SHELTER CONSTRUCTION TECHNIQUES FOR MODERATE WEATHER

By Nick Weighton, October 2012; Revised Aug 2014

This article augments the survival chapters in your Student Manual and is the follow-on complement to another website document titled "Survival Guide." All shelters in this article are for moderate weather conditions experienced during April to October in the Colorado Rockies. Some will seem designed for winter but temperatures can drop to freezing in the mountains on a summer night. Winter shelters are discussed in an optional website supplement for those interested in advanced survival procedures. Shelter designs in it are intended for those planning to do cold weather hiking or high altitude climbs where special survival methods are required. The Winter Shelter article is not required reading for WTS.

I. GENERAL COMMENTS APPLICABLE TO SURVIVAL SHELTERS

You can build different types of shelters depending on the equipment you carry, natural resources that might be available and the knowledge and skills of you and your group. This article includes topics on tools, types of resources and uses, special techniques and site considerations. Applicable shelters are discussed for spring to autumn conditions and include sizes, building materials and construction methods for each. Dimensions, procedures and completion times are intended as guidelines. Common sense and good judgment must be applied during construction.

If in a survival situation, keep an open mind about the types of shelters you can build. More than one might be appropriate depending on circumstances. Knowing how to construct different shelters opens up options from which to choose the optimum one. In survival there are no limits in shelter concepts so if you have a good idea and the ability to apply it, go for it. If you are ever in a survival mode, evaluate conditions and all resources then select what you think is the best shelter for your situation. It might be a bivy tent, tarp or natural shelter. It's your decision. Stay flexible and do what is smart and logical.

II. SURVIVAL TOOLS AND SUPPLIES – BASIC ITEMS ARE CUTTING TOOL, CORD, TARP, INSULATED PAD, SHOVEL

Your mind is the most important "tool" you'll have in survival but several other items are very helpful. You are not limited to these five, take what you think is needed to survive.

- Cutting tool (larger than basic pocket knife such as fold up *hand saw, hunting knife or heavy duty cutting chain) – Essential for efficiently building most shelters. Helpful for medical situations too. *Thin piano wire saws are not reliable, they tend to break.
- Cord (1/8" diameter or less) – Mainly for shelter construction including roof supports, anchoring tarps, lashing together logs/other materials and miscellaneous uses. Carry 75-100 feet, you'll need more than expected.
- Tarp/Thermal blanket – Numerous uses: shelter construction; entry closure; barrier for blocking sunlight, wind, rain or snow; reflecting radiant body and fire heat back to you; protecting a casualty from the elements; making a litter/stretcher; and signaling. Light, durable and compact it can be easily carried on day or overnight hikes.

- Insulated pad – Critical for protection from a cold surface especially if it's wet, snow covered or rocky. Vital for placing under a casualty. Closed-cell foam pad is best. Three-quarter length is sufficient (use leftover quarter for sitting pad). Be aware an air mattress will get chilled if not insulated beneath. Foam pads eliminate gathering natural materials for floor insulation. They are a necessity for tarp shelters since ceiling height is only 2 feet and cannot accommodate a thick floor of natural materials. A raised floor would put you in contact with cold, non-insulating tarp walls. In a larger natural shelter, pads can be laid on pine boughs or small logs providing additional insulation against cold, rocky or wet ground.
- Shovel – Should be small, lightweight and durable. It's often difficult to impossible to dig in mountain soil but useful for gathering and transporting assorted debris for insulating shelter interior/exterior and sealing edges/ends of shelter. Metal types are stronger than plastic ones and not much heavier (preferred for avalanche rescue and snow survival).
- All these items are convenient, quick to employ and serve multiple purposes. They are reasonably light weight, easy to pack and relatively inexpensive.
- Besides these five basic items, every hiker should consider extra equipment that would be useful for survival.

III. Types and Uses of Survival Resources

- Natural materials: When available they have multiple uses and should be incorporated into your overall survival plan. They provide the obvious such as construction material for shelters and windbreaks; fuel for fires; medical uses like splints and litters; signaling and even weaponry against predators.
- Tarps: These are any strong, durable sheeting materials such as a plastic tarp, thermal blanket or poncho. In mild weather, scarce resources or limited construction time, tarps can be substituted in place of natural materials for building a small shelter. However they are best used to augment a natural shelter as roof covering, interior roof lining, flooring protection or wrapping around you. Rig tie-down cords in advance to primary grommets so tarp is ready for immediate use in an emergency or at night. Two feet of cord per tie-down is recommended for anchoring to pegs, logs or rocks.
    - A good wilderness tarp is the orange or red 5'x7' thermal blanket. They are strong enough for constructing a shelter and punctures can be easily patched with duct tape. Their bright colors make them excellent signaling devices. One side is silver which reflects radiant heat. Blue tarps are not as visible from a distance as you might think, use bright colored ones. If several tarps are used for a roof, overlap them "shingle style" (higher tarp over lower) so water runs onto an underlying tarp, not under it.
- Space blankets: Very thin, extremely light 5'x7' foil sheets. The most common type is gold on one side and silver on the other. Ones that are silver on both sides are equally effective but the gold coating is better for signaling. They are excellent for reflecting radiant body and fire heat. Wrap yourself in them or use as a fire backdrop. They are fragile so avoid using for construction as they tear easily and rattle in the wind. They shred apart on the smallest twig or rough surface.

- Note: Tarps, thermal blankets and space blankets do not insulate you. Any part of you in contact with them and a cold surface, water or air will be chilled due to conductive heat loss. It is slow but steady and can contribute to hypothermia.
- Backpacks: While often considered for entry closures, use other resources like yard bags and natural materials. Packs are not very effective and serve better purposes inside your shelter. They could also get wet along with gear inside. Build your shelter long enough to store your pack inside, you want access to it during the night for water, food, clothing and supplies. Consider using a pack to put your feet and lower legs in or as a pillow.

IV. Shelter Devices, Techniques & Tips

- Grommets: Primary attaching points on tarps. Most tarps come with a few but rarely enough. Standard 5'x7' tarps have manufacturer grommets at the corners and sometimes center of the long sides. It is recommended you install extra grommets at home. Add 2-3 at narrow ends and 3-4 to the long sides. (Heavy duty tape will add strength where extra grommets are installed.)
- Field Expedients for Anchoring Tarps: Even with extra grommets, sometimes there isn't one where you need it. Field expedients can resolve this.
  - Guy line: Used to anchor a tarp where there's no grommet or pull a tarp wall outward for more interior room. Find a small roundish pine cone or smooth stone, "wrap" it inside a portion of tarp where you want to attach a cord. Tie cord behind the item making a small "fist" at the tarp and tie other end to an anchor point. The term "tie-out" can refer to this technique but that also includes any cord attachments at tarp corners and edges. Some people refer to it as a "monkey fist" but technically that's a specially tied balled knot with a length of cord handle like a medieval ball and chain. Assorted manufactured gripping clips and tie-outs are sold at outdoor equipment stores and online.

Figure 1: Guy line tied to tree and pine cone/stone in mid tarp to pull wall outward; note yard bag end closures and solid anchoring of tarp edges

  - FYI – Tarp in guy line picture was laid lengthwise and perpendicular to support cords making a larger interior. Sufficient shelter length was obtained using trash bags.
  - Another expedient is to take 2-3 inches of duct tape and fold it lengthwise on top and under a tarp edge. Punch a small hole through tape and tarp then push cord through the hole, tie it off and secure to an anchor. Any number of knots can be used to anchor the tarp such as a double overhand, girth hitch, clove hitch or taut knot. Or apply the saying, "If you don't know knots, tie lots!"

- If you don't have tape, place a small straight stick (4-6" long) under and parallel with the tarp edge. Wrap the stick in an inch of edging and punch a small hole behind the center of the stick. Pass cord through tarp and under the stick to tie them together. Tie cord to an anchor point. This is only good along edges where it disperses stress and reduces tearing the tarp. Use the cone or stone method at interior places.

- Slip Stick: Simple technique for securing a tarp to a roof support cord without knots. Allows easy adjustment of the tarp to or from an anchor point. Find/make a small stick about the size of your index finger. Push a short loop of cord through a grommet and insert the stick half way into the loop. Tighten cord to secure the stick on the grommet thus locking tarp in place. Move tarp toward or away from an anchor point by taking in or letting out cord over the stick while moving the tarp in the desired direction. Then put tension on the cord to retighten it. This expedites construction by eliminating knots that might need to be repeatedly tied and untied while setting up the shelter. After tarp is correctly situated, fully anchor it while leaving the slip stick in place.

Figure 2: "Slip stick" for adjusting location of tarp ends during initial construction

- Drip line: Where a cord or log runs under a tarp to an anchor point that's higher, water can migrate underneath the tarp. Tie a short piece of cord between tarp and anchor point with a trailing piece hanging down to drip the water outside and not on you.

- "Race Track" & "Spreader Bars": Combination of cord and small limbs, sticks or poles. Lash bars perpendicular about every foot to a looped cord. Works for single or double tarps. Bars widen and flatten roof creating a more functional interior. Cut off ends of spreader bars past cords to maximize tarp wall height. Blunt or tape ends to avoid punctures. Small limbs/sticks with natural forks are ideal and you can saw notches/slots at ends for secure attachment to cords. Always lash all spreader bars securely to cords so they don't dislodge during the night.

Figure 3: Race track loop and spreader bars for double wide 2-person tarp shelter

- Sealing Shelter Ends and Edges: There are optional ways to close up shelter ends. Can narrow the entry end by pulling tarp corners toward a tree or each other. If using a large tree,

pull the non-entry corner against or partially around it. For small trees, anchor tarp end and corner to base of one tree or around it toward the other. Close up the raised end wall with more rocks/logs and debris (needles, leaves, dry grass, bark, dirt). Another way is to use yard bags to cover and seal up both ends. They are often incorporated with the first method. Don't forget to include an entry closure as part of your sealing process. Seal all tarp edges with logs, rocks and debris. Use hefty logs and rocks that can withstand the elements (mainly wind). Small limbs and rocks won't work. Use assorted debris to seal gaps and cracks so cold air will not blow into your shelter from any direction.

- Entry Closure Device: Always close up an entrance to keep elements out. Use a closure device of some type even in mild weather in event weather conditions change. Keep it small (< 2'x 3'). Be sure you can easily open and close it from inside your shelter.
  - Use large trash/yard bags. Also good for sealing shelter ends as in "guy line" picture. Attach a weighty limb or log horizontally or vertically to the bag at entry point. Lash limb/log to tarp corner and part of the edge to form a "flap" that can be closed after going into the shelter. Can tie cord to the system and route around an anchor tree to pull the device snug against it. Can cut bags down one side and across the bottom seam to double their size. Don't pre-cut bags since you might need them intact for other uses. Add expedient duct tape grommets in the field for tie-down cords. Two large bags will seal up both ends of a shelter.

Figure 4: Closure consisting of trash bag lashed to tree trunk and log; note pegs at R end of log to hold it snug against tree

  - "Cork in a Bottle" for natural shelters: Put soft ends of pine boughs, leaves, grass or needles in a yard bag or pile on a 5'x7' tarp until nearly full but still able to draw corners together. Close up the bag or tie tarp corners together leaving 5-6 feet of leftover cord to pull the "cork" in behind you after going inside. The cork will conform to the shape of a small entrance. If turning around in a shelter will be difficult, tie the pull cord to your ankle to grasp later and kick the cork out to exit.
  - A "log cabin door" can be made from short logs (3-4' long) lashed together side by side to upper and lower perpendicular logs. This is a good closure for natural shelters where the weight of the door works well on a slanted entry. Configure your entry so you can lean the door against it at an angle. Tie a short cord to the "top" of the door to pull it closed after entering like a castle drawbridge. Can wrap and lash a trash bag or spare tarp around the door to seal it against wind and rain.

V. Special Comments about Shelters

- Since we cannot cut live vegetation in Colorado for training, you will practice making shelters using tarps. Do not think it is "required" you construct a tarp shelter in an emergency

if natural resources are available. Obviously tarps may be your only option when there are no resources but always evaluate everything on hand before deciding.

- Dimensions listed in shelter descriptions are "approximate." Final dimensions of your shelter will vary based on number of occupants, size, resources and other factors.
- Construction times: Bivies take only minutes to set up but tarp and natural material shelters can take a lot of time to construct. Dozens of variables affect the process making it impossible to precisely state how long it will take to build any particular type. Factors like "thoroughness" of construction and your judgment of when a shelter is "completed" will affect the outcome. Completion times can vary from a minimum of 15-30 minutes for the simplest of tarp shelters up to an hour or more for all natural material designs. Thus "time ranges" are listed in shelter sections and are broad approximations. How fast a shelter is built depends on conditions and you. In an extreme situation like rain or you are already cold, a "hasty" tarp shelter can be constructed very rapidly. While not ideal, it may have to do to get you out of the elements. Less stressful situations might allow time to build a well constructed shelter. If rescue will not arrive for several days, you can spend a couple hours building the "perfect" shelter the second day of survival. (You will exceed all listed construction ranges the first couple times you build any of the shelters in this article. So after WTS, practice making a "well constructed" shelter in the field on your own so you can efficiently handle a real crisis.)
- In actual survival and if available, small trees (< 3" diameter) can be substituted where "cord roof supports" are described. Be sure trees are strong and rigid. Large trees reduce interior space but are excellent for anchors and sealing tarp edges.
- FYI – fir tree needles are soft whereas spruce needles have sharp tips. You might remember this as "fir is furry" and "spruce is spiky." Something to consider when insulating your shelter floor if both trees are available in your survival area.

VI. Shelter Considerations Before Construction

- Site Safety: While selecting a shelter spot, look about to insure you are not setting up under dead trees or where leaning trees will likely fall during a storm. Stay away from natural drainage areas or low points where water could flow or collect. Green logs are strong but heavy, lash firmly in place if used overhead. Dead logs are often lighter but test for strength and ants before using. If a fire is needed all night as with a lean-to, someone must stay awake to guard against burning down your shelter or injuring occupants.
- Shelter Location and Alignment: Consider a couple potential sites before starting construction if time permits. A small patch of level or semi level ground is preferred but may not be available. Lying on an incline will be tedious but comfort is not a high priority in survival. On sloping terrain, align the length of a shelter perpendicular to slope with entrance downwind. On level/flat terrain, align shelter with entrance downwind the best you can determine. If no wind or uncertain of direction, position entrance based on seasonal prevailing winds for the region.
- Ground Surface: After selecting the exact spot for your shelter, inspect it for hidden rocks, stumps, logs, protruding roots and ants. Remove unwanted surface debris including pine cones, rocks and sticks. You won't be comfortable in survival but don't make it worse.

VII. MANUFACTURED SHELTERS

- A bivy is a compact, water proof or water resistant tent typically designed for one person that is an efficient and quick solution for a shelter. Not a necessity for most day hikers but worthwhile if doing more challenging hikes, especially above tree line or all seasons. Technology has reduced bivy weights over the years with many being less than 2 pounds. Costs vary considerably so do your research. If you're skillful you can make your own bivy to your specifications.
- Self-supporting types with sleeve poles are great since they don't require vertical attachment points like tree limbs to hold them up. You don't have to depend on nature for construction materials. A bivy eliminates searching for materials which is beneficial when setting up a shelter at night. Construction time range: 2-10 minutes for most designs.
- Natural materials can augment a bivy such as placing it on a debris base to increase insulation and protection against cold, wet or snowy ground. If conditions allow, a windbreak can be built or set up a bivy within a natural shelter like a large lean-to or log frame and bough design. This would be useful in cold conditions, heavy rains, high winds or extended survival.

Figure 5: Light weight, self supporting 1-person bivy; 8' long, 2.5' wide & 2' high, 1.75 lbs

Figure 6: Homemade 1 or 2-person 5'x7' bivy 2' high with goretex roof, tarp floor and velcro & zipper closures, 1.75 lbs

VIII. TARP SHELTERS

- Tarp shelters are relatively quick and easy to set up but need to be thoroughly anchored and sealed. Can construct in an hour or less. Normally adequate when night temperatures are above 50 degrees Fahrenheit. Below that it is better to construct a natural shelter since it will provide more insulation and protection from the cold. Two basic types: 1-person (slanting & horizontal) and 2-person ("double wide").
- Drawbacks of tarp shelters are small interiors, confinement and potential for conductive heat loss. Raising the floor level is very limited which will be an issue if setting up on muddy

ground or heavy rains are expected. A thin flooring of boughs or logs might be laid down but could result in a restrictive interior and constant contact with tarp walls.

- Tarp size determines shelter size. A standard 5'x7' tarp creates a low, narrow and relatively short shelter. Larger tarps are heavy and bulky and marginally worth carrying. Interior space will be especially limited if using a single roof support cord (also called ridgeline or spine cord), slant the end fully to the ground or you are a tall or large person. A tarp that slants fully to the ground at the far end is easier to seal up but more likely to cause conductive heat loss. The reverse is true of tarps with a raised end wall. There are helpful remedies for these issues but there will still be limitations. (Explained later.)
- It is often impractical to slant the lower end of a tarp to the ground unless you are very short. Up to 2 feet of interior length can be lost at the sloping end where there are only inches of clearance. Even when initially taut, the roof can sag as the cord stretches or the weather changes. Contact with the tarp could result in conductive heat loss and dampen your clothes or skin from condensation. You might snag your boots on the tarp possibly dislodging a side or end. Better construction methods are provided in this article.
- All shelters discussed throughout the remainder of this article are made using tarps and/or natural materials and are thus dependent on what is available and supplies you bring. While single person shelters are discussed, 2-person shelters are recommended. Building a 2-person shelter applies a "team approach" to survival where you divide up tasks, use resources efficiently, share body heat and supplies and gain psychological comfort from being with a friend.

IX. Tarp Shelter Designs

- **Single Cord & Dual Cord Roof Support Options:** A tarp can be suspended using a single cord or two. Dual cords are strongly recommended. A single cord results in roof sections sagging whereas dual cords create steeper walls with less sagging. A wider roof with slanted walls provides more interior room and tarp standoff. Roof heights are virtually identical for single and double cord supports. Combined with a raised end wall, dual cords produce a more functional interior. As previously stated, in actual survival trade out roof cords with small trees for stronger support. (Figure 7)
- **1-Person Slanting Design:** "Slanting" means a shelter roof that slants fully to the ground or slightly downward to a raised end wall.
  - A slanted shelter is described as going from the higher/entry/head end towards the lower/far/foot end. Since you might lie head or feet first, be flexible about terms.
  - Preferred technique is to raise the tarp's low end by building a short wall of logs/rocks. Above tree line, use hiking gear (poles, ice ax), rocks and/or snow. The raised wall creates vertical room for your feet or head regardless of body alignment. (Figure 8)
- **1-Person Horizontal Design:** "Horizontal" means the roof is level the entire shelter length creating two large open ends. These openings must be well sealed. Install either single or dual roof support cords. The same pros and cons of single and dual cords apply as with a slanting shelter.

Figure 7: Single tarp interior using dual roof support cords and raised end wall

Figure 8: Raised end wall with dual roof support cords anchored behind it

- **2-Person "Double Wide" Design:** Highly recommended. It is superior to single tarp designs, promotes radiant heat exchange of occupants and offers psychological comfort. Good for a variety of conditions and efficiently utilizes survival gear of two people. Apply looping "race track" roof support and "spreader bars" for optimal interior space. Roof is always slanted and entry is always at lower end.

X. Constructing Tarp Shelters

- **Critical points to apply:**
  - Build your shelter very strong and well anchored.
  - It is better to use dual roof support cords than a single one, it's even better to use small straight trees in place of cord.
  - Build a raised end wall, avoid slanting the foot end fully to the ground.
  - Anchor tarp ends and edges and seal up every possible part of the shelter, especially the ends.
  - Always make a closure device that seals up your entry.
- **1-Person Slanting Shelter Using Dual Cord Roof Support:**
  - Dimensions are generally 2' high at entry end, 6-foot long interior using a raised end wall, and 3' wide at ground level. (A 7-foot long tarp does not make a 7-foot long shelter without additional items like yard bags. A foot or more is used up at the anchor tree and raised wall.) Construction time range: Minimum 15-30 minutes.
  - Locate a single large tree 12-16 inches in diameter or two small trees >2 inches in diameter and about a foot apart. Small trees should be nearly perpendicular to the direction of your eventual shelter. Don't need perfect trees. Can widen cords using spreader bars or draw them inward by tying short cords at the end(s).
  - Lay tarp lengthwise on the ground with high end against tree base(s). Determine where to build an end wall then move tarp aside. Location of wall depends on your height. If < 6'

tall, position logs/rocks so tarp extends onto and possibly over them. If > 6', position them so tarp extends up to the end wall. Build a 12-18" high raised wall of logs or rocks 3-4 feet wide. This also becomes the end closure. (Figure 9)

- Loop 20 feet or so of cord around trunk of the tree(s) about 2 feet above ground level (Longer cord can be used and cut later. May need to wrap cord twice around small trees to keep in place.) Run two even strands of cord from tree(s) and over and behind the raised wall. Align them parallel 12-18" apart or in a wedge. Temporarily secure with anchor items (log, rocks, sticks). Don't permanently anchor cords until high end is fully adjusted and anchored.
- Variation of dual roof cord design: Two large trees about 7 feet apart are ideal for looping cord around them forming a "race track" roof support. One tree replaces the raised end wall where cord is 12-18" up the trunk and high end cord about 2' up the other tree. (Figure 10)
- Another optional technique is to lash short "spreader bars" 12-16" long to the roof cords as discussed in Section IV. (Not needed if using small horizontal trees in place of cords.)
- Place tarp lengthwise on roof support and temporarily secure with cord tied to tree(s) and center end grommet or slip sticks in the roof cords. Adjust tarp so it is snug against tree(s). Adjust cord height on trunk(s) so tarp mid-sections reach the ground with walls slanting slightly outward with a 3-foot ground width. Anchor as needed to tarp attachment points.
- At far end tighten up roof cords and fully anchor behind raised wall. Don't anchor to a top log or rock, could dislodge. Anchor corners and any additional end grommets or make field expedient ones. Extra attachments between corner and center grommets will thoroughly secure tarp.

Figure 9: Dual roof cords anchored to pegs behind raised wall; end sealed later with trash bag

Figure 10: Looped "race track" pattern using trees for closures; well sealed with debris; entry is on far side of R end

- Check entire shelter for layout. Fully anchor all possible attachment points. Fabricate an entry closure device. Use yard bags and/or other materials to seal up remaining openings at both ends of the shelter. Seal edges and gaps between logs/rocks and tarp.
- It might be possible to use the space between two small trees as your entry. Lash a short, thin log to the entry end at the height of your roof cords. Use it to attach the tarp at the entry. Anchor high end sections to base of trees.
- Lay foam pad inside shelter, crawl inside and test closure device. Note any issues and make corrections.
- If rain is expected, dig a shallow trench around the perimeter of your shelter.

➢ **1-Person Slanting Shelter Using Single Cord Roof Support:**

- Dimensions are same as dual cord shelter but with less functional interior space because of the low sloping walls. Construction time range: Minimum 15-30 minutes.
- Steps are similar to dual cord procedures. Use a large tree or two small ones to support the tarp. Lay it lengthwise on the ground with high end against tree base. Determine location for the end wall and set tarp aside.
- At far end build a raised wall of logs/rocks 3-4 feet wide.
- Tie roof cord to tree trunk(s) about 2 feet above ground level then extend cord 10-12 feet with trailing end over the raised wall. Temporarily secure using anchor items. (A second tree 7-8' away can be used to brace the raised wall and anchor the roof cord.)
- Lay center of tarp lengthwise on roof cord. Attach high end to cord using a "slip stick" then move tarp as close to the trunk as possible.
- Adjust cord height so entry corners touch the ground in an "A frame" pattern while achieving optimal interior width and height.
- If using a large tree, incorporate into your high end closure by drawing one or both corners toward it.
- Check entire shelter for layout. Fully anchor all possible attachment points. Fabricate an entry closure device. Use yard bags and/or other materials to seal up remaining openings at both ends of the shelter. Seal edges and gaps between logs/rocks and tarp.
- Check shelter interior and test entry device. Note any issues and make corrections.
- If rain is expected, dig a shallow trench around perimeter of your shelter.

➢ **1-Person Horizontal Shelter Using Single or Double Roof Cords:**

- Dimensions are nearly identical to slanting design except both ends are about 2' high. Construction time range: Minimum 15-30 minutes.
- Use two trees about 7' apart. Tie roof cord(s) to tree trunks 2 feet above ground. If a second tree is not available, make an "X" frame of logs lashed together as a substitute. Anchor later with a guy line so it doesn't collapse inward when the tarp is attached.
- Lay tarp lengthwise along the cord(s) and temporarily secure using slip sticks. Fully anchor when satisfied with shelter layout. Roof cord(s) will sag depending on how far

apart trees are situated, can double up cord and/or make very taut. If using a single roof cord, conductive heat loss is likely from contact with tarp walls. As with the slanting tarp, dual roof cords have proven more effective.

- Permanently seal up one end and use the other as your entry. Anchor and seal up the entire shelter as previously explained. Make an entry closure device. It's critical to seal up both ends or cold air will flow through one and out the other chilling you in the process.

➢ **2-Person "Double Wide" Shelter:**

- Dimensions depend on tarp sizes. Using two 5'x7' tarps you can make a shelter 7-8' long, 3' high and 4' wide at ground level with a 2-foot wide roof and slanted side walls that reduce conductive heat loss. Construction time range: Minimum 20-30 minutes.
- Use two large trees 1-foot thick or more. Since tarps must overlap a foot or so, ideal spacing of trees is 7-8 feet with good ground between them. Shelter can be made with trees farther apart by sealing tarps together at one end. Can also use pairs of small trees at each end that are 1-2 feet apart and perpendicular to the shelter length.
- Wrap a long piece of cord in a looping style around the trees like an elliptical race track. Position cord about 3 feet above ground at the high end and slant slightly downward toward the other end to shingle tarps and bleed off rain/snow melt. Adjust loop height later so tarp edges reach the ground.

Figure 11: Race track loop and spreader bars for double wide 2-person tarp shelter

Figure 12: Lower tarp on race track loop; spreader bars create steep walls and wide floor

- Lash numerous "spreader bars" (18-24" long) perpendicular to the looped cord every foot or so down the length of the roof . As previously discussed, cut off ends of sticks protruding past the cords and securely lash ends of all spreader bars to cords.
- Starting with lower tarp, lay it lengthwise perpendicular across the looped cords. Be certain to place a couple spreader bars directly underneath where the tarps will overlap to avoid back flow of water from the lower tarp. Do not anchor tarp.
- Lay upper tarp shingle fashion onto lower one by overlapping it about a foot or more. Do not anchor. Adjust both tarps so they reach the trees and still overlap with all four corners

touching the ground. Adjust cord height at trees so tarp edges touch the ground and walls slant slightly outward with a 4-foot floor width. Maintain shingle effect of tarps.

- Anchor tarps securely to the ground and trees using pieces of cord, fabricated tent pegs and logs/rocks.

Figure 13: Tarp end "stitched" behind tree for good closure; pegs & logs anchor tarps with entry L of tree

Figure 14: Completed shelter; contrasting tarps show "shingle" concept; R log is entry closure and anchors both tarps

- **Using Logs to Raise Shelter Height:**
  - Logs can increase the height of a tarp shelter several inches but there are trade-offs and extra tasks. Logs need to be fairly thick (6"+), straight and 6-7 feet long. Goal is to merge tarp edges with the logs thus raising the shelter height the thickness of the logs. Good sealing of edges is critical. Place single logs along shelter sides and anchor tarp edges onto logs at multiple points, not just corners and mid points. Raise roof support cords at both ends of shelter to maximize interior height. Extra grommets or field expedient attachments are required, do not attempt without them.
  - Run tarp edges "outside" the top center of logs to keep rain out. Edges must fully contact logs their entire length without raised gaps or sagging inward. Fully seal sides with extra debris piled on and under logs and cover tarp edges.

XI. Constructing Natural Shelters

- "Natural shelters" have unique advantages over bivy tents and tarps. Larger size and layering of exterior and interior materials provide more insulation and protection from the elements. Since interior height is not limited, a raised floor can be made from boughs, or logs then boughs on top, to insulate you from the ground, mud, rocks or rain. Construction takes longer but they are superior to tarps in harsher conditions. A natural shelter can be custom built to easily accommodate 2-3 people. Worst case scenario, several people can crowd into one large shelter. While cramp quarters, you'll appreciate the radiant body heat. Building a natural shelter frees up resources like tarps for other uses.

- Drawbacks of natural shelters are the absence or limited availability of materials. Special items are required to cut and lash them together. It takes considerable time and effort to gather resources and construct the shelters. If a large volume of materials is needed, you will need to roam farther and farther from your shelter site to cut, collect and transport them. Construction time can reach an hour or more.
- Shelters described below use layers of natural materials (pine boughs, needles, leaves, brush, logs) as insulation for walls, roofs and floors. Where "pine boughs" is stated, it is understood other materials can be substituted.
- **Tree Tent Shelter:** Makes a good, sturdy shelter for 1-2 people. Similar to a slanting tarp tent but made of natural materials.
    - Dimensions: For two people, goal is an interior area 7-8' long, 4-5' high and 5-6' floor width. For one person reduce width to 4'. Interior height is greater since natural flooring is used in place of or in addition to a foam pad. Floor is extra wide to compensate for rib branches bowing where they contact the ground. Construction time range: 30-60 minutes.
    - Find a 15-20 foot high tree with a trunk 3-6 inches in diameter and lots of limbs (full like a perfect Christmas tree). Several factors will "shorten" the tree. A few feet of the weak top will bend and lay flush on the ground and a couple feet are expended for trunk lashing. At the far end, you want an interior height of 2-3 feet. Shorter branches beyond this point are not cut. These factors will use up nearly half the tree length.
    - Cut trunk about 5 feet above the ground. On gentle sloping terrain fell tree upslope so trunk entry is down slope. On level ground fell tree into the wind so trunk entry is downwind. If on very steep terrain fell tree perpendicular to the slope with entry downwind if possible. Lash tree to the trunk securely with cord whether it is fully separated or partially attached to trunk. The trunk lashing is what holds up the tree roof and shelter, not the branches.
    - Trim out interior limbs in an "A-frame" fashion creating slanting walls of "rib" branches down the length of the tree. Use cut limbs as floor insulation. Cut off excess exterior limbs and layer them along both sides of the tree to thicken walls.

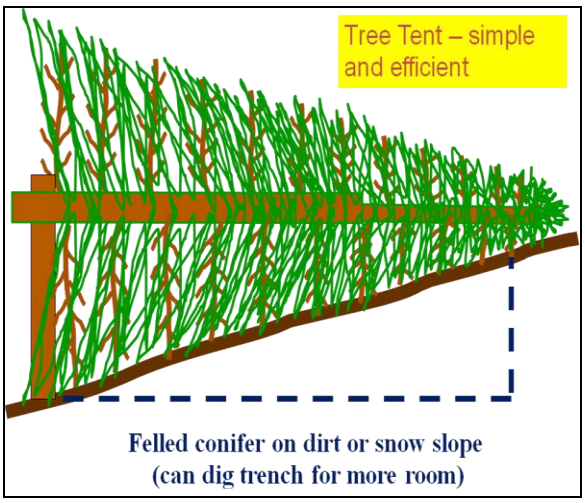

Figure 15

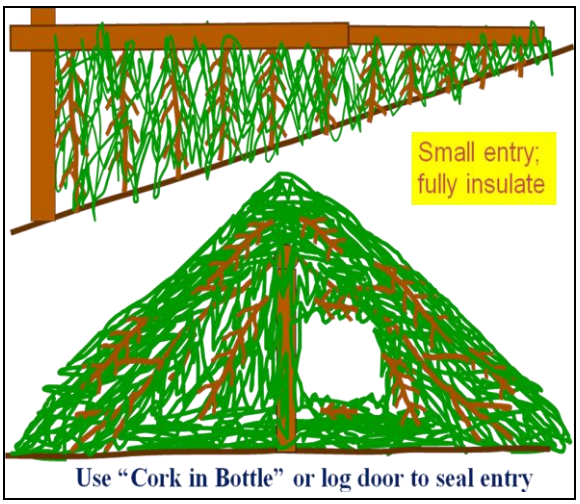

Figure 16

- Cut more trees and use branches to fully insulate walls and floor with 12-18” of pine boughs. Walls can form an A-frame roof or it can be doom shaped.
- Close up entrance leaving a 2'x2' opening and make a door closure. A “cork-in-a-bottle” or log door work well with this shelter.
- If expecting rain or wet snow, slant the tree downward at the trunk on sloping ground. (Tree already slopes on flat terrain.) Anchor tarps on the roof or to the interior rib framing in shingle fashion. Don’t puncture. A bright colored tarp roof also makes a shelter visible to rescuers rather than camouflaged.

➢ **Log Frame Shelter:** If an ideal tree isn’t available, no problem, you can construct a ribbed frame from individual logs and limbs by lashing them together. Slant roof slightly to drain off water using shingled tarps. Insulate the structure and floor with boughs and debris. Will resemble a tall, A-framed pup tent.

- Dimensions – For 2 people make shelter 7-8’ long, 5-6’ wide at ground level and 4-5’ high (interior height). Increase width and height slightly for 3 people. Construction time range: 30-60 minutes.
- On gentle sloping ground, align entry down slope like the tree tent. If on steep terrain build perpendicular to the slope and if on level terrain build with entry downwind.
- Framing: Build a slightly slanting roof between two trees (or horizontal if no rain). Lash spine log to two standing trees 5-6’ up the trunks with 7-8’ interior ground length between them. Pick trees so entry will be downwind. As long as your logs are strong, they achieve the same effect as a felled tree.

Figure 17: Log and bough shelter; augment with roofing tarps to shed water

- Lash rows of logs and large limbs along both sides of the spine log to form sloping walls. Make an entry hole and devise a closure. Seal up far end and cover entire shelter with pine boughs and debris. Use pine boughs and foam pads for flooring.
- Field expedient frame: If good standing trees aren’t available, you can make a frame by lashing logs together to support a spine log. Lay two 6-foot logs side by side then lightly lash them together about a foot from one end. Stand upright and spread logs open to form slanted legs that cross near the top with desired floor width at their bottom. Then firmly

lash again. (Parallel lashing tightens when logs are spread apart but you can cross upper log ends first then lash if preferred.) Can add a slanting third log like a tripod to make logs self standing – useful for added support or if surviving alone. Make two sets of crossed logs. Lay spine log on top of the "Vs" above the lashing. Lash spine log in place and continue construction steps as previously described for a log frame.

XII. Log Hut

- This is a small, crude log cabin without windows. Labor intensive but ideal shelter in harsh conditions and extended survival of several days or more.
  - Dimensions – For two people make shelter 7-8' long, 4-5' high (interior roof height) and 4-5' wide (floor width). Interior roof height can be raised for extra thick natural flooring on mud or snow. Construction time range: Up to an hour or more. Half the time will be spent cutting, dragging and stripping trees for construction.
  - Find several trees that match these rectangular dimensions and use them as corner posts. You can fabricate a 3rd or 4th "crutch post" by lashing vertical corner logs to horizontal wall logs.
  - Cut green trees or use strong dead ones that are several inches thick. Lash together to form walls. Don't interlace logs perpendicular to each other, this creates huge gaps requiring filling.
  - It's recommended the long side wall logs be lashed first then cut short logs to fill in the ends of the hut. Can lash end logs horizontally or vertically. Roof logs can be laid lengthwise or perpendicular. Can support long roof logs by adding one or more "support pillars" under the roof. Lash a short log perpendicular at the end of a log like a "T" and place perpendicular under roof logs. This would be helpful if the roof sags and/or you'll add heavy insulation.
  - Insulate roof, walls and floor with 12-18" of pine boughs. (Can insulate roof and walls as thick as you want.)
  - Incorporate a small entrance (2'x2') at the down slope or downwind end of the hut and make a door closure (cork in bottle or lashed log door).

Figure 18

XIII. LEAN-TO

- This open front shelter has limitations but is good for mild to cool conditions if you have several space and thermal blankets and adequate fuel resources to maintain a fire throughout the night. It is not recommended in heavy rain or fluctuating wind directions. For these conditions, build a shelter that can be sealed up to provide wind and rain protection from all directions. If already raining, usable firewood may be unavailable thus negating construction of a lean-to.
  - Dimensions: Size can vary to accommodate survivors. For two occupants, common size is 6-8' wide, 5-6' high at front and 6-7' in depth at ground level. For one occupant, can build 6-7' wide, 4-5' high and 4-5' in depth (lie parallel to front for maximum exposure to fire). Construction time range: 30-60 minutes not including collecting firewood and building a reflective back wall for a fire.
  - Lash a strong log horizontally between two trees at your preferred height and width to form the front roof support beam and entrance. Entrance should face downwind since it will not be sealed up. Must face down slope on steep terrain but this could put you into the wind. Lash logs/limbs of assorted sizes slanting diagonally from the front support beam down to the ground at the rear of the shelter.
  - Lash nearly vertical logs and limbs to left and right of the slanting roof to form side walls. Cover roof with boughs, limbs, leaves and other debris starting from the ground and working up so materials act like thatching. Lash limbs and boughs to side walls. Anchor roofing materials with cord or add extra logs/limbs to prevent being blown off.
  - If using small debris like leaves, dead needles and grass, try to use fairly straight roof logs side by side and lots of small limbs to prevent debris from falling through. If pine boughs and other insulating debris are not available, cover with tarps or stack another layer of slanting logs to seal up gaps.
  - If required, the entire lean-to framing can be constructed without using standing trees. Start with two front vertical "corner posts" each lashed to side roof logs slanting to the ground. Attach a horizontal support beam in their "V" notches. Or use the field expedient log framing method previously described to support the horizontal beam. Then apply the rest of the steps.
  - If rain or wind is expected, tarps can be placed on top of the framing before adding pine boughs or on top of the roofing debris. If a tarp(s) won't cover the roof, lash to interior roofing logs.
  - Insulate the floor with pine boughs and/or foam pads. Line interior roof and walls with space blankets or thermal blankets with silver sides showing to reflect radiant heat from the fire. Construct a fire pit beyond the front of the shelter with reflective back wall using rocks, logs and space blanket.
  - Stockpile a large amount of wood to maintain a fire the entre night. This is critical for the effectiveness of the shelter. Without a fire, the shelter provides minimal protection from the elements and your efforts would be better spent building an enclosed shelter.

IT IS HOPED YOU ARE NEVER IN A SURVIVAL SITUATION, BUT AFTER YOUR FIELD TRAINING YOU'LL KNOW HOW TO HANDLE IT A LOT BETTER. IF CIRCUMSTANCES FORCE YOU TO REMAIN IN THE FIELD, THINK BEFORE ACTING. EVALUATE ALL RESOURCES AND OPTIONS THEN DETERMINE THE BEST SHELTER FOR YOUR SPECIFIC SITUATION. APPROACH SURVIVAL WITH A POSITIVE ATTITUDE, WORK AS A TEAM AND BE DETERMINED TO SURVIVE!