)
- Antidiarrhetic pills (for diarrhea)
- Laxatives (for constipation)
- Snakebite kit

8. **Flashlight.** The flashlight is primarily used to permit continued travel after dusk. One flashlight in the party is not enough. To select the right light, you need to think about several matters. You want enough useful light for your varied purposes, whether walking trails or reading in the sleeping bag. Seek a light that has the least weight and cost.

A camp light with a battery yield of 1.8 volts is about the lowest level that will provide enough light to follow a trail.

When considering batteries and lamps, consider the cost as well as the weight of the extra batteries you must carry on the trek.

9. **Map.** The kind of map to carry and where to obtain your maps will vary depending where you are going. We will be doing some map and compass work in a later session.
10. **Compass.** The natural partner to the map is the compass. You need a compass that has a clear base with grid lines that can be aligned with a map reference line for orientation.

| Burning Times of Alkaline Batteries | | | | | |
|--|-------------|--|------------------|--------------------|------------------|
| | | Continuous Burning Time (Hours) | | | |
| | | 70 Degrees F | | 0 Degrees F | |
| Pair of Batteries | Bulb | 1.8 Volts | 1.0 Volts | 1.8 Volts | 1.0 Volts |
| AA | PR 4 | 2.88 | 4.37 | .33 | .73 |
| C | PR 4 | 9.67 | 15.00 | .25 | 2.43 |
| D | PR 2 | 11.80 | 19.47 | .75 | 4.77 |
| D | PR 4 | 30.33 | 35.92 | 3.75 | 11.23 |

Other Essentials

Whistle. For rescue, the sound of a whistle carries better than yells.

Sunscreen. Sunburn can ruin a hike. Look for sunblock with an SPF (sun protection factor) that fits your needs. Lip balm or lip gloss will help protect your lips from chapping and getting red and raw.

Insect repellent. There are lots of products on the market today. You need to select one that fits your needs and body chemistry.

Repair kit. Accidents happen, and our motto is "Be Prepared." Even experienced backpackers have accidents. Some items you may wish to carry in a repair kit might be:

- Cloth tape (for repairing tarps)
- Ripstop tape (for mending parkas, bags, and tents)

- Thread (a spool of heavy cotton-covered polyester for mending clothing and sewing on buttons)
- Needles (several sizes)
- Awl and coarse thread (for sewing pack bags, tent floors, and other tough fabrics)
- Safety pins (several large ones and lots of little ones for such emergencies as a zipper that breaks)
- Clevis pins and wires (for pack frame problems)
- Nylon cord ($\frac{1}{8}$ " or so for lashing together broken packs and damaged boots)
- Light steel wire (for field reconstruction of damaged pack frames)
- Nails and screws (a small assortment)
- Pliers (for manipulating materials)

Toilet Kit. The following simple toilet kit is environmentally safe if used in moderation:

- Toothbrush and toothpaste in carrying case
- Biodegradable soap (can double for dishwashing)
- Small cloth towel
- Polished steel mirror
- Comb
- Handkerchief

All of these items are important to your successful trek and should be considered in your planning process.

SESSION 2

BACKPACKING EQUIPMENT

Learning Objectives

As a result of this session participants should know how to:

- Select a backpack
- Pack properly
- Select hiking boots

Materials Needed

Backpacking Venture pamphlet, No. 3442

Sample packs

Sample boots

Items for participants to pack

Trainer's note: This is a hands-on practice session. Participants who have them should bring their own packs, but have a variety of packs on display. Give a packing demonstration and then have each participant pack his or her own pack. Demonstrate boots in the same way. Many outdoor equipment stores have sample boots that are cut away so that you can see the structure. These could be of help in this presentation.

Start the presentation by having the group show their packs and frames, explaining why they selected them and how they use them.

Choosing a Backpack

There are many packs on the market today. Much like purchasing a computer, you must first determine your personal needs and then purchase a pack that meets those needs.

There are basically two types of framed packs used today: the **external frame** and the **internal frame**.

External Frame Backpacks

(Note: Have several frames on display and point out the different parts as you talk.) The dominant external frame is the aluminum S-ladder. The usual frame material is high-strength aluminum alloy tubes, either aircraft quality or furniture grade. Some frames are quite rigid; others have thinner tubing with thicker walls, and are strong yet flex with the body.

While the "S" ladder is the external frame most often selected, there have been challenges to its supremacy.

The other common frame patterns are the "H," or ladder, in which the outside members are separate; and the upright, or inverted "U," which is formed from a single tube.

The most frequently used method of joining the metal members is welding. Brazed frames are inexpensive and quite sturdy if they are carefully made. **Care in construction matters more than the parts or the method; welds can break and couplings can slip.** Remember: the more parts to the frame, the greater the cost.

Some frames are adjustable, either by using couplings that let the cross-bars be moved or by telescoping the outside members. Frame length and pack bag position can be varied to suit bodies of different builds. Frames that are non-adjustable ordinarily are offered in two to four sizes.

Hip Belt

The key component of the external-frame pack is the hip belt. It was designed to help support the load. In the past, packs were suspended from the shoulders. When the shoulders sagged, the hiker would lean forward to bear the weight on his back. In many cases, hikers would attempt to grab the edges of the pack and try to carry it off the shoulders until their arms tired.

The advantage of a hip belt varies from model to model, and with different adjustments of belt and shoulder straps. The load is carried high, in a vertical line parallel to the body axis. The weight is transmitted through the frame to the hip belt, and from there to the strong muscles of the hip area and legs.

With this hip-carry system, the strain on the shoulders and back is lessened, and the hiker walks upright rather than in a crouch.

A quick-release buckle is convenient at rest stops. It also serves as a safety device; the belt must be completely unbuckled before crossing streams. Lacking a quick release, a hiker could suffer a serious fall.

Shoulder Straps

Even with a hip belt, your shoulders haven't been relieved of the full duty of carrying weight. They still carry 25 to 50 percent of the weight. On portions of the body bearing weight, a two- to three-inch-wide padded shoulder strap should be used. The sternum strap on some external frame models adds stability, as well as lateral web straps for adjustments to contours.

The Bag

Although still used, cotton or cotton-canvas bags are rarely seen today in backpacking. The most common bag fabric is nylon, which is lighter and limper and can be coated for water repellency. Cordura is more abrasion-resistant, but becomes stiff when coated. Ripstop nylon is very light and strong and is used in ultralight packs.

Whether packs are treated or not, with continued exposure, moisture will eventually get inside a pack. Rain covers are important and can be found to fit all styles and shapes of packs. A pack may have a reinforced bottom, possibly double layered for waterproofness when set down in a puddle.

Over the years, bags have been fastened to frames using several methods. The clevis pin is the most common method used today. The pin is a stud that goes through a grommet in the bag, then through a hole in the frame. It is held in place by a split lock or key wire. As far as size, the best bag to purchase is one that extends two-thirds of the frame length; a sleeping bag and pad can then be carried outside, strapped to the lower third of the frame.

The most popular bag as far as access is concerned is the top-opener. A rain hood or storm flap is usually tied over the top to the lower bag by straps and buckles or cords and toggles; a tent or tarp may be carried under the flap.

Fitting the Frame

When you are buying a pack, you might consider the following procedure. Load about twenty pounds into the bag to prevent it from floating around. Put on the pack. If suspension is from the crossbar, adjust the shoulder straps so the crossbar is level with the top of the shoulders. Fasten the hip belt around the upper, curved part of the hip bone. While doing this, hunch your shoulders; upon straightening, the pack weight should have settled on your hips. The pack is a good fit if, with the hip belt in proper position, the shoulder straps run almost horizontal from the crossbar over the shoulders. If they angle sharply downward, the frame is too short; if sharply upward, too long. Keep looking and trying until you find one that fits physically and meets your hiking needs.

Carry extra clevis pins, locking wires, and nylon cord for emergency lashings. In loading the bag, locate heavy items close to the back and up high. Keep metal objects away from the back; they may rub against the frame and wear holes in the bag. In wet climates, place all gear in waterproof nylon or poly bags to keep water out of dry things and to keep wet items from dampening other things in the bag.

Internal Frame Backpacks

Many features of the external frame are shared by the internal frame. The internal frame is built into the inside the pack, and the stays are bent to custom fit your spine.

The hip belt is shaped like the body—narrower at the top and wider at the bottom. Belts and shoulder straps come in various sizes for a custom fit.

A lumbar pad protects your body from the stays and improves posture, making for a more upright stance.

The bag may either be a single compartment or have several compartments, including a sleeping-bag bottom compartment. It may be panel-opening or top-opening.

In purchasing an internal frame pack, the size must fit; then the stays are bent to meet the needs and shape of your body. You must then learn how to make adjustments after you have broken in the pack.

Sizes and Weights

Packs that have forty to fifty-four hundred cubic inches should handle most of your weekend needs. If you are going to be a serious backpacker, you should consider packs with sixty-five hundred cubic inches or more. The volume does not include the possible addition of detachable pouches that are available for some models.

The weight of the pack and the weight it can carry are in proportion to the bag volume. The thirty-five-pound limit was exceeded a long time ago.

Cost will vary, depending on your needs. As was stated earlier, you need to select the pack and frame that meet your hiking needs and body shape.

Trainer's note: When you do this demonstration, you may wish to have one pack already packed well and one packed badly. Ask the participants to bring a packed pack to the session and have them evaluate what they have brought along.

Packing a Backpack

We see many sad experiences each year in Scouting when we introduce boys to backpacking. Even though they use the correct equipment, and the weather conditions are perfect, the weight of the pack is what gets to them immediately. We talked earlier about getting into condition. Experts say that you should walk two and a half miles an hour while carrying a pack weighing twelve to twenty-five pounds; of course that's on a flat surface, with no obstacles to overcome.

Much has been written about how heavy a load a human can endure. Philmont Scout Ranch has a maximum weight to be carried by any person. A good standard is that a person of average strength can carry about one third of his or her body weight, or 60 pounds for a 180-pound man, 40 pounds for a 120-pound woman. These figures are above the comfort range—the man will be happier with 40 pounds, the woman with 25. Also we must assume that the body is not overweight and that everyone is in perfect physical condition. The body-weight rule does not apply to growing children; however, the average girl at 14 and the boy at 16 have adult weight-carrying capacities.

You must give some thought as to how you are going to stow your gear. As we mentioned earlier, the heavier items should be packed closer to your back, but there is no one system that is better than others. We show different ways of packing in some of our pamphlets.

Obviously, things used in camp, such as food and cooking pots, belong inside the bag, and those required on the trail or for emergencies belong in the outer pockets. Always put the items back in the same place to avoid unzipping every pocket to find an item.

Considered individually, each item may be small and only weigh a few ounces, but assembling them all in the pack makes the weight increase rapidly. When you assemble your gear, evaluate each item as to whether you really need it.

Selecting Boots

Trainer's note: Begin this section with participants talking about their boots and why they selected their particular style.

How do you select the correct boot? There are two major considerations. First, don't buy too much boot. The Army Research Institute of Environmental Medicine has determined that carrying one pound on the feet requires as much energy as carrying six pounds on the back. Second, buy enough boot. Purchase a boot that is going to meet your needs on the trail.

What is enough boot? Two factors rule: the terrain to be walked and the load to be carried. Where will you be walking? What is the terrain like? What about probable weather conditions? How much are you going to be carrying? Your feet need to be protected from bruises and twisting.

Boots, like packs, are selected based on what you feel you need. What we are going to share with you are some construction techniques and materials to look for when you purchase your boots. Hiking boots are constantly changing and being improved. The best thing you can do is go to a store that has a variety of boots for you to try on and evaluate.

All boots are constructed of three parts: the upper, the middle (insole, midsole), and the lower (outsole).

Boot Uppers

Leather has not yet been replaced. No material has been invented that replaces the combination of flexibility, breathability, waterproofness, durability, and comfort of leather.

Leather will vary in thickness. In preparation for boot use, the hide may be sliced in as many as a half dozen layers of different thickness, or "gauge." Thin gauge leather is characteristic of light-duty boots; heavy gauge is used for heavy-duty boots.

Leather made from a layer that includes the outer surface of the hide (grain side) is called top grain. This is the best slice for the boot uppers. It is the toughest and most water-resistant. The inner surface of the hide is called the flesh side.

In a boot upper, when top-grain leather is used with the grain side outside, it is called smooth leather. Experts say this tougher and more water-repellent surface is the proper one with which to confront the wilderness.

A top-grain leather with the flesh side outside is called rough-out leather. Experts say that to preserve its water-repellency, the tough outer layer of hide is best kept from contact with the wilderness. The flesh side, though it scuffs and abrades easily, is never weakened structurally and wears away slowly.

Boots are now also made with cotton canvas uppers and synthetic fabrics used in conjunction with leather. Typically, the panels of the upper are nylon. This is much more abrasion-resistant than canvas, much lighter and cooler than leather, and it can be sewn to leather. The fabric may be coated to make it temporarily water-repellent. The areas of heavy wear, too great for the fabric to withstand, are made of leather, either a top-grain or a suede, depending on the intended use of the boot.

Boot Construction

The upper is usually made from a single piece of leather, thus keeping seams to a minimum. A double-stitched upper has two lines of stitching at every point, thus reducing the chances of all stitches being cut at once. Triple stitching gives much more insurance.

All boots have some sort of lining, reinforcement, and padding. The more there are, the more foot protection, insulation, comfort, weight, sweat, and expense.

Most boots have padding in the ankle area; some are padded elsewhere. The padding material, inserted between the outer soft wall and the liner, may be foam, rubber, or felt.

The 9-inch logger boot has pretty much disappeared in backpacking circles. Most hikers wear 7½-inch or 5½-inch shoes or boots. Many boots have a gap-closing device at the top to prevent water, snow, or pebbles from slipping down inside. Most common is an elastic fabric, perhaps padded, that fits snugly against the leg.

All but the lightest boots have long had a heel counter—a piece of leather or rigid fiber inserted into the heel. Cupping the heel, the counter helps anchor the foot to the boot sole, thus minimizing the vertical motion of heel lift. It also gives additional protection to the heel.

Insole

The function of the upper is to rebuff boulders, resist dirt and water, and keep the ankle from twisting. The role of the sole—insole, midsole, outsole—is to cushion the foot against the thud of hard places, the punctures of sharp things, and the possibility of slipping in slick spots.

The insole immediately touches the foot bottom. In older boots meant for heavy-duty hiking, it was made of soft leather—calfskin with layers of slippery nylon for low-friction foot entry. In lightweight boots or walking shoes, there may be nothing more elaborate than a slice of jute or a sandwich of polyurethane and tight-woven cotton.

Midsole

Lightweight boots are made for soft paths and often lack midsoles. On bumpy ground, each pebble bruises the foot unless the hiker has the agility to avoid the rocks.

The midsoles in most heavy boots are inherited from the logger boot. They are made of leather, rubber, neoprene, or wood, with a filler of cork or foam for cushioning.

Outsole

The leading cause of boot loss is the separation of the outsole and the upper. Despite a research effort, bootmakers still have not come up with a guaranteed method.

With vulcanizing, a pre-formed rubber outsole is bonded by heat and pressure to the upper—not very well or for very long, but very cheaply. Cementing is the next least expensive method. The outsole is cemented directly to the midsole/upper and the upper. As the technique has been refined, it has gained favor for light-duty boots. With injection molding, molten neoprene is applied under pressure; this is somewhat successful. In the inside stitching method, the upper is folded under and sandwiched between insole and midsole, the outside is glued to the lower midsole, and the layers are stitched together in a double row and concealed inside the boot. The better hiking shoes are made this way. Welting is another way to bond outsides to uppers.

SESSION 3

FINDING YOUR WAY

Learning Objectives

As a result of this session, participants should be able to:

- Use a map and compass
- Plan a trek
- Deal with obstacles

Resources

Orienteering merit badge pamphlet, No. 3385

Orienteering Venture pamphlet, No. 3442

Be Expert with Map and Compass: The Orienteering Handbook, by Bjorn Kjellstrom. New York: Macmillan, 1976.

Topographic maps

Compasses

Trainer's note: You may have people in this session who have had considerable map and compass experience. They can assist those who are not as experienced. As an exercise during this session, participants should be paired to plot a trek on the topographic map they are given. You can make it as challenging as you want. Have them figure the number of days it will take and the directions they must go. Create obstacles, including storms, injuries, etc. Also conduct exercises outdoors to test their skills.

Route Finding

Many of you in this session may have been hiking for years, but have been following the person in front of you, rather than plotting a course yourself. Mastery of wilderness navigation takes considerable time and study and is complex.

The basic equipment of route finding is built into the human body. The skilled navigator, using his sight and hearing and other senses, and always watching where he is going and where he has been, maintains sort of a mental gyroscope.

Using a Compass

Some of this may seem basic to you, but a refresher course never hurt anyone. The compass needle always points north. Right? Wrong! The needle has two ends, and one points south; to avoid gross errors, the distinction between the ends must be kept in mind. The north end of the needle always points north. Right? Wrong! It does not point to true north (the North Pole) but to magnetic north (the North Magnetic Pole, located about a thousand miles to the south in the Canadian Arctic). The difference between true north and magnetic north is the *declination*, and unless the declination is known for the area being traveled, the compass merely confuses the situation.

As an example, the current declination in the state of Washington is approximately 22 degrees east (that is, the needle points 22 degrees east of true north), and in the state of Maine approximately 20 degrees west. Some maps give the local declination, but some do not, in which case the information must be obtained elsewhere before the trip. Trail navigation is not so precise that the hiker must worry about declination down to the last several degrees. However, failing to distinguish between east and west, and thus adjusting for declination in the wrong direction, is a good way to see a lot of unexpected country.

Before it is used, a compass must be oriented. Set it on a flat surface or hold it carefully in your hand, making sure no metallic objects are close, since their slight magnetism may distort the reading. When the needle stabilizes, rotate the compass the proper declination—for example, in Washington, until the needle points 22 degrees east (right) of the north symbol on the dial, and for Maine, 20 degrees west (left) of the symbol. The compass is now oriented and the north symbol on the dial indicates true north.

True north can also be found by spotting the North Star on a clear night. True south can be found with a watch: point the hour hand (standard time—not daylight savings) at the sun; true south lies halfway between the hour hand and twelve.

Map Reading

Anyone who paid moderate attention to geography lessons has at least a basic ability to interpret maps, sufficient for the elementary demands of trail travel. Though only field experience makes perfect, mainly a novice needs to know which maps to use and where to get them.

A planimetric map shows lines (roads, trails, rivers, and perhaps ridge crests) and points (camps and peaks) in their horizontal relationship, but without depth. A familiar example is the highway map.

Topographic maps contain all the data of a planimetric map. In addition, these maps portray the vertical shape of the terrain with contour lines. On any given contour line, every point is the same elevation above sea level. With experience a hiker develops stereoscopic vision that allows him to look at a topographic map and clearly distinguish ridges from valleys; however, even a novice can readily learn from the contours such crucial matters as whether a planned camp is at six thousand feet rather than two thousand.

Topographic maps of the United States are produced and sold by the U.S. Geological Survey. For areas west of the Mississippi River, order from U.S. Geological Survey, Federal Center, Denver, CO 80225; for areas east of the Mississippi River, contact the U.S. Geological Survey, Washington, DC 20242. Index maps of the sheets available for individual states are free upon request.

Trainer's note: Now is the time to begin a project based on the maps you are using. Have the group find items on the maps. Go through all parts of the maps.

SESSION 4

CLOTHING, GEAR, AND FOOD

Learning Objectives

As a result of this session the participants should be able to:

- Select the proper clothing for backpacking
 - Select sleeping bags
 - Select cooking gear
 - Select food
-

Clothing

Hiking attire can be varied while on a trek. Layering clothing is probably the best way to prepare for hiking since the number of garments can be varied according to the weather conditions. Layering enables a single basic outfit to fit every situation—an afternoon stroll, all-day hike, overnight or weeklong expedition—in forest or desert or snowfield, in summer or in winter.

A convenient way to describe the layers is to classify clothing in three primary categories, by their principal function.

The **underwear layer** maintains a pleasant microclimate next to the skin; it is always chosen for skin comfort, occasionally for warmth, often to wick moisture from the skin, and sometimes for all three reasons.

The **insulation layer** provides additional warmth when the basic clothing needs help; sweaters, jackets, and parkas are common insulation garments.

Finally, the **shell layer** protects against wind, rain, snow, and sun.

Material

Wool

Wool's tightly curled fibers trap air very efficiently, giving warmth. Wool's main attribute is its ability to continue trapping air and giving warmth even when soaking wet. Fully saturated, having absorbed 30 percent of its own weight in water, wool retains half of its insulation value (the other half is lost to the conductivity of the water).

The faults of wool are that it tears easily, so outer garments take a ripping from brush and rocks; it resists abrasion poorly, so sock heels and

toes and shirt elbows wear through; and it feels scratchy. These faults are eliminated by combining wool with other fibers, such as nylon. This results in a fabric that is tougher and softer than pure wool and that retains wool's quality of not puckering or pilling, as do many chemical fabrics. A final complaint is that many people are allergic to wool and must keep it away from the skin or, in extreme cases, off the body altogether.

Cotton

When dry, cotton cloth insulates well against both heat and cold, and when tightly woven it rebuffs the wind. It drinks liquids greedily, which can be good or bad. Next to the flesh it absorbs sweat, which is appreciated in warm weather. Once wet, though, insulation ceases; should the temperature drop, cotton garments freeze hard as a rock.

Cotton is soft against the skin, non-itchy, and easy to wash, though it is prone to mildewing and rotting if not kept clean and dry during storage. The fiber is readily manufactured into any number of different cloths for shirts, sweaters, and pants. In backpacking garments, cotton is most often used in combination with various synthetics, as discussed below.

Nylon

Nylon is easy to manufacture and treat. Therefore, it is comparatively inexpensive, stronger than cotton at equivalent weight, abrasion-resistant, and durable. It dries quickly and usually wears out for other reasons long before rotting. It is weakened by ultraviolet radiation and stretches when wet, matters of some significance for tents but not clothing. Because the filaments are slippery, cut edges of nylon fabric fray easily. Machine washing often causes the coating to peel from the fabric; hand washing is therefore recommended for coated nylon.

Seams used to be the leaky spots, and a hiker may still find a need to paint nylon seams periodically with a sealant. However, many seams are now microwelded with heat in addition to or instead of sewing, and also are backed with seam-seal tape.

Some of the nylon fabrics common in clothing, sleeping bags, packs, tents, and boots are discussed below.

Ripstop. The distinctive feature of ripstop nylon is that about every quarter inch in both warp (lengthwise strands) and fill (crosswise strands), the threads are doubled, forming reinforcing squares that stop rips from spreading. For comparable weight, this fabric is stronger than others. It is popular for many purposes, such as tents.

Taffeta. This has the same tear-resistance as ripstop and equal (medium) abrasion-resistance. It may weigh a bit more or less. A chief reason it has taken over much of ripstop's former domain is the softness and quietness of the plain-weave taffeta fabric.

Taslan yarn is "air-bulked," spun in a stream of swift air, giving a rough texture that has stylish "surface interest." It is also strong and abrasion-resistant.

Nysilk. Abrasion resistance and tear strength are low, but the cloth is lightweight and tightly woven, made soft and silky by calendaring (pressing between rollers or plates). Nice for sleeping bags and high fashion.

Antron. Medium abrasion resistance, low tear strength. Woven from a “trilobal” yarn that refracts light, giving a cool sheen.

Cambrelle. This light, knitted fabric, inexpensive and durable, is used in boot linings. It’s soft on the foot and wicks perspiration away from the body.

Pack Cloth. Mainly used for packs, of course, pack cloth is also used in some boots and other garments. Small, dense fibers make a smooth fabric that can be successfully coated for waterproof gaiters, overmitts, and packs. The cost is low and many colors are available.

Cordura. Rough-looking cordura is several times more tearproof, burstproof, and abrasion resistant than pack cloth. Cordura is used for packs, boots, and reinforcements on gaiters, mitts, and the seats of britches. The rough texture makes it more difficult to waterproof than pack cloth, but water-repellency can be obtained.

Ballistics cloth. Developed by Du Pont for the military’s bulletproof vests and helmets, this is a high-tenacity nylon, very tough and abrasion-resistant, and has a smooth finish. Current uses are for backpacks and soft-sided luggage.

Magnum cloth. This is similar to ballistics cloth but lighter; it is a nylon in a basket weave with the same smooth finish. It is primarily employed in medium-priced luggage for the mass market.

Polypropylene

The selling point is that it is totally hydrophobic—it absolutely will not absorb water and therefore wicks both visible sweat and vaporous perspiration away from the flesh to the outer garments (or outer air). It does this six times faster than wool, preventing the heat loss that occurs when sweat evaporates next to the skin. Unable to absorb water, it dries rapidly and cannot remain wet and clammy, as does cotton. In summary, though “polypro” is not bragged up as an insulator, it gives warmth by reducing evaporative cooling when the body is overheating in hard work, and by not staying wet to do conductive cooling when the body is resting. Both of these are particularly important considerations in cold weather.

Being light, stretchy, and not itchy, polypro has come to dominate the next-to-skin area, though it hasn’t been quick to expand into outerwear.

The objections are that it pills; except at low temperatures it cannot be machine washed or dried without risk of melting; and unless frequently washed it stinks like an old gymnasium, driving tenters out into the storm. Moreover, because of the inherent difficulties of manufacture, it is high priced.

Mixing polypro with other fibers eliminates some problems, such as the resistance to dying. A two-layer fabric with polypro inside and cotton or wool outside combines the virtues of each and minimizes the faults.

A recent new item is *polypro duck cloth*, resembling canvas, for luggage and rucksacks.

Creating a Vapor Barrier

Human skin likes the relative humidity of the air immediately next to it to be about 70 to 95 percent. Maintaining that level requires, during rest, about one pint of water a day in *insensible perspiration* (gaseous water, invisible vapor). But in cold weather the air cannot be brought to the desired humidity. The body keeps pumping out vapor and still the skin dries; a person isn't sweating, yet mysteriously develops a fierce thirst. If, in addition, hard work is being performed, producing excess heat, the body tries to cool itself by pouring out *sensible perspiration* (liquid water, sweat). If this is "breathed out," heat is conducted away from the body by the water at a terrific rate, twenty times faster than by air. As a further complication, the insulating materials of garments become wet. The extraordinary conditions of hard labor in extreme cold and/or at high altitude are best met by erecting a vapor barrier, as follows:

1. Put on a wicking undergarment, such as polypro underwear. The wick carries moisture to collar, cuffs, and waist for release to the outer atmosphere.
2. Over this, wear a vapor-barrier shirt.
3. Next, put on a sweater, parka, or whatever is being worn for insulation.

Creating a Radiant Heat Barrier

When two surfaces of differing temperatures are opposed, the warmer surface transmits heat to the cooler surface. The day-warmed ground radiates warmth to the night sky; the human body with its calorie-burning furnace radiates warmth to any part of the near environment that is below 98.6 degrees Fahrenheit.

Just as clouds make a warmer night by reflecting the "black light" back to the ground, and a tent or overhanging branches of a tree make for warmer sleep, so a *heat shield*, or *radiant heat barrier*, helps a hiker keep warm. This heat shield is accomplished by using insulating materials; materials that have *loft*.

Insulators

Both of these insulators are discussed in more detail under "Sleeping Bags."

Down. Down is warmer when dry, and thus is better in dry cold or when fully protected by a tent, stuff bag, or rain jacket, with occasional opportunity for airing in the sun. It is softer than polyester, breathes better, and can be stuffed into a smaller bag. The initial cost is higher, but its life is longer, so down is cheaper in the long run.

Polyester. Polyester is nearly as warm as down when dry, loses little warmth when wet, and can be dried by wringing out and wearing. It is nonallergenic and doesn't mildew readily. Polyester is better for hikers who lack rain jackets, sleep under tarps, or travel wetlands where the sun rarely shines.

Layering Clothing

Underwear Layer

In most summer hiking, with the weather ranging from moderate to hot, underwear is chosen solely for comfort—to let air flow freely over the skin, cooling and drying, and to prevent dampness by absorbing perspiration. Whatever feels good in town is fine on the trail. Cotton underwear is the most popular, but any loose, absorbent garment will serve, whether wool, silk, or synthetic.

COMFORT RANGES OF GARMENT LAYERS*

| Garment | Material | Weight (ounces) | Thickness (inches) | Comfort Range (degrees F) |
|--|---------------|-----------------|--------------------|---------------------------|
| Thin polypro top | Polypropylene | 6 | 0.07 | 40 to 70 |
| Thin wool top | Wool | 8 | 0.08 | 40 to 70 |
| Two-layer top | Polypro/wool | 8.5 | 0.09 | 35 to 65 |
| Ragg sweater | Wool | 19 | 0.25 | 35 to 65 |
| Fleece sweater | Polyester | 19 | 0.20 | 30 to 60 |
| Pile jacket | Polyester | 21 | 0.50 | 15 to 50 |
| Polyester-filled parka | Quallofil | 21 | 1.0 | -10 to 30 |
| Gore-Tex parka | Gore-Tex | 22 | 0.95 | 40 to 70 |
| In Combination | | | | |
| Thin polypro top | | | | 40 to 70 |
| Polypro top and Gore-Tex parka | | | | 25 to 55 |
| Polypro top and pile jacket | | | | 10 to 40 |
| Polypro top, polyester-pile jacket, and Gore-Tex parka | | | | -5 to 25 |
| Polypro top and polyester-filled parka | | | | -20 to 25 |
| Polypro top, polyester-pile jacket, and polyester-filled parka | | | | -40 to 10 |
| Polypro top, polyester-pile jacket, polyester-filled parka, and Gore-Tex parka | | | | -50 to -10 |

*Tests were conducted by the REI Quality Control Department, assuming (1) an "average" person, not exceptionally thin or stocky or unduly fatigued and with normal metabolism, (2) a uniform amount of insulation over the entire body, and (3) dry garments (wet insulation is 9 to 50 degrees F less warm).

Clothing Layer

Shirt and pants, hat and socks, perhaps mittens or gloves, are the garments that directly confront the elements in most of a hiker's trail life and are his sole—and only necessary—protection against sunburn and wind chill. This basic layer is expected to provide warmth by insulation, fend off excessive sun rays and breezes, absorb perspiration and transport it to the outer air, and let the limbs swing freely.

PARKA WARMTH

| Parka Type | Insulating Material* | Weight (ounces) | Thickness (inches) | Minimum Comfort Rating (degrees F)† |
|-----------------------|----------------------|-----------------|--------------------|-------------------------------------|
| Expedition down | GD | 52 | 2.75 | -40 |
| Alaskan down | GD | 62 | 2.75 | -40 |
| Gore-Tex and down | GD | 42 | 1.75 | -10 |
| Down | GD | 32 | 0.9 | 0 |
| Down | GD | 34 | 1.5 | 0 |
| Light down and nylon | GD | 19 | 1.5 | 0 |
| Gore-Tex and down | GD | 28 | 1.3 | 5 |
| Light down and poolin | GD | 23 | 1.5 | 5 |
| Thinsulate | GD | 34 | 0.55 | 15 |
| Thinsulate | T | 33 | 0.75 | 15 |
| Thinsulate | T | 40 | 0.62 | 15 |
| Gore-Tex and pile | T | 28 | 0.5 | 20 |
| Pile and Thinsulate | BP | 34 | 0.25 | 20 |
| Pile and Thinsulate | BP/T | 32 | 0.25 | 20 |
| Pile jacket | BP/T | 18 | 0.38 | 25 |
| Gore-Tex and pile | PP | 30 | 0.20 | 25 |
| Pile jacket | BP | 21 | 0.38 | 25 |
| Shell bunting jacket | PP | 24 | 0.20 | 25 |
| Fleece jacket | BP | 19 | 0.19 | 30 |
| Pile jacket | NP | 17 | 0.31 | 30 |
| Bunting jacket | BP | 19 | 0.19 | 30 |

*BP—bunting pile (fleece)
 GD—goose down
 NP—nylon pile
 PP—polyester pile
 T—Thinsulate

†Comfort rating: temperature at which a person engaged in light activity feels comfortable. The rating assumes that the head and lower torso are equally protected. It must be kept in mind that the rating in the field is affected by wind, rain, personal metabolism, level of fatigue, and food intake. These data, obtained in 1983 tests by the REI Quality Control Department, are indicative and suggestive rather than comprehensive and definitive. Materials and designs change from year to year, and vary from manufacturer to manufacturer.

Shirts. Wear a medium-weight wool shirt with full collar and tail below the belt line.

Pants. More miles are walked by people in shorts than all other bottom-wear combined. It's not a garment demanding a lot of thought.

Head and Hands Coverings

The most critical portion of the body for regulation of the thermostat is the head and neck. The head, having little fatty insulation, may account for up to half the body's total heat loss. If the head and neck are cold, the whole body will shiver. It is wisely said, "If your feet are cold, put on a hat."

Similarly, in scorching sun an overheated head can lead to dizzy misery, even heat stroke.

Choose headgear for warmth. The long-standing trail favorite is the simple stocking cap or watch cap, wool with nylon reinforcement.

For sun protection you may wear a handkerchief hat, a bandanna knotted at the corners to fit the head, periodically dipped in streams or rubbed with snow for quick cooling. The bandanna may also be worn to protect the neck, an excruciating place for a sunburn. The Bushman, Aussie bush hat, and panama keep away the sun from the head and ears.

Sleeping Bags

A sleeping bag retains body-generated heat by trapping innumerable tiny pockets of dead air. Not the components of the bag themselves but rather the air (a poor conductor and thus a good insulator) provides a barrier between the hot body and the cold, cold world. The warmth of a bag is determined by its structure, means of closure, the covers and liners that may be added, but mainly by the kind and amount of insulating material.

Insulating Materials

Polyester

Generic polyester is a solid-core fiber—or rather, a number of such fibers of widely varying quality and no consistency at all.

The lowest priced of the polyesters with registered trademarks is Du Pont's **Hollofil 808**, a hollow fiber that traps more air than one with a solid core. The typical use is for inexpensive bags that are not meant to be carried far, if at all.

Hollofil II is the same except for the addition of a silicone agent to make the fibers softer, slicker, and more drapable, and to give better fluffing for warmth and compactibility for stuffing. It is mostly used in backpacking bags for mild climates.

The top of the Du Pont line is **Quallofil**, made of Dacron 113, which has its own registered trademark. The core of the fiber is pierced by not one but four tubular holes, trapping much more air and yielding a down-like feel.

PolarGuard is made by 3M. Unlike the short-crimped Du Pont fibers, some two inches long, it is a continuous filament. Assembled in batts, the filaments are intertwined to prevent the shifting and clumping that would form cold spots. The batts are silicone-treated for softness, loftiness, and compressibility.

Downs

Down, the fluff growing next to the skin of water fowl, traps air more efficiently than any other readily available lightweight substance, yet allows body moisture to breathe out; compacts in a small bundle for carrying, yet is extremely resilient, quickly expanding when released; and withstands thousands of compression-and-expansion cycles before getting too bent and broken to rise to the occasion.

The insulating value of down is determined to be about 60 percent by *fill power*, or *loft*—the ability to spring out to full expansion after being crushed. Both are measurable, but are measured differently by different manufacturers.

Polyester vs. Down

1. Unlike down, which once soaking wet doesn't dry for days, the polyester fiber absorbs less than 1 percent of water by weight. Crawl into a wet bag at night and by morning it will be dry from body heat alone.
2. Unlike down, which clumps up, flattens out, and loses much loft in humid conditions and 80 percent of its loft when saturated, the polyester fiber loses only about 5 percent of its loft even if drenched. Wring out a sopping bag, shake it vigorously, snuggle in, and be warm.
3. No matter how carefully protected from storms, down accumulates moisture from the body and the air, and over a period of a week or less, collapses.
4. Unlike down, which flattens to zero loft under the sleeper, the polyester fiber resists compression and gives a certain amount of bottom insulation.
5. Unlike down, polyester is nonallergenic and can be washed regularly and easily to get rid of dust. It is therefore the only choice for people who sneeze at feathers and dust. Unlike down, it also resists mildew.

The Outer Shell

Backpacker bags have outer shells of nylon—strong, easy-breathing, wind-resistant, and effective at preventing the filler from escaping. Car-camping bags often use cotton, which is cheaper and less vulnerable to campfire sparks, although it is heavier for the same strength.

A human body exhales so much moisture in the breath that even on the coldest nights the sleeper should keep his nose outside the bag to avoid swamping the interior. In extreme cold he may need to protect the nose from freezing by breathing through a “snorkel,” such as a sweater.

Rectangular bags are ordinarily wide open at the top; if the night grows cold, a sleeper can slither down into the bag and wrap a sweater around his head.

Barrel bags, and some modified rectangles, have a drawstring to reduce the size of the top opening, even to nose-size.

The warmest design, and the choice of nearly all backpackers, is the mummy bag, contoured to the body and closed at the top by a drawstring that completely shuts off breezeways, but exposing the sleeper's nose and mouth.

Some bags have another string at the neck, to let the bag be snugged there, leaving the shoulders free. Some designs have a floating hood that turns with the head in the manner of the owl; others have an extra measure of insulation in a filled collar or muff to keep the shoulders cozy.

Zippers

Very light bags dispense with zippers altogether (the more zipper, the more weight and cost) and are donned and doffed like body stockings.

Most bags have a side zipper, either left-opening or right-opening. Choosing one over the other only matters when two bags are to be zipped together, in which case one of each is required.

Mummy bags often have half-length zippers some thirty-six-to-forty-inches long, extending about halfway down from the top; as a general rule, the less zipper, the less chance of a cold spot and thus the warmer the bag.

Other mummies, most rectangulars, and all barrels have a full-length (seventy-inch or so) zipper. Some have a zipper running the full length and across the foot for complete temperature control in warm weather, or full-length zippers on both sides.

The best zippers are nylon, which, unlike metal zippers, don't conduct heat, freeze, or rip the shell when snagged; and of tooth design rather than the cheaper, lighter, riskier coil. The highest-quality bags have oversized or heavy-duty zippers for greater dependability. They also have a zipper stiffener, a webbing that runs the full length of the zipper to prevent snagging.

A two-way (two slide) zipper adds expense but is convenient in letting the bag be opened from either top or bottom. In this way, the feet can be ventilated without chilling the shoulders.

In the best bags, the zipper is covered by a draft tube, wider and longer than the zipper, to prevent heat loss.

Bag Length and Width

Sleeping bags come in three lengths: short, for people up to five feet four inches; regular, to six feet; and long, to six feet six inches.

Though for reasons of warmth, weight, and expense a person should buy the shortest bag into which the body fits comfortably, the inner length of a person's bag should be about four inches longer than his height. When in doubt, better a too-long bag than cramped knees and neck.

Cooking Gear

Cooking may be done on either a wood fire or on a stove.

Gear for Wood Fire

Although cooking with wood fires is prohibited in many campsites and wilderness areas, they are still permitted in some regions. Several pieces of equipment should be carried for cooking with wood.

Matches, of course, are a necessity. Carry a main supply in a poly bag, and an emergency reserve in a waterproof box of foil, plastic, or metal. Regular kitchen matches, if kept dry, strike easily on a dry rock. Waterproof matches won't ignite if the striker on the box is damp. Over long stretches of wet weather all matches get soggy and useless, and a butane lighter is good to have handy.

The easiest way to cook on a wood fire is with a metal grate or grill. It should be less than one-half pound and be narrow enough to slip easily into a pack.

Stoves

Backcountry cookery used to be either on a wood fire or a Primus brand stove. Now, however, in choosing from among the dozens of stoves on the market, the backpacker must ignore the heavy ones intended for car camping, canoe camping, and other trips where weight doesn't matter. Instead, focus on those that weigh two pounds or less. You must then decide which fuel you prefer: white gas, kerosene, butane, or several fuels in a single, versatile stove.

The accompanying table compares the weight, cost, and efficiency of the currently most popular stoves. (Hand out copies from the appendix.)

Eating Tools

Any number of methods will get food from pot to mouth. There are hikers who cannot eat unless all elements of the meal are spread before them at the same time on a plate. You can use the lids of billies and other kettles, plates included in cooking kits, pieces of aluminum foil, or plates of plastic or aluminum.

Many experienced hikers do all their eating from a cup. A traditional favorite is a stainless-steel cup with wire handle. It can serve as a small pot, to heat water for a cup of tea. It weighs about three ounces. The capacity is nine ounces—a good thing for the cook to remember (one cup equals eight ounces).

The pocket knife every hiker must carry also serves ordinary cooking and eating needs. If it lacks an effective can opener, a separate one must be included in your gear.

Food Containers

Backpacking shops stock many kinds of plastic bags, bottles, and jars for hauling foods, including water.

Strong, light, transparent poly bags, in sizes from 5" × 8" to 15" × 18", have many uses. Cheaper and lighter sandwich bags and those in which bread and produce are sold can be doubled for durability. Bags can be closed by rubber bands or, better, paper wrapped wires—several of which should always be in every hiker's pocket to replace the ones that disappear.

Polyethylene bottles in shapes from oval to round, with capacities of two ounces to two quarts (sixty-four ounces), serve as containers for liquid detergent or cooking oils, or as shakers for mixing the morning orange juice, and so on. The larger sizes are the standard canteens nowadays; only a few traditionalists carry the old "canteen-shaped" canteens of aluminum or rigid plastic. Nalgene bottles, of high-strength polyethylene, don't absorb contents as the lighter-weight ones do, but they become brittle at 0 degrees Fahrenheit (compared to -100 degrees Fahrenheit for the others) and must be handled gently in bitter cold. For most purposes, wide-mouth bottles are preferred to the narrow, to dump juice powder and cram snow into. Loop tops cannot be misplaced or lost; a flexible plastic ring keeps bottle and top together. Rectangular bottles fit more snugly in packs.

Poly boxes or jars, square or round, Nalgene or plain poly, with snap-on or screw-on lids, are good for lettuce, grapes, tomatoes, peanut butter, and other crushable or sloppy foods. Poly vials handle pills, spices, and "secret ingredients." Poly squeeze tubes are excellent for jam, honey, peanut butter, margarine, and other oozy foods—except in cold weather, when contents refuse to squeeze. The tubes have a bottom clip to permit refilling and washing.

A plastic two-compartment salt and pepper shaker is convenient. If a larger supply of salt is carried separately, as is customary on long hikes, the other half of the shaker can be filled with garlic salt, lemon pepper, cinnamon, or some other favorite spice. Film cans are also excellent carriers.

Dishwashing Tools

The tools of dishwashing are simple enough. First you need some device to loosen food particles (and charcoal) from utensils, particularly cooking pots. Oldtimers did the job with sand and gravel; much neater is a plastic or metal scouring pad.

Second is some means of cutting grease. Hot water alone serves very well, but a small amount of soap or biodegradable detergent, liquid or solid, speeds the process. It also minimizes consumption of hot water, which may be in short supply when the cooking has been done on a stove for which the fuel has been carried a long, long way.

Note: If aluminum utensils are not thoroughly cleaned and dried, acids will form that dissolve the metal with startling speed. Foods containing salt are highly corrosive, as is chlorinated water; pots must be washed thoroughly after cooking and completely dried.

Selecting Trail Food

The first mistake many hikers make regarding food is to haul too much of it—twice as much as they can eat and four times more than they need. The second mistake is to worry about the proper mix of protein, vitamins, and minerals.

Opening a can is within the capacity of most beginning hikers, given a can opener. Nearly all are able to strip a banana and assemble a jelly sandwich. No higher skills are required to make out well enough on short trips. As miles and days mount, though, cookery becomes slightly less simple—but nowadays never really complicated.

Food for a Day Hike

For an afternoon stroll a chunk of chocolate, an apple, or a packet of nuts may add to the pleasure of a rest stop; food, however, is purely optional.

The only meal during a full-day hike is lunch. Any menu will do—sandwiches, crackers and cheese, smoked salmon, grapes, cookies, carrot sticks, cherry pie—whatever you enjoy. Be sure you carry enough for a possible emergency.

Even in well-watered (and pure-watered) country you should have a canteen supply, either to drink (perhaps mixed in the cup with lemonade powder) or for first-aid purposes.

Do not drop along the trail or toss in the brush candy wrappers, orange peels, or cans. And don't bury them. *Pack it out! Pack it ALL OUT!*

Food for Overnight Hikes

The same rule that applies to day-hike lunches extends to weekend meals. The rule is, there is no rule. At one extreme are meals that are essentially a succession of quick lunches. At the other extreme is wilderness feasting, where backpackers work up an appetite along the trail for lavish meals in camp.

The average weekender meals fall somewhere in the middle. For example, supper may be cherry tomatoes, soup, canned beef stew, bread and butter, stir-and-serve pudding, and instant coffee, tea, or milk. Breakfast may be orange juice, oatmeal “cooked” in the cup by adding hot water, and instant coffee or cocoa. Thousands of other menus have been published.

High-Tech Packaging

In retort packaging the food is placed in a three-layer retort pouch, polyester on the outside, foil in the middle, and polypropylene on the inside—a “flexible tin can.” The air is pumped out, the pouch sealed, the food cooked. All the natural moisture is retained so the food is heavier than dried food, though the overall package is lighter per unit of food than with a metal can.

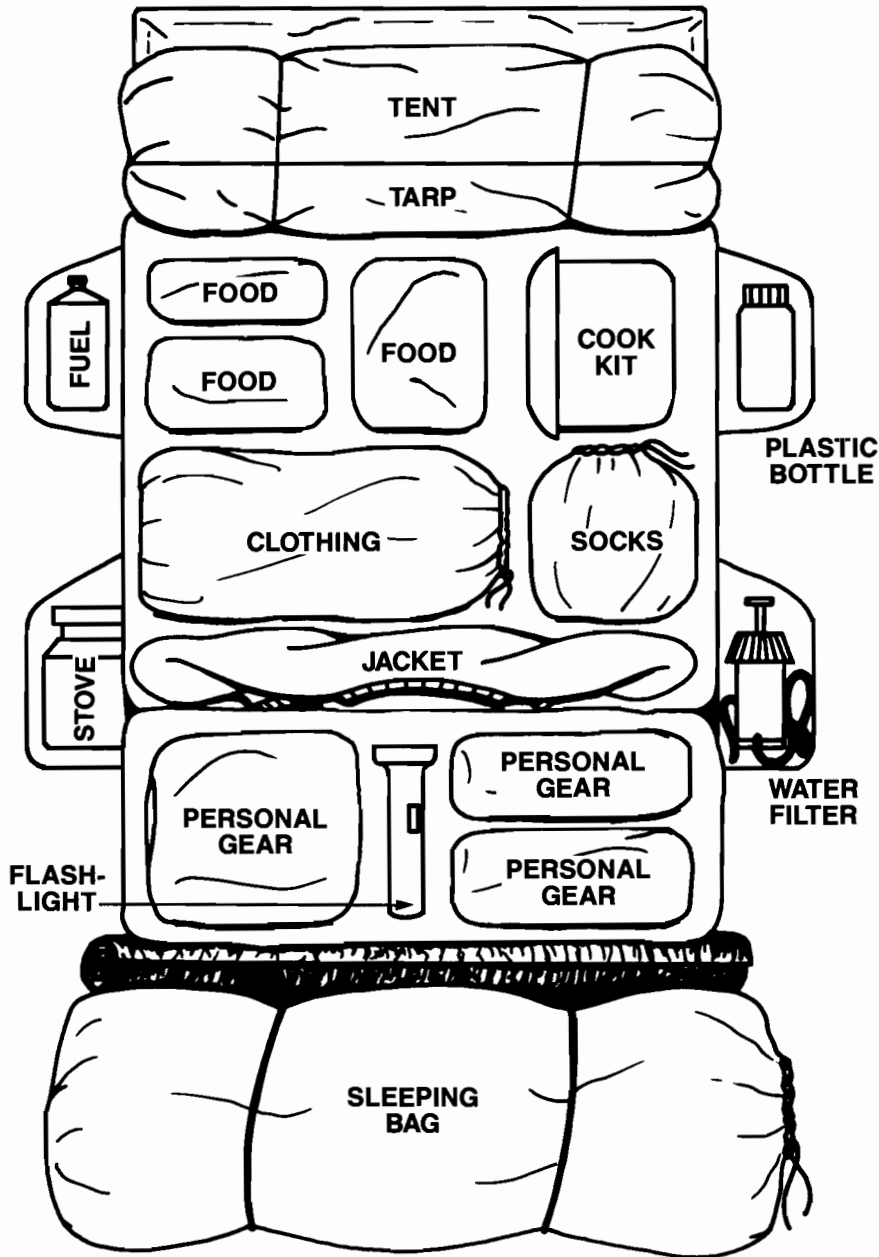
The food easiest to prepare in camp as freeze-dried, but it costs more. Shelf life is one to two years. Meats and such taste better than canned (which are cheaper).

Sterile boxes contain fruit juices that taste fresher than those in cans or reconstituted from powder—because they are fresh. Shelf life is one and a half years. The boxes (fragile—easily damaged in the pack) can be dropped in a creek for cooling.

[The following text is extremely faint and largely illegible. It appears to be a series of paragraphs or a list of items, possibly describing the contents or uses of the sterile boxes mentioned in the bolded text above. Some words like "fruit", "juice", "shelf", and "cooling" are faintly visible.]

APPENDIX A – A WELL-ORGANIZED PACK

This is an example of a well-organized pack. Clothing should include extra socks, polypro T-shirts, and pants. Personal gear should include a book, medical kit, writing pad, waterproofed matches, flashlight, emergency candles, and hygienic items.

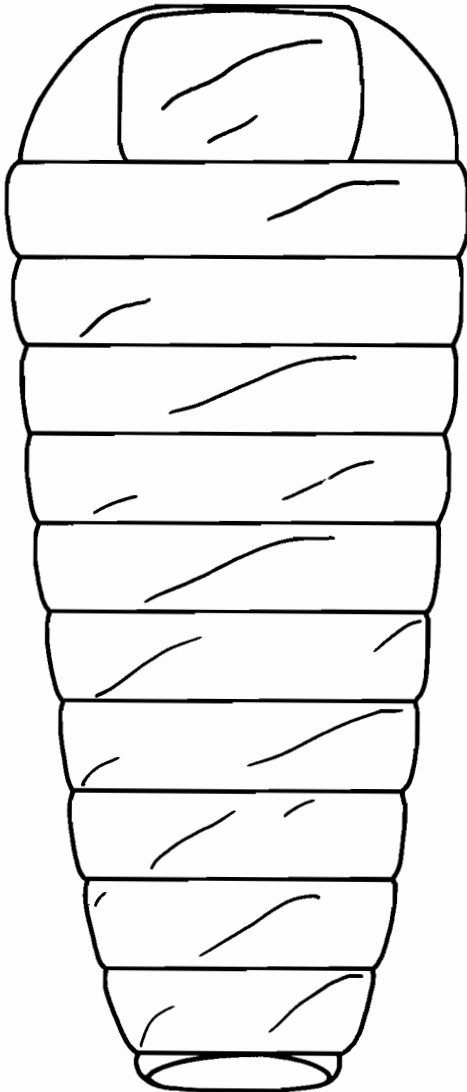


APPENDIX B—SLEEPING BAGS

A. The mummy-style sleeping bag has been noted to have the most efficient shape.

B. Many people prefer the comfort of the modified square-cut bag, particularly in summer.

A



B



APPENDIX C — BACKPACKING STOVES (FUEL PRICES)

| Stove Model | Fuel* | Weight (Ounces) | | Fuel Price Code** |
|---------------------------|-------|-----------------|--------------|-------------------|
| | | | Without Fuel | |
| Optimus 199 Ranger | ABC | | 31.4 | C |
| MSR Whisper Lite | B | | 13.3 | B |
| MSR/X-GK | AB | | 18.8 | D |
| Coleman Peak 1—Multi-fuel | ABC | | 18.6 | C |
| Coleman Peak 1 | B | | 29.2 | B |
| Svea 123R | B | | 18.2 | B |
| Gaz C-206 | E | | 11.6 | A |

***Fuel**

- A = kerosene
- B = white gas
- C = alcohol
- D = gasoline (leaded, no-lead aviation)
- E = butane

****Fuel Price**

- A = \$ 0–\$24
- B = \$25–\$49
- C = \$50–\$74
- D = \$75–\$100

When considering fuel type, pay attention to differences in boiling time per pint of fuel required to boil a quart of water. Remember to carry a carefully waterproofed set of matches or a lighter. Also consider fuel container weight, not included above.

APPENDIX D – BACKPACKING STOVES (OPERATIONS)

| Stove Model | Stove Weight Without Fuel (ounces) | Fuel Capacity (pints) | Burning Time at Maximum Flame (minutes) | Average Boiling Time* (minutes) | Water Boiled per Pint of Fuel (quarts) | Ease of Operation | Cold-Weather Use | Compactness | Stove Stability | Pot Stability |
|--------------------|---------------------------------------|--------------------------|--|------------------------------------|---|-------------------|------------------|-------------|-----------------|---------------|
| White gas | | | | | | | | | | |
| Coleman Peak 1 | 29.2 | 0.69 | 70 | 3.4 | 29.8 | G | G | G | E | G |
| MSR Firefly | 18.2† | † | 106‡ | 2.9 | 28.3 | G | E | G | E | E |
| MSR WhisperLite | 12 | † | | 3.8 | 28.7 | G | E | E | E | E |
| Svea 123R | 18.2 | 0.30 | 29 | 4.1 | 23.6 | G | F§ | E | P | F |
| Optimus 8R | 22.4 | 0.25 | 23 | 4.1 | 22.4 | G | F§ | G | G | P |
| Optimus 324 Rider | 24.4 | 0.35 | 33 | 3.9 | 24.2 | G | G | G | F | G |
| Kerosene | | | | | | | | | | |
| Optimus Camper | 27.6 | 1.04 | 107 | 3.7 | 27.8 | F | E | E | E | E |
| Butane | | | | | | | | | | |
| Gaz C-206 | 11.6 | " | 183 | 8.5 | 21.5" | E | F# | F | F | G |
| Multifuel | | | | | | | | | | |
| MSR X-GK | | | | | | | | | | |
| Kerosene | 18.8 | † | 116‡ | 3.0 | 30.0 | F | E | G | E | F |
| White Gas | 18.4 | | 128‡ | 3.4 | 29.2 | G | E | G | E | F |
| Optimus 199 | | | | | | | | | | |
| Kerosene | 31.4 | 0.25 | 27 | 4.4 | 24.5 | F | G | G | G | G |
| White Gas | 31.4 | 0.25 | 32 | 6.0 | 21.3 | G | F | G | G | G |
| Alcohol | 31.6 | 0.25 | 37 | 13.2 | 11.2 | G | P | G | G | G |

Note: The stoves in the table are currently the most popular among the models available. The tests were conducted by REI Quality Control Department.

E = Excellent; G = Good; F = Fair; P = Poor.

*Water at 70°F in covered pot, in still air at sea level.

†MSR fuel bottle: weight 4 ounces, capacity 1.29 pints; 0.6-liter Sigg Bottle: weight 2.6 ounces, capacity 1 pint; 1-liter Sigg Bottle: weight 3.9 ounces, capacity 1.97 pints.

‡With MSR fuel bottle.

§Stove must be insulated from snow or cold ground unless Optimus Mini-Pump is used.

"6.7-fluid ounce cartridge (empty weight, 3.3 ounces).

#Fuel cartridge must be kept above 30°F.