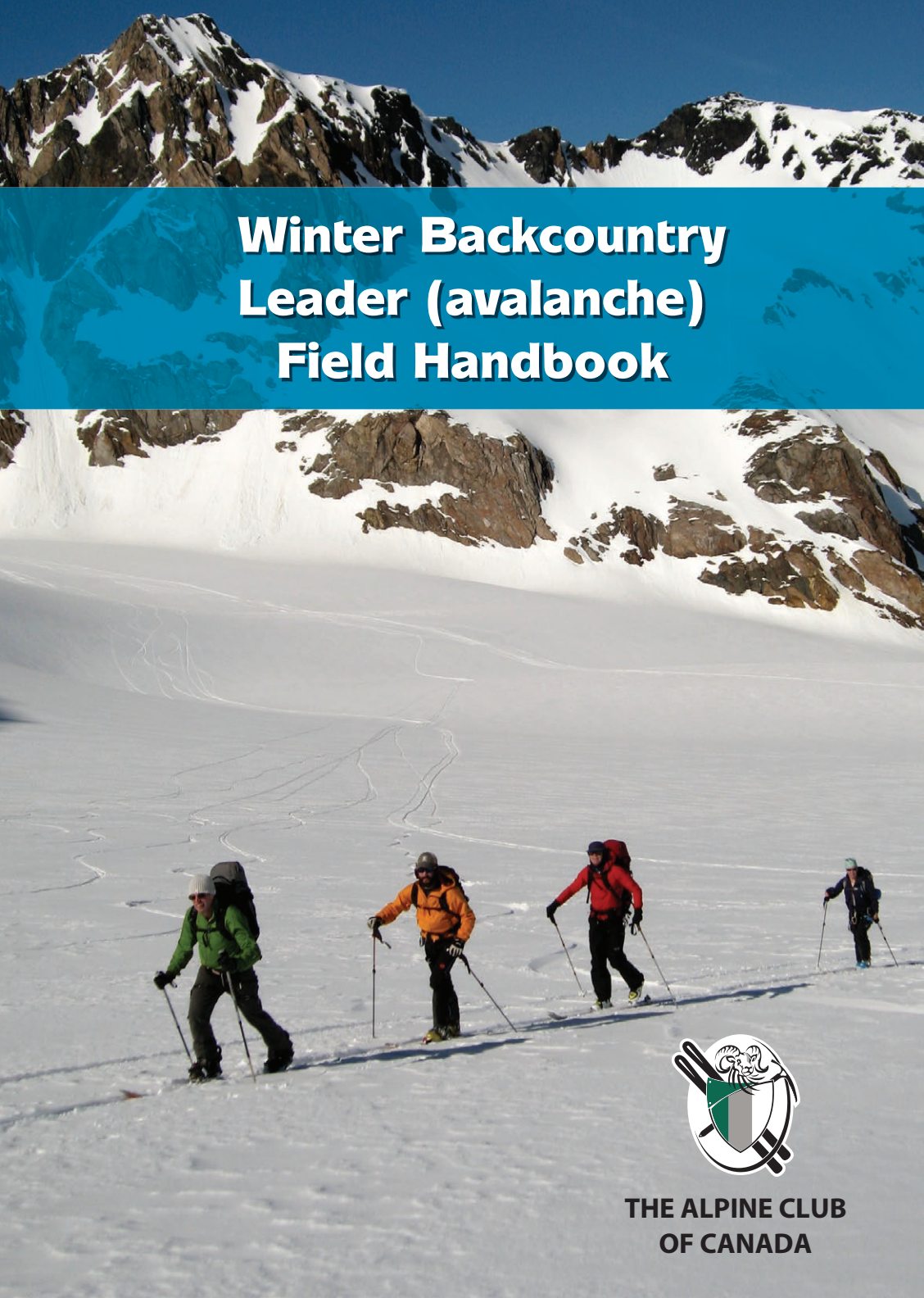
Winter Backcountry Leader (avalanche) Field Handbook



THE ALPINE CLUB OF CANADA

Winter Backcountry Leader (avalanche) Field Handbook

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Foreword

The Alpine Club of Canada's (ACC) passionate volunteer leaders have expressed a desire for a nationally-supported training program that recognizes the diversity of ACC trip leaders and their roles in the various types of trips they lead in Sections across Canada. The ACC's Section representatives and Board of Directors have expressed concern at the lack of a standardized national training curriculum. Previous attempts, over the last four decades, to provide standardized leader training materials (developed by national panels, mountain professionals or external consultants) were not well-received.

The approach taken in developing this field manual (and associated materials) recognizes that past attempts to develop curricula and training materials failed, largely because they were developed using a top-down approach whereby the Sections and their volunteer leaders were merely the recipients of materials at the end of a process. In 2012 the Leadership Development Committee (LDC) co-chairs proposed the opposite, whereby the Sections and their leaders would be involved right from the beginning in identifying volunteer leader types, associated competencies and appropriate levels of proficiency, to be considered "really excellent leaders".

The process proposed by the Leadership Development Committee (LDC), and endorsed by Section Council and the Board of Directors, was driven by ACC volunteer leader input and participation. The LDC merely acted as facilitators, coordinating the process and ensuring results met ACC members' expectations. All ACC Sections were invited to appoint a volunteer leader to participate in an ACC Competency Profile working group (ACP). ACP reps were active volunteer leaders who were familiar with their Section's own leadership needs and current training practices. After establishing an initial list of leader types found nationally, ACP representatives and LDC members met to finalize the list and draft a competency profile for each leader type. Resulting "DACUM" charts list competencies and related learning objectives.

Draft profiles were sent to ACP reps for their review to ensure the competency profiles captured their intent and then shared with other volunteer leaders, for further input. A final set of 15 competency profiles was endorsed by the ACP reps, and by Section Council and Board of Directors.

With Section input, ACP reps then prioritized the development of training materials for their top three leader types: Top Rope Rock Climbing Leader, Winter Backcountry Leader (avalanche), and

Summer Mountaineering Leader. In addition, the ACP reps ranked a list of course goals addressing the competency profiles for each leader type based on their Section's view of the highest-priority learning objectives for each competency. Section Council then directed the LDC to begin developing a training module for the Top Rope Rock Climbing Leader created in 2016, followed by this module the Winter Backcountry Leader (avalanche) and the Summer Mountaineering Leader both created in 2017.

Both the ACP and LDC recognize there are numerous skilled and competent volunteer leaders currently active in ACC Sections, and not all of them will have high proficiency in every competency identified in the applicable profile. It is not the intent of the LDC or the ACP reps to define the minimum levels of proficiency in each competency for a given leader type necessary to lead Section trips. The relative importance or necessity for proficiency in each competency varies across the country according to the context in which each Section operates. It is therefore up to individual Sections to decide which competencies are absolutely necessary for the various leader types in their context, and what appropriate minimum levels of proficiency are in each competency relative to their Section's needs.

Aspiring volunteer leaders can consider the Competency Profile to represent the ACC's definition of what skills an exceptional volunteer leader would have or aspire to develop. It is possible that volunteer leaders already leading Section trips may not have the highest levels of proficiency in all competencies. This should NOT be taken to mean they are no longer qualified to continue leading Section trips; rather, the competency profile can be used by these individuals as a road map for continued personal leadership development.

This handbook follows competencies in the Winter Backcountry Leader (avalanche) Competency Profile. Together with an accompanying Instructor Agenda, Lesson Plans, Participant Evaluation Form and Competency Vetting Form, it forms a complete module intended to facilitate training of volunteer Winter Backcountry (avalanche) leaders by qualified ACC volunteers, professional outdoor educators, or guides. Individual ACC Sections may choose to simply refer to the module to augment existing Section training materials, or use it as the basis for their own local volunteer training programs. They may choose to use volunteers from within their own or other Sections, or professional instructors, in the delivery of all or some of the materials presented.

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Introduction

The purpose of this field handbook is to support The Alpine Club of Canada's Winter Backcountry Leader Training Program, as well as to act as an ongoing resource for winter backcountry leaders. It is designed to highlight techniques and applications commonly used by winter backcountry leaders to assist in the delivery of a successful winter backcountry day or overnight outing.

TARGET AUDIENCE

The intended audience for this field handbook includes experienced recreational winter backcountry travellers, with some prior basic group management experience and basic (AST 1) avalanche training, and who also possess current first aid training. Additionally, it is designed for aspiring leaders who are in the process of increasing their recreational winter backcountry knowledge and abilities, and as a reference resource for winter backcountry leaders who have successfully completed higher level training (i.e. Apprentice Ski Guide) or have been recognized via the Prior Learning and Assessment Recognition process.

LIMITATIONS

This field handbook strives to provide information specific to common, or routine, winter backcountry travel in non-glaciated and group management scenarios. However, it is not all-encompassing and cannot account for all potential situations or circumstances. It is therefore expected that in addition to this manual, winter backcountry leaders are capable of exercising good judgment and situational awareness.

DISCLAIMER

The information contained in this field handbook has been obtained from equipment manufacturers, industry best practices, applications promoted by the Association of Canadian Mountain Guides, and the policies of The Alpine Club of Canada. Every care has been taken to ensure that the information contained herein is accurate and current. However, the content of this field handbook is subject to change as equipment, techniques, and best practices evolve. Therefore, the field handbook should be used as a resource guide only.

The author, publisher, The Alpine Club of Canada, its board, directors and officers, and employees are not responsible for the results of any actions taken by users of the information contained in this book. Wilderness backcountry outings are an inherently dangerous activity that you pursue at your own risk.

Designing a Winter Backcountry Outing

A successful winter backcountry outing starts well before stepping out on the trail. Careful planning and diligent preparation significantly increase the probability that the winter backcountry outing will be a success. In this chapter we will first explore the concept of avalanche terrain and its influences, followed by key aspects specific to the planning and design of a winter backcountry day or multi-day trip.

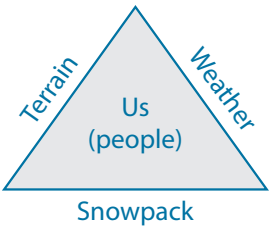
Avalanche Terrain

There are numerous enjoyable winter backcountry trips that do not travel in avalanche terrain. Outings taking place in the mountains, however, often have exposure to avalanche terrain. The four main ingredients influencing avalanche risk for backcountry travellers are:

- Terrain – is it steep enough to slide?
- Snowpack – are there instabilities in the snowpack that may fail?
- Weather – are there weather factors at play that are changing the avalanche conditions or building an unstable snowpack?
- People – are we in avalanche terrain and/or a potential trigger?

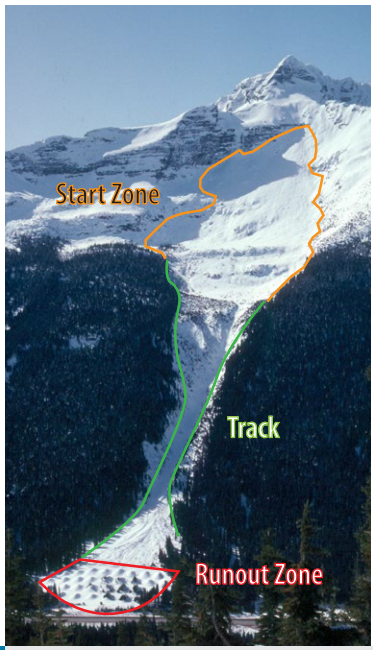
Of the elements in the Avalanche Triangle, Terrain choice is the one element the winter backcountry leader can control with certainty

While we are unable to control weather or the snowpack, the winter backcountry leader can recognize and control where the group is in mountainous terrain. Terrain choice then becomes the primary factor in reducing one's exposure to avalanches.



Of the two primary types of avalanches (of which there are several sub-categories): loose snow and slab avalanche, it is slab avalanches that can be most destructive.

DETERMINING AVALANCHE TERRAIN



Avalanche terrain is often characterized by three components:

- Start zone: typically 30 to 45 degrees
- Track: typically terrain between 15 degrees and 45 degrees
- Run-out zone: typically 15 degrees or less

Not all avalanche terrain has well-defined start zones. Start zones in some terrain features may be located below treeline. The winter backcountry leader will develop an eye for recognizing avalanche terrain and employ mitigating travel (safety) measures as required.

There are several characteristics of a start zone the winter backcountry leader would be aware of as these influence safety measures taken during an outing:

- Slope incline – is the terrain 30 to 45 degrees?
- Orientation to wind – is the slope on the leeward side of the wind and being loaded with blown snow?
- Orientation to the sun – warming by the sun can create crusts as well as weaken the bonds between snow grains. North aspect slopes which see little sun and warming may have weak layers persist for longer periods of time than south aspect slopes.
- Terrain shape – convex slopes play a role in start zones in that the convexity is an area of tension within the snowpack and hence more sensitive to failure under load.
- Elevation – higher elevations tend to experience more wind and precipitation (load).
- Ground roughness – is the ground on which the snow is sitting smooth, rough, lightly forested or densely forested?
- Thin spots in the snowpack – thin spots may make sensitivity to triggering more likely than a deeper (thicker) snowpack. Thin spots include rock outcrops, trees sticking out of the snow, shallow buried rocks and trees, as well as moraine features.
- Cornices – cornice failure may initiate an avalanche.

Avalanches may be big or small and may be triggered naturally or artificially (i.e. humans). There are many factors that influence the potential size of an avalanche. As mentioned earlier, slab avalanches have more destructive potential as they tend to propagate, thus increasing the overall size and mass of the slab avalanche. Slab avalanches may be shallow or deep. Deep instabilities may be harder to trigger, however they will have a greater volume of snow (mass) and therefore have more destructive potential.

Rarely is the slope uniform from top to bottom and from side to side. For this reason, the winter backcountry leader would anticipate spatial variability in terrain. That is, the winter backcountry leader would expect differences is snow depths and underlying terrain features that may influence avalanche terrain and instabilities on a chosen slope.

Most often it is the avalanche victim or someone in their party who triggered the avalanche

FACTORS AFFECTING AVALANCHE CONDITIONS

There are three primary factors that influence avalanche conditions:

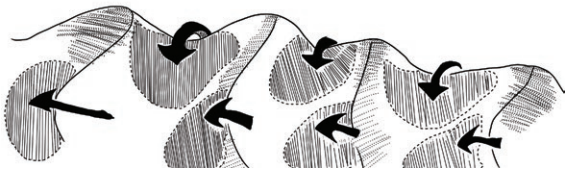
» wind
» precipitation
» temperature

As a general rule, 30 cm or more of snow within 48 hrs, rain, significant wind transport of snow, or a rapid rise in temperature would suggest avalanches are more likely

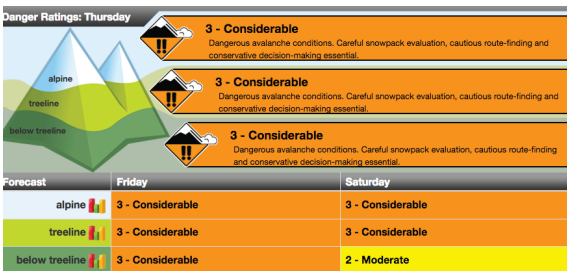
Wind has the ability to transport snow to the leeward side of a ridge or slope and form a wind slab. These wind slabs may be sitting on a weak layer, or may become the bed surface of another weak layer. As with slabs that may propagate when triggered, the winter backcountry leader would recognize wind slabs as a potential hazard and employ appropriate safety measures for the group.

Precipitation can be in the form of snow or rain. Rain would represent a rapid load to the snowpack as well as weaken the bonds between snow grains increasing the avalanche hazard. A heavy snowfall would represent a rapid change in snow load and increase the avalanche hazard

A rapid rise in temperature to near 0˚C will weaken the bonds between snow grains resulting in a weak snowpack. This can happen during a warming event, but is most common in the spring with afternoon daytime heating.

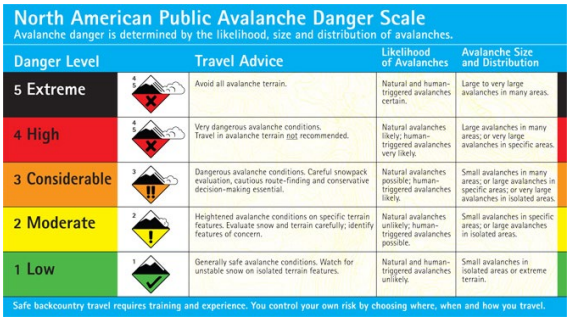


AVALANCHE DANGER RATINGS



Forecast	Friday	Saturday
alpine	3 - Considerable	3 - Considerable
treeline	3 - Considerable	3 - Considerable
below treeline	3 - Considerable	2 - Moderate

The Public Avalanche Bulletins produced by Avalanche Canada as well as Parks Canada incorporate the North American Avalanche Danger Scale. In this scale there are five ratings ranging from Low to Extreme. The avalanche danger is based on the likelihood, size and distribution of avalanches. While Low and Extreme appear relatively straight forward and intuitive, the winter backcountry leader will pay particular attention to 'Considerable'. It is this rating that is often the most uncertain and careful terrain selection needs to be exercised as the Considerable description suggests. The danger



In an avalanche forecast, a danger rating is assigned to three elevations bands: Alpine (ALP), Treeline (TL) and Below Treeline (BTL)

scale also incorporates travel advice for each rating.

The avalanche ratings produced by Avalanche Canada, Parks Canada, Kananaskis Country and Vancouver Island are monitored and updated regularly. As a result, the winter backcountry leader may see changes in the ratings for the planned outing due to the three primary factors discussed earlier (wind, precipitation and temperature).

AVALANCHE TERRAIN EXPOSURE SCALE (ATES)

After a tragic incident involving a school group in Glacier National Park in 2003, Parks Canada completed a terrain (avalanche) exposure rating for many of the backcountry trails in the national parks. Kananaskis Country has also rated many of the popular routes and trails. Avalanche Canada has also been involved in terrain ratings for popular areas outside the national parks for both self-propelled and mechanized (sledding) activities. The ratings in these cases tend to be for areas or zones rather than for specific routes.

Description	Class	Terrain Criteria
Simple	1	Exposure to low angle or primarily forested terrain. Some forest openings may involve the runout zones of infrequent avalanches. Many options to reduce or eliminate exposure. No glacier travel.
Challenging	2	Exposure to well defined avalanche paths, starting zones or terrain traps; options exist to reduce or eliminate exposure with careful routefinding. Glacier travel is straightforward but crevasse hazards may exist.
Complex	3	Exposure to multiple overlapping avalanche paths or large expanses of steep, open terrain; multiple avalanche starting zones and terrain traps below; minimal options to reduce exposure. Complicated glacier travel with extensive crevasse bands or icefalls.

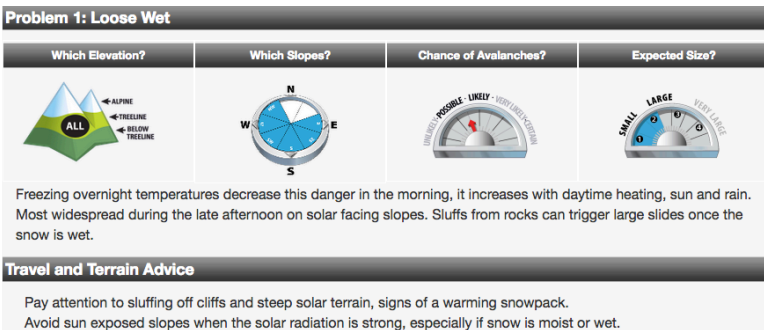
Terrain that has been rated is assigned one of three descriptions: Simple, Challenging or Complex. This public description is based on a technical model that further describes such factors as slope angle and shape, avalanche frequency, runout zone characteristics, route options, glaciation and exposure time.

The winter backcountry leader would be familiar with terrain ratings and where to find trip ratings on the Parks Canada and Avalanche Canada websites. Many trip ratings are also available in most current winter backcountry guidebooks. Should the hazard increase on an outing, it may be wise to reduce exposure by stepping back with respect to terrain selection (i.e. move from Challenging to Simple terrain).

DETERMINING AND MONITORING THE AVALANCHE FORECAST

The winter backcountry leader would be familiar with locating, reading and monitoring the avalanche forecast for the region in which an outing is proposed. The Avalanche Canada website (www.avalanche.ca) would be considered the primary resource for accessing this information. The Avalanche Bulletins offer insight into the particular type of avalanche problem, at which elevation band the problems reside, where on the compass it can be found, the likelihood of triggering, and its potential size.

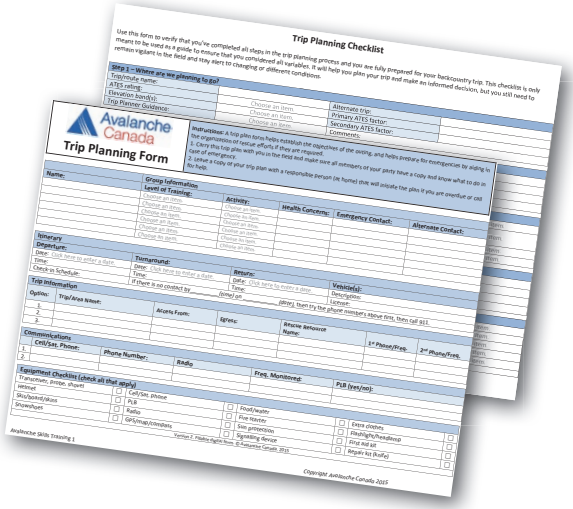
Although monitoring avalanche conditions throughout the season is considered good practice, the winter backcountry leader would pay particular attention to the avalanche forecast for the proposed trip approximately one week in advance. This allows the winter backcountry leader to stay informed of changing conditions and prepare for alternative plans if deteriorating avalanche conditions are taking place.



Pre-Trip Planning

The first step in organizing a winter backcountry outing involves basic pre-trip planning. This planning will enable the winter backcountry leader to determine the suitability of the trip for varying participant abilities, and ensure that the terrain and objectives are appropriate.

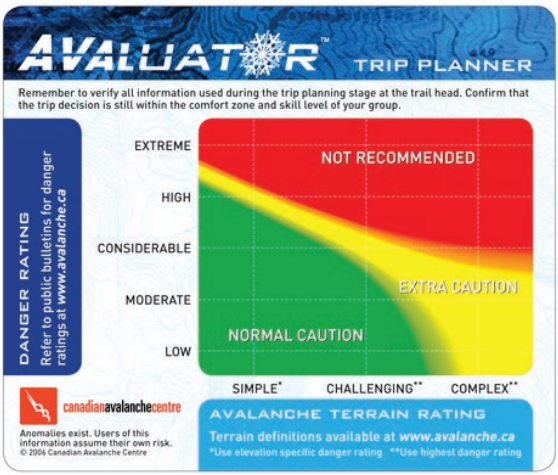
At this stage, the winter backcountry leader may consider using the Avalanche Canada Trip Planning Form and Checklist to start compiling potential trip information on to one document. This form would also include participant information once the planning process has progressed to where participants are signing up for the outing.



Copies of these and any other forms in this book can be found at www.alpineclubofcanada.ca/forms

AVALUATOR TRIP PLANNER

One tool that the winter backcountry leader may find useful at this stage of the trip planning process is the Avaluator Trip Planner. This tool allows the winter backcountry leader to visit the pre-trip planning section of the Avalanche Canada website and plot the Danger Rating against the Terrain Rating of the particular outing to determine if the trip requires normal caution, extra caution or is not recommended. As noted in the previous section, monitoring the avalanche forecast may see a change in the danger rating and hence may change the caution level suggested by the trip planner.



ESTABLISHING TRIP OBJECTIVES

Establishing clear trip objectives early in the planning process will enable the winter backcountry leader to choose the most suitable route for the outing. It will determine necessary participant prerequisites, equipment requirements, participant-to-leader ratios, and overall feasibility.

Common winter backcountry outing objectives may include:

- Skiing
- Peak ascents
- Traverses
- Loops
- Introducing first-time winter travellers to day touring or overnight travel
- Coaching basic movement (i.e. ski) skills
- Educating introductory companion rescue skills
- Continued development for intermediate winter travellers
- Team work and trust building

SELECTING A BACKCOUNTRY TRIP

Based on the established objectives for the winter backcountry outing, the winter backcountry leader can then select the most ideal route for the trip. The winter backcountry leader would consider the following criteria in their trip selection:

- Terrain Rating of the trip
- Current and forecast avalanche hazard
- Weather forecast
- Popularity of the trip (may determine group size)
- Identify a Plan B in the event avalanche and or weather conditions suggest that Plan A may be unsafe

PERMIT REQUIREMENTS

Many provincial and national parks require user permits, and in some instances activity permits may also be required. National parks also require backcountry overnight permits and fees. Prior to offering a winter backcountry outing, a winter backcountry leader must determine if any, and what, permits are required. They must also determine what, if any, stipulations the permit presents, and who will be responsible for obtaining the permit or permits prior to the outing.

SEASONAL/UNUSUAL CLOSURES, AND ACCESS ISSUES

Many popular backcountry areas are subject to seasonal or periodic closures for a variety of reasons (i.e. avalanche control). Often the closures may be related to ecological sensitivities or habitat areas (i.e. caribou). It is important that the winter backcountry leader research the proposed trip and ensure that no closures are in place.

Closures may be due to avalanche control along highway corridors. Unlike ski areas, such control work is to maintain highway safety and not backcountry safety. Highway closures are typical, and even common, through the mountains in western Canada and can include any road or artificial structure that may be affected by avalanches. The winter backcountry leader will monitor highway and parks bulletins for any anticipated closures due to avalanche control.

Glacier National Park (Rogers Pass) has Prohibited, Restricted and Unrestricted areas for the backcountry winter traveller. To help manage this, a Winter Permit System is in place to help protect the public from artillery fire, in Restricted areas, during periods of avalanche control. The winter backcountry leader planning a trip to Rogers Pass would be familiar with the regulations and processes of the Winter Permit System.

Information can be found on the Glacier National Park website at: www.pc.gc.ca/en/pn-np/bc/glacier/visit/hiver-winter/ski/.

Occasionally the entire route itself may not be closed, but the roads, trails or lands used to access the venue may be under a closure. In these instances, it is imperative that the winter backcountry leader research if alternative access points to the route exist. If no alternate access to the venue exists, the winter backcountry leader must select a different trip option.

Determining Participant Prerequisite Requirements

Once the objectives have been determined and the route selected, the winter backcountry leader should then determine what type of participants the trip is suitable for. Criteria such as age, experience and ability should be considered when determining participant requisite requirements. Some trips may not be suitable for specific participant demographics. Trips that involve Complex terrain ratings, for example, would not be advised for participants who are inexperienced. If considering an overnight trip, the winter back country leader would consider the length and difficulty of the trip and the targeted experience level. Participants new to overnight winter back country travel, for example, may be more suited to a shorter trip in simple terrain where successful skill development can take place without the urgency of a long day to complete the outing in the prescribed time.

Depending on the objectives of the outing and the terrain ratings, prerequisite experience may be required. Backcountry travel that is intermediate in nature requires a certain level of movement skills (i.e. touring and or downhill skiing), previous companion rescue training, or previous winter overnight experience.

As an aid to determining participant experience and prerequisites, the winter backcountry leader may rate their trip as either Novice, Intermediate, or Advanced. The following offers a general guide to classifying one's trip and should be consulted with any ACC section policy or guidelines that may exist.

For a novice trip, the target audience may be new or relatively inexperienced and may or may not have any avalanche training (depending on ACC section policy). As such, the terrain used would be low consequence and the trip may take the form of being more instructional to help develop the participants' skills. The length of the outing would be low or moderate to accommodate an anticipated slower pace.

The Intermediate trip may target participants who have participated on several outings and have at least AST 1 training (depending on ACC section trip policy). It is expected that these participants are more self-sufficient but are still gaining and refining their backcountry skills. The outing may include Challenging terrain with moderate distances.

An outing with an 'advanced' rating may be targeted for participants who have completed a certain number of intermediate trips and have AST training. Terrain may be Challenging and/or Complex with longer trip distances.

The winter backcountry leader should stipulate previous experience requirements for the proposed outing.

DEFINING LEADER TO PARTICIPANT RATIOS

An ideal setting is one where the participants are experienced, the avalanche hazard is low, the winter backcountry leader is experienced, the trip has no objective hazards, and the participants are focused. In situations where the participants or winter backcountry leader lack experience, the trip presents significant objective hazards, the trip rating is Complex, or the participants are minors, the ratio of participants to leader(s) should be decreased accordingly. A winter backcountry leader would strongly consider a co-leader to help manage the rear of the group (a sweep) with appropriate communications between them. Innocent delays due to equipment problems or blisters to the feet can be more easily managed with a co-leader who can readily communicate the information to the winter backcountry leader who can then take appropriate group management measures. The appropriate ratio between winter backcountry leaders and participants will vary depending on the objectives of the outing, the terrain rating of the trip, the experience level of the group, the age of the group, the experience level of the leader, and the leader's familiarity with the area.

A group ratio might be as low as 1:4 in complex terrain where

group management is critical, or as high as 1:8 in familiar and less complicated terrain where there is a wider safety margin. A group of more than about eight can become unwieldy due to the need to space out for avalanche safety and may be best handled by two parties with separate winter backcountry leaders.

LEADER FAMILIARITY WITH THE AREA

Whenever possible, winter backcountry leaders should avoid taking participants on trips they are not personally familiar with. In situations where the winter backcountry leader is facilitating an outing that is unfamiliar, they should decrease the participant ratio to accommodate for their lack of knowledge and experience in the area.

When taken from a decision-making perspective, familiarity can be a heuristic trap in that one can become complacent in familiar surroundings, thus missing or discounting important situational awareness observations. The winter backcountry leader recognizes this heuristic and uses familiarity as a means to remain informed of an outing's progress.

Familiarity with a trip allows for the winter backcountry leader to anticipate breaks and transitions, cruxes, and potential challenging areas for participants. Inexperienced participants may appreciate this knowledge. Familiarity also aids in time management of the outing, determining if the trip can be completed as planned or if there should be a turnaround point to ensure the group returns to the trailhead safely. Familiarity allows the winter backcountry leader to focus as much energy as practical to the group.

Developing Pre-Trip Communications

Initial communication between the winter backcountry leader and participants will begin to build rapport with participants and set the tone for the winter backcountry outing. Participants need to be acutely aware of the trip objectives, the trip and trip rating, the access, driving directions, what is expected of them, and what the winter backcountry leader will be responsible for. Early communication with participants also allows the winter backcountry leader to gain information specific to the participants, and modify the objectives slightly to best meet the participants' needs.

EQUIPMENT AND CLOTHING LIST

Participants may be responsible for ensuring that personal gear such as clothing, travel equipment (i.e. snowshoes, backcountry skis, skins, boots and poles, nordic equipment etc.), avalanche transceiver, shovel and probe, day pack, food and water, etc., are brought. The equipment may be dependent upon whether the outing is a day trip, multi-day trip, hut-based or winter camping. A sample list that could be provided to participants prior to their participation in a winter backcountry outing is:

PERSONAL EQUIPMENT

- Avalanche transceiver (digital)
- Shovel
- Probe
- Snow saw (optional)
- Travel equipment (touring skis and skins, boots, poles, or snowshoes, or nordic skis etc.)
- Ski crampons
- Sunglasses and or goggles
- Headlamp
- Lighter (or alternative fire starting device)
- Ski helmet
- Sunscreen
- Lip balm
- Day pack, minimum 30 litres so all equipment fits inside the pack (day trip)

- Small ensolite to sit on (optional)
- Water bottle, minimum 1 litre and/or thermos

» Personal first aid kit (including blister kit)
» Personal medications
» Compass (with clinometer) and altimeter (optional – in addition to the leader's navigation equipment)

CLOTHING

» Sun hat
» Toque
» Neck scarf (i.e. BUFF)
» Lightweight insulating bottoms
» Waterproof breathable shell jacket
» Waterproof breathable shell pants
» Lightweight synthetic or wool gloves
» Insulating gloves or mitts (two pair)
» Base layer
» Warm socks
» Insulating layer(s)
» Hand warmers

GROUP EQUIPMENT

» Group first aid kit
» Tarp or emergency shelter(s) able to accommodate all group members
» Emergency communication device
» Improvised rescue equipment
» Emergency fire starting kit
» Backpacking stove and pot (optional)
» Map (in addition to the leader's map)
» Repair kit suited to mode of travel (skis, snowshoes etc.)

WINTER CAMPING EQUIPMENT

- Stove and pots
- Stove board
- Eating utensils
- Cup and bowl
- Snow saw
- Sleeping pad
- Sleeping bag (rating depends on time of year and trip—typically -18° C for most winter camps)
- Toiletry kit
- Spare base layers
- Extra socks (two pair)
- Camp booties
- Four-season tent
- Large pack (60 to 70 litres)
- Heavier insulated parka (i.e. down coat)
- Spare batteries for headlamp and avalanche transceiver
- Lighters(s) or alternate fire starting method (i.e. strike anywhere matches)
- Candle

On overnight winter camping trips, more equipment is required. It becomes a balance between being comfortable and carrying a burdensome pack. The winter backcountry leader may offer the following advice to participants: Take what you need, and need what you take.

Layering

Appropriate layering ensures the comfort of the winter backcountry leader, and of the participants throughout the day in a multitude of conditions. Appropriate layering will enable participants to stay warm when it is cool, and avoid overheating when it is warm. Layers are commonly separated into three categories—a base layer that sits next to the skin, a mid layer that traps in heat, and an outer layer that protects from the elements such as wind, rain and snow.

CHARACTERISTICS OF BASE LAYERS:

- Wick moisture away from the skin
- Lightweight
- Close fitting
- Have flat seams to avoid chaffing
- Constructed of a material that dries quickly and is breathable
- Common base layer fabrics include synthetics such as polyester or natural materials such as wool

Cotton articles should be avoided in climates that are cool and/or damp. This includes cotton base, mid, and outer layers. That said, on an overnight hut-based trip, a cotton or cotton blend shirt or pants can make one's hut stay more comfortable.

CHARACTERISTICS OF MID LAYERS:

- Lightweight
- Air permeable
- Compressible and packable
- Provide insulation and warmth
- Fit comfortably over a base layer, but still fit close to the body
- Common mid layer materials include synthetics such as fleece and lofts, and down

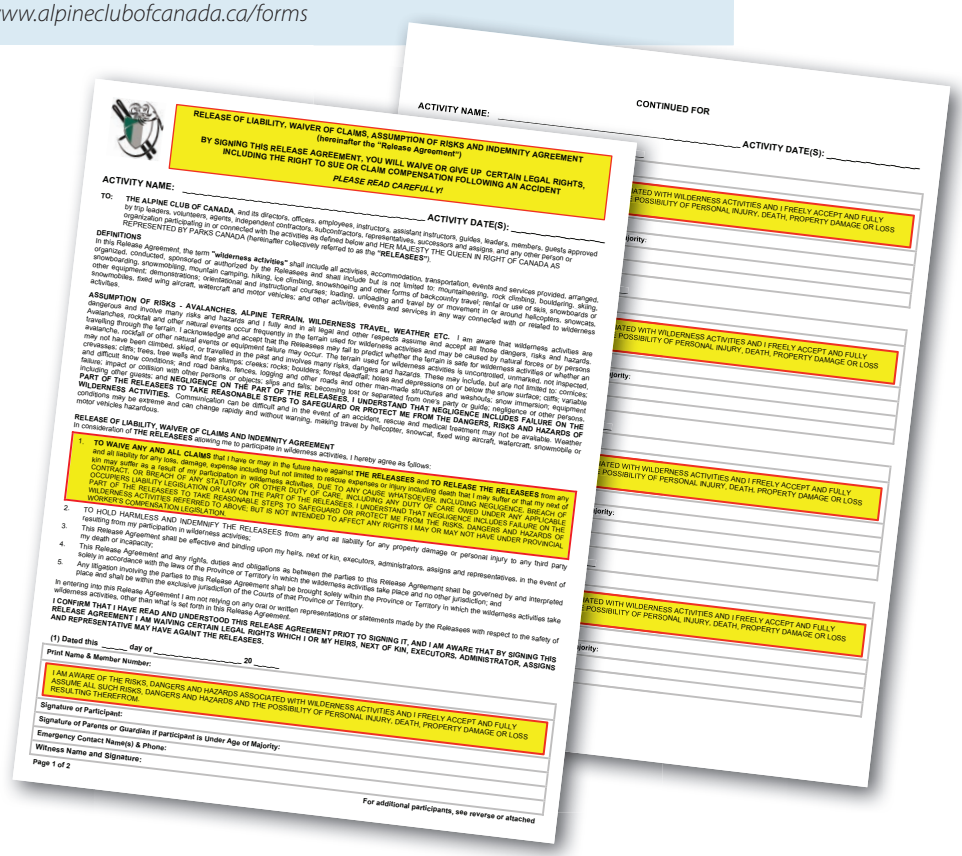
CHARACTERISTICS OF OUTER LAYERS:

- Block the wind
- Block precipitation
- Breathable
- Fit comfortably over base and insulating layers
- Allow freedom of movement
- Common outer layer materials include: breathable hard shell nylon materials, and soft-shell nylon materials

Waiver Documents

Waivers are commonly used to transfer responsibility and highlight risks associated with winter backcountry activities that may involve travel in or through avalanche terrain. It is recommended best practice to provide participants with waivers in advance of the winter backcountry outing so they can familiarize themselves with the risks specific to their participation, and ensure they are comfortable and accepting of them.

Participant waivers should be signed in blue or black ink, in person, at the commencement of the winter outing. Providing the waivers as part of the participant pre-trip communication allows participants to review the waiver, and choose not to participate in the activities without any element of duress. Copies of these and any other forms in this book can be found at www.alpineclubofcanada.ca/forms



RELEASE OF LIABILITY, WAIVER OF CLAIMS, ASSUMPTION OF RISKS AND INDEMNITY AGREEMENT
(hereinafter the "Release Agreement")
BY SIGNING THIS RELEASE AGREEMENT, YOU WILL WAIVE OR GIVE UP CERTAIN LEGAL RIGHTS, INCLUDING THE RIGHT TO SUE OR CLAIM COMPENSATION FOLLOWING AN ACCIDENT
PLEASE READ CAREFULLY!

ACTIVITY NAME: _____ ACTIVITY DATE(S): _____

TO: THE ALPINE CLUB OF CANADA, and its directors, officers, employees, instructors, assistant instructors, guides, leader's, members, guests approved by trip leaders, volunteers, agents, independent contractors, subcontractors, representatives, successors and assigns, and any other person or organization participating in or connected with the activities as defined below and HER MAJESTY THE QUEEN IN RIGHT OF CANADA AS REPRESENTED BY PARKS CANADA (hereinafter collectively referred to as the "RELEASEES").

DEFINITIONS
In this Release Agreement, the term "wilderness activities" shall include all activities, accommodation, transportation, events and services provided, arranged, organized, conducted, sponsored or authorized by the Releasees and shall include but is not limited to: mountaineering, rock climbing, bouldering, skiing, snowboarding, snowmobiling, mountain camping, hiking, ice climbing, snowshoeing and other forms of backcountry travel, rental or use of skis, snowboards or other equipment, demonstrations, orientational and instructional courses; loading, unloading and travel by or movement in or around helicopters, snowcats, snowmobiles, fixed wing aircraft, watercraft and motor vehicles; and other activities, events and services in any way connected with or related to wilderness activities.

ASSUMPTION OF RISKS - AVALANCHES, ALPINE TERRAIN, WILDERNESS TRAVEL, WEATHER ETC. I am aware that wilderness activities are dangerous and involve many risks and hazards and I fully and in all legal and other respects assume and accept all those dangers, risks and hazards. Avalanches, rockfall and other natural events occur frequently in the terrain used for wilderness activities and may be caused by natural forces or by persons travelling through the terrain. I acknowledge and accept that the Releasees may fail to predict whether the terrain is safe for wilderness activities or whether an avalanche, rockfall or other natural events or equipment failure may occur. The terrain used for wilderness activities is uncontrolled, unmarked, not inspected, may not have been climbed, skied or travelled in the past and involves many risks, dangers and hazards. Thaw may include, but are not limited to: crevasses; cliffs; trees, tree wells and tree stumps; creeks; rocks; boulders; forest debris; holes and depressions on or below the snow surface; cliffs; variable and difficult snow conditions; and road banks, fences, lodging and other roads and other man-made structures and washouts; snow immersion; equipment failure; impact or collision with other persons or objects; slips and falls; becoming lost or separated from one's party or guide; negligence of other persons, including other guests; and NEGLIGENCE ON THE PART OF THE RELEASEES. I UNDERSTAND THAT NEGLIGENCE INCLUDES FAILURE ON THE PART OF THE RELEASEES TO TAKE REASONABLE STEPS TO SAFEGUARD OR PROTECT ME FROM THE RISKS, DANGERS AND HAZARDS OF WILDERNESS ACTIVITIES. Communication can be difficult and in the event of an accident, rescue and medical treatment may not be available. Weather conditions may be expense and can change rapidly and without warning, making travel by helicopter, snowcat, fixed wing aircraft, watercraft, snowmobile or motor vehicles hazardous.

RELEASE OF LIABILITY, WAIVER OF CLAIMS AND INDEMNITY AGREEMENT
In consideration of THE RELEASEES allowing me to participate in wilderness activities, I hereby agree as follows:

1. TO WAIVE ANY AND ALL CLAIMS that I have or may in the future have against THE RELEASEES and TO RELEASE THE RELEASEES from any and all liability for any loss, damage, expense including but not limited to rescue expenses or injury including death that I may suffer or that my next of kin may suffer as a result of my participation in wilderness activities, DUE TO ANY CAUSE WHATSOEVER, INCLUDING NEGLIGENCE, BREACH OF CONTRACT, OR BREACH OF ANY STATUTORY OR OTHER DUTY OF CARE, INCLUDING ANY DUTY OF CARE OWED UNDER ANY APPLICABLE OCCUPIERS LIABILITY LEGISLATION OR LAW ON THE PART OF THE RELEASEES. I UNDERSTAND THAT NEGLIGENCE INCLUDES FAILURE ON THE PART OF THE RELEASEES TO TAKE REASONABLE STEPS TO SAFEGUARD OR PROTECT ME FROM THE RISKS, DANGERS AND HAZARDS OF WILDERNESS ACTIVITIES REFERRED TO ABOVE, BUT IS NOT INTENDED TO AFFECT ANY RIGHTS I MAY OR MAY NOT HAVE UNDER PROVINCIAL WORKER'S COMPENSATION LEGISLATION.
2. TO HOLD HARMLESS AND INDEMNIFY THE RELEASEES from any and all liability for any property damage or personal injury to any third party resulting from my participation in wilderness activities;
3. This Release Agreement shall be effective and binding upon my heirs, next of kin, executors, administrators, assigns and representatives. In the event of my death or incapacity;
4. This Release Agreement and any rights, duties and obligations as between the parties to this Release Agreement shall be governed by and interpreted solely in accordance with the laws of the Province or Territory in which the wilderness activities take place and no other jurisdiction; and
5. Any litigation involving the parties to this Release Agreement shall be brought solely within the Province or Territory in which the wilderness activities take place and shall be within the exclusive jurisdiction of the Courts of that Province or Territory.

In entering into this Release Agreement I am not relying on any oral or written representations or statements made by the Releasees with respect to the safety of wilderness activities, other than what is set forth in this Release Agreement.

I CONFIRM THAT I HAVE READ AND UNDERSTOOD THIS RELEASE AGREEMENT PRIOT TO SIGNING IT, AND I AM AWARE THAT BY SIGNING THIS RELEASE AGREEMENT I AM WAIVING CERTAIN LEGAL RIGHTS WHICH I OR MY HEIRS, NEXT OF KIN, EXECUTORS, ADMINISTRATOR, ASSIGNS AND REPRESENTATIVE MAY HAVE AGAINT THE RELEASEES.

(1) Dated this _____ day of _____, 20 ____

Print Name & Member Number:

I AM AWARE OF THE RISKS, DANGERS AND HAZARDS ASSOCIATED WITH WILDERNESS ACTIVITIES AND I FREELY ACCEPT AND FULLY ASSUME ALL SUCH RISKS, DANGERS AND HAZARDS AND THE POSSIBILITY OF PERSONAL INJURY, DEATH, PROPERTY DAMAGE OR LOSS RESULTING THEREFROM.

Signature of Participant:

Signature of Parents or Guardian if participant is Under Age of Majority:

Emergency Contact Name(s) & Phone:

Witness Name and Signature:

Page 1 of 2

For additional participants, see reverse or attached

ACTIVITY NAME: _____ CONTINUED FOR _____ ACTIVITY DATE(S): _____

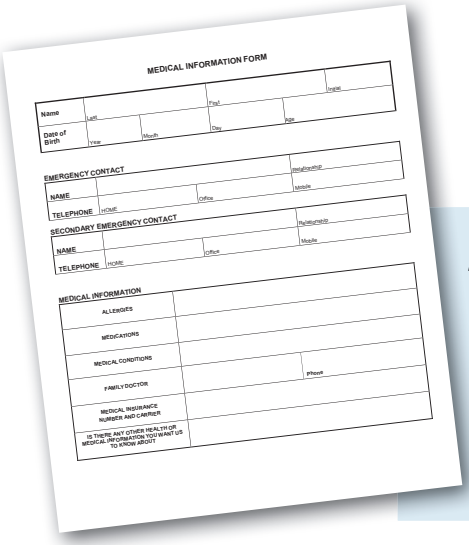
I AM AWARE OF THE RISKS, DANGERS AND HAZARDS ASSOCIATED WITH WILDERNESS ACTIVITIES AND I FREELY ACCEPT AND FULLY ASSUME ALL SUCH RISKS, DANGERS AND HAZARDS AND THE POSSIBILITY OF PERSONAL INJURY, DEATH, PROPERTY DAMAGE OR LOSS

Signature of Participant:

Signature of Parents or Guardian if participant is Under Age of Majority:

MEDICAL FORMS

Medical forms enable the winter backcountry leader to familiarize themselves with pre-existing injuries, medical conditions, allergies, and any medications participants may have or require. It is recommended that this information be collected from the participants prior to the outing and reviewed by the winter backcountry leader to ensure the outing is suitable for all members of the group. If medications are required by participants for allergies or pre-existing medical conditions, this provides the winter backcountry leader with the opportunity to remind participants to bring their medications on the trip. The winter backcountry leader may consider transferring the pertinent information to the Avalanche Canada Trip Planning Form or form used by the ACC section. Occasionally a participant may innocently omit disclosing pertinent medical information. For this reason, it is recommended that the winter backcountry leader check in with participants at the trail head prior to departure as a means to double check if any medical information has not been disclosed.


MEDICAL INFORMATION FORM

Name — Last — First — Initial

Date of Birth — Year — Month — Day — Age

EMERGENCY CONTACT — Relationship

NAME — HOME — Office — Mobile

TELEPHONE

SECONDARY EMERGENCY CONTACT — Relationship

NAME — HOME — Office — Mobile

TELEPHONE

MEDICAL INFORMATION

ALLERGIES

MEDICATIONS

MEDICAL CONDITIONS

FAMILY DOCTOR — Phone

MEDICAL INSURANCE NUMBER AND CARRIER

IS THERE ANY OTHER HEALTH OR MEDICAL INFORMATION YOU WANT US TO KNOW ABOUT

Participant medical information should be sourced prior to the trip, however the forms should be accessible throughout the outing for reference by the winter backcountry leader should a medical incident occur. Personal medical information is subject to Freedom of Information and Privacy laws and must be kept strictly confidential and destroyed following an outing. Copies of these and any other forms in this book can be found at www.alpineclubofcanada.ca/forms

CONTINGENCY PLANS

Participants should also be informed of any potential contingency plans. The winter backcountry leader should ensure they have contact information for all participants, in the event last minute communication with participants is needed the morning of the trip. Participants should also be provided with a phone number, or other means of contacting the winter backcountry leader on the day of the outing.

Trips with Minors (participants under the age of majority)

It is possible an outing may be designed for, include, or attract the participation of youth (participants under the age of majority). Travelling with minors requires certain and specific procedures. Some of these are policy within The Alpine Club of Canada (ACC), while other policies have been implemented by external land managers – i.e. national parks.

The winter backcountry leader will be familiar with the ***ACC Policy for persons under the age of majority***. A PDF copy can be found on this webpage: www.alpineclubofcanada.ca/adventures/trip-administration/.

This policy describes the process of waiver (assumption of risk administration), information and trip requirements as well as terrain limitations. These may include strategies beyond the typical planning process such as the following examples from the ACC policy for persons under the age of majority:

» Reduced winter backcountry leader-to-participant ratios
» Detailed trip plan forwarded to the parent(s) or guardian
» Permission forms together with the required waiver forms
» Encourage parental participation if practical / possible
» Compliance of Parks Canada policies with respect to winter travel
» Emergency plans and communications

If considering an outing in a national park, the winter backcountry leader will be familiar with Parks Canada Custodial Groups Policy: www.pc.gc.ca/en/pn-np/mtn/securiteenmontagne-mountainsafety/gardiens-custodial.

This policy refers to the Avalanche Terrain Evaluation Scale (ATES) that was developed as a result of a tragic incident involving a custodial group travelling in avalanche terrain in 2003. Custodial groups are limited to simple terrain unless the winter backcountry leader is an ACMG or IFMGA ski or mountain guide (with appropriate permits). In this instance, it may be possible, under certain conditions, to travel Challenging terrain. In outings where club leadership is used (i.e. no ACMG or IFMGA ski our mountain guide), travel is limited to Simple terrain unless the danger is rated as high or extreme, in which case it is recommended backcountry travel be avoided. Custodial groups are not permitted to travel in Complex terrain under any conditions.

Parks Canada policy has been adopted by the ACC and is considered mandatory.

References and Further Reading

The Alpine Club of Canada (n.d.). The Alpine Club of Canada: policy for persons under the age of majority webpage: www.alpineclubofcanada.ca/adventures/trip-administration/.

Government of Canada (n.d.). Parks Canada – custodial groups www.pc.gc.ca/en/pn-np/mtn/securiteenmontagne-mountainsafety/gardiens-custodial.

Jackson, J., & Heshka, J. (2011). ***Managing risk; systems planning for outdoor adventure programs***. Palmer Rapids, ON: Direct Bearing Incorporated.

Jamieson, B. (2011). ***Backcountry avalanche awareness*** (8th ed.). Revelstoke, B.C.: Canadian Avalanche Association.

Priest, S., & Gass, M. (2005). ***Effective leadership in adventure programming*** (Second ed.). Champaign, Il: Human Kinetics.

Prouty, D., Panicucci, J., & Collinson, R. (Eds.). (2007). ***Adventure education theory and application***. Champaign, Il: Human Kineitcs.

Scott, B., Pham, H. (Eds.). (2015). ***ACC Ottawa Trip Leader Guidelines*** http://alpineclubottawa.ca/wp-content/uploads/2015/04/ACC-Ottawa-Trip-Leader-Guidelines-v1.01.pdf.

Stremba, B., & Bissoon, C. A. (Eds.). (2009). ***Teaching adventure education theory***. Windsor, ON: Human Kinetics.

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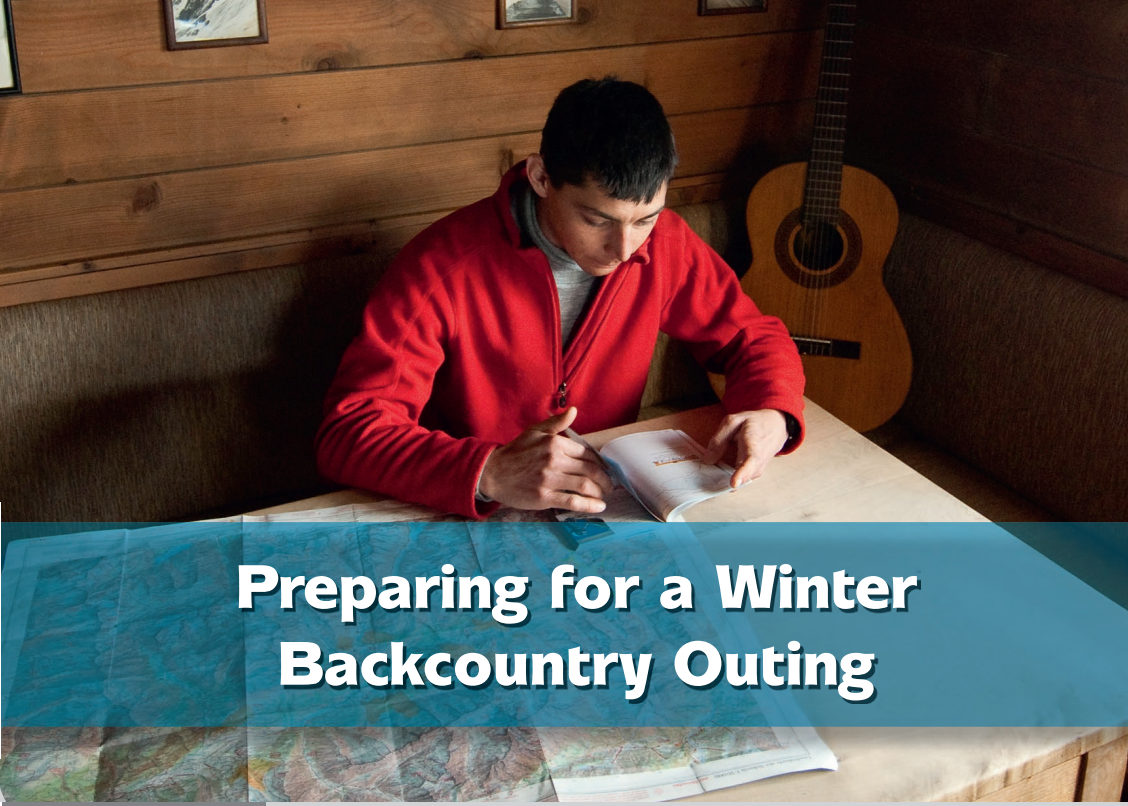


Preparing for a Winter Backcountry Outing

Following completion of the design phase, it is important to then communicate with participants and prepare for the winter backcountry outing. Participants who possess a clear understanding of the trip logistics, activities and expectations will be far better equipped to achieve the outing objectives. In this chapter we will explore the key information that needs to be conveyed to participants, the requisite weather and avalanche related information that the winter backcountry leader should research, and the required decision making process as to whether or not to proceed with the outing based on that research.

Coordinating and Communicating with Participants

Early in the preparation stage it is important to coordinate and communicate with participants. This provides them with sufficient time to ensure the trip is suitable for their skill level, they meet any prerequisite requirements, and they are capable of appropriately equipping themselves for the outing and arranging transportation to the designated meeting place. There are many ways to communicate to participants, however email is one of the simplest methods to ensure all participants receive consistent and accurate information. The winter backcountry leader may offer the opportunity for direct telephone conversation with any participant who is either new to the activity or who has any specific questions that might be challenging to describe via email. Often such phone conversations can clarify things such as prerequisites, specific equipment, or outing difficulty fairly quickly and with fewer assumptions. Information that must be communicated to participants includes:

- Meeting time
- Meeting location (parking / trailhead, carpool locations, or restaurant/coffee shop, etc.)
- Winter backcountry leader contact information (cell phone number, email)
- Level of risk specific to the activity (trip description, ATES terrain rating if available)
- Prerequisite requirements: winter travel experience, skiing ability (for winter ski trips), backcountry camping experience (for overnight trips) etc.
- Clothing requirements for the outing (include clothing list for participants)
- Equipment requirements for the outing (include equipment list for participants)
- Contingency plans for the outing (alternate trips, local ski hill, trip cancellation)

Weather and Avalanche Gathering Information

One of the greatest factors in determining the success of a winter backcountry outing, and the level of risk the outing will present to participants, is the weather and avalanche conditions. Cool, dry and calm conditions are by far preferable to warm, wet and windy days when on a winter backcountry outing. Being able to anticipate weather and avalanche occurrences and changes for the duration of the outing enables the winter backcountry leader to adapt the objectives, location, or timing of the outing to increase participant enjoyment and success while also decreasing the level of risk.

The winter backcountry leader may hear the terms hazard and danger used to describe the same thing. For practical purposes, these terms can be used interchangeably.

RESOURCES FOR GATHERING WEATHER INFORMATION

Current, short-range, and long-range weather forecasts can be quickly accessed online through a variety of sources. During periods of stable and predictable weather, these forecasts tend to be quite accurate and highly reliable. However, during periods of instability or changing weather, the forecasts and modeling upon which they are based become less reliable and the winter backcountry leader may need to complete further research to obtain an accurate depiction of the weather systems that will affect the outing.

Resources for Obtaining a Basic Weather Forecast:

- Environment Canada (radar, satellite and jet stream mapping) www.weather.gc.ca/
- Avalanche Canada Mountain Weather Forecast www.avalanche.ca/weather/forecast
- Snow-Forecast.com www.snow-forecast.com/
- The Weather Network www.theweathernetwork.ca
- Accuweather www.accuweather.com
- Spot Weather Forecast www.spotwx.com
- Televised weather stations and Weather Radio Canada: frequency (MHz) 162.40
- Ski resort and highway web cams
- Parks Canada Banff, Yoho and Kootenay weather stations http://avalanche.pc.gc.ca/station-eng.aspx?d=TODAY.

Resources for obtaining a more detailed understanding of the weather systems:

- Environment Canada https://www.weather.gc.ca/map_e.html?layers=radar&zoom=3&center=46.08983504%2C-74.09278312

Understanding Basic Weather

Weather is a combination of atmospheric pressure, atmospheric humidity, air temperature, elevation and wind. These variables combine to create localized weather systems, widespread weather patterns, and changes in weather conditions. In the context of preparing for a winter backcountry outing, it is crucial that the winter backcountry leader explore the weather forecast, and at times complete further research to obtain a solid understanding of the anticipated weather for the day. As we will explore in another section in this chapter, not only does weather play a role in the comfort of the day for participants, but it also plays an important role in affecting avalanche hazard and conditions. Widespread weather systems are typically easy to predict, however localized weather can at times be more challenging. Understanding if the weather will be poor for an entire day, or just for brief periods during the day, will enable the winter backcountry leader to determine if they should proceed with the trip, reschedule, or implement contingency plans.

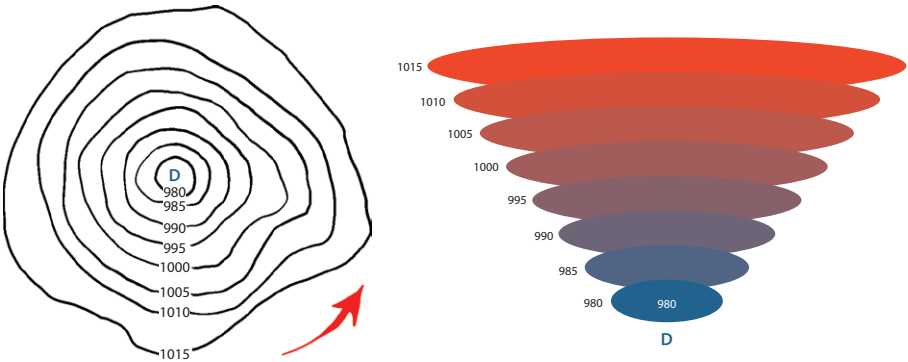
ATMOSPHERIC PRESSURE

Atmospheric pressure is essentially the measurement of air density and is commonly measured in either hectopascals, kilopascals or millibars. Atmospheric pressure gives an overall sense of the widespread weather systems throughout a region, and is commonly viewed on a large-scale pressure map that enables the viewer to identify areas of both high and low pressure.

Jet streams are narrow bands of strong wind high in the atmosphere that steer weather systems and transfer heat and moisture around the globe. The local weather that we experience is related to high and low pressure systems and fronts, however, jet streams high in the atmosphere impact their movement and impact their trajectory and speed.

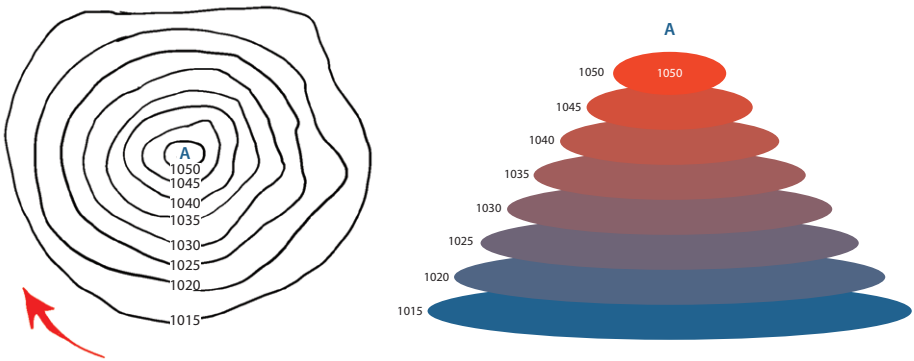
As air warms it rises and expands creating lower pressure at the earth's surface. The continual upward movement of the air mass can create strong winds and overall instability of the pressure centre. Warm air tends to be more humid and as it rises and cools, precipitation often develops. During the summer months this precipitation comes in the form of rain and thunderstorms, and in the winter months it comes in the form of snow. A low pressure system will show increasing pressure outward when viewed on a large scale pressure map.

As air cools it contracts creating higher pressure at the earth's surface. A high pressure system draws



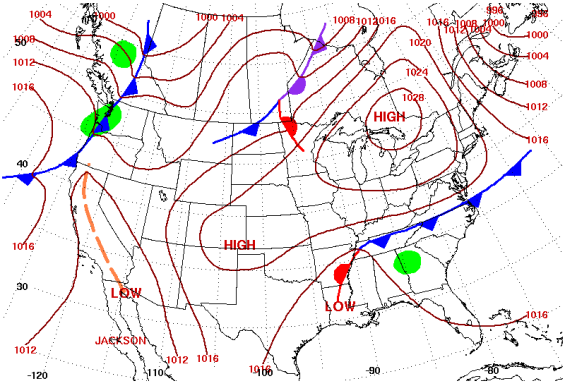
Low Pressure System

air downwards, often creating calm wind conditions and overall stability of the air mass. Cool air tends to be dry and lack humidity, therefore, a high pressure system is typically not characterized by notable precipitation. A high pressure system in the summer usually offers calm, comfortable climbing conditions, whereas in the winter a high pressure system may bring with it extreme cold and clear conditions. A high pressure system will show decreasing pressure outward when viewed on a large scale pressure map.



High Pressure System

Decreasing pressure often signifies worsening weather conditions, whereas rising atmospheric pressure tends to indicate improving conditions. A rapid change in the pressure often signifies a shorter but more intense shift in the weather, whereas a slow and steady change in the pressure typically indicates a change that will last for an extended period of time. Changes in the atmospheric pressure are typically characterized by both ground and high level winds.



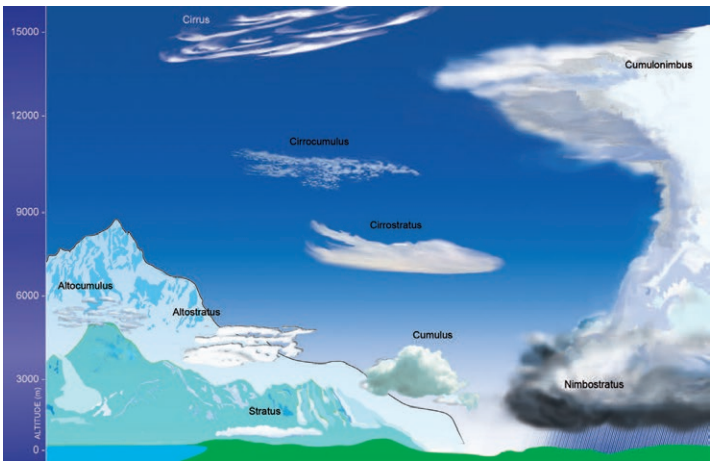
Surface Weather Map at 7:00 A.M. E.S.T.

Coriolis Effect: as pressure systems travel across the earth they do not move in straight lines. The rotation of the earth, the earth's strata, and high level atmosphere winds, such as jet streams, cause rotation in the air mass, and weather systems that are circulating in nature.

The location where two air masses converge is referred to as a front. Fronts are often depicted on weather maps with modeling that illustrates the anticipated trajectory and speed of the front. Cold fronts are typically shown in blue to delineate where a cold air mass is replacing a warm air mass, whereas warm fronts are typically shown in red to define warm air replacing cold air.

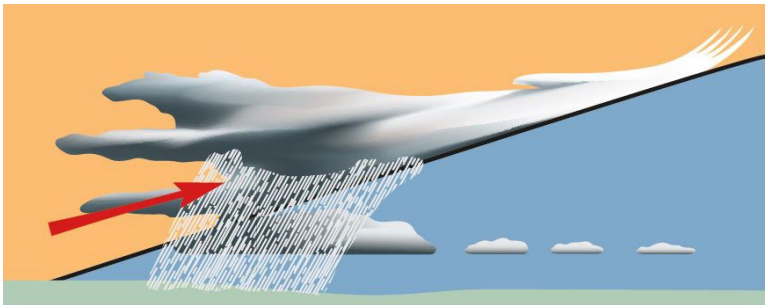
INTERPRETING CLOUDS

The ability to identify and understand cloud formations will assist the winter backcountry leader in identifying changes in the weather prior to their winter backcountry outing, as well as throughout the day. Clouds are commonly categorized as either cumulus, which indicate a vertical development, or stratus, which are clouds that form horizontally.

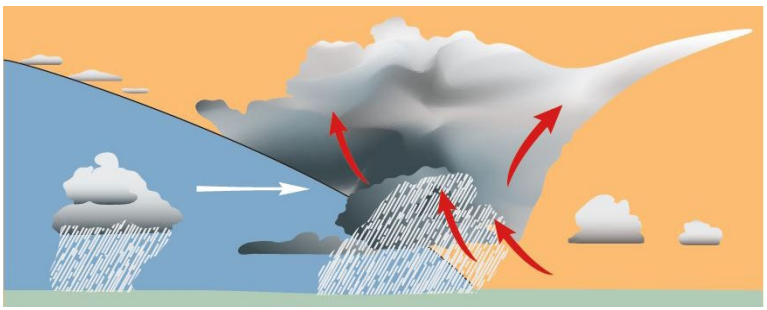


Clouds between 2,000-6,000 metres are commonly given the prefix alto whereas clouds above 6,000 metres are coined cirrus.

Different cloud formations indicate the arrival of different weather systems. High cirrus clouds will be visible prior to the arrival of a low pressure system or warm front. Cirrus clouds will commonly be visible before the weather changes are felt at a ground level. Initial cirrus cloud formation will precede the ground level weather changes because the warm air mass moving in is less dense and will overlay the cooler air mass. The initial high cirrus clouds are commonly followed by cirrostratus clouds, altostratus clouds, and eventually stratus, and nimbostratus clouds, which commonly bring rain or snow events.



Conversely, the arrival of a high pressure system or cold front is often characterized by a decrease in visibility and the development of alto stratus and cumulus clouds in a chain-like configuration. Weather changes at ground level are often felt quite quickly as the cold air mass pushes the warm air mass on top of it. This causes rapid cooling of the warm air as it gains elevation and nearly immediate precipitation.



Mountain Weather and Snow Climates

It would be easy if the effects of weather were constant from the coastal regions to continental regions in that temperature and snowfall would be similar. We know, however that this is not the case and as such there are three general snow climates the winter backcountry leader should be aware of: Maritime, Transitional and Continental.

In a Maritime snow climate (i.e. the Coast ranges), one would expect milder temperatures accompanied with heavy precipitation (typically snowfall). Although the maritime climate can experience cold arctic outbreaks, these are relatively infrequent and hence the mild temperatures tend to promote a weak (constructive) temperature gradient within the snowpack. Storm snow is often the instability to be aware of which is often short lived, again due to the relatively warm temperatures.

In a Continental snowpack (i.e. the Rockies), the winter backcountry leader would experience a relatively shallow snowpack that is influenced by colder air temperatures. The shallow snowpack is a result of fewer snowfall events (or fewer significant snowfall events) accompanied by longer periods of no precipitation. The result of this is a strong (destructive) temperature gradient within the snowpack that promotes faceting resulting in persistent weak layers. The periods between precipitation events also promote surface re-crystalization in the form of surface facets together with the development of surface hoar (clear cool nights). While not a problem on the surface, once buried these become problem layers and can last for several weeks or even months (persistent weak layers).

With a shallow snowpack and cold temperatures, the basal layer

Snowpack temperatures: A strong temperature gradient is one where the change in temperature within the snowpack is greater than 10° C every 10 cm. A weak temperature gradient is one where the change in temperature within the snowpack is less than 10° C every 10 cm.

can also experience re-crystalization into a form described as depth hoar. Depth hoar is a basal layer and would not be found in the middle of a snowpack (for example). Depth hoar differs from surface hoar in that it develops at the bottom of the snowpack as previously described. It is also cup shaped in appearance (upside down three dimensional cup) versus the two dimensional feather-like appearance of surface hoar (on the surface or preserved elsewhere in the snowpack when buried). Depth hoar would also be considered a persistent weak layer.

A transitional snow climate can experience weather patterns similar to both coastal and continental. There may be periods of milder temperatures and heavier precipitation together with cold outbreaks. As a result, this transitional zone may not have the 'typical' problems of a continental snowpack, such as a shallow snow, yet may have persistent weak layers within the snowpack due to prolonged periods of little to no precipitation.

WEATHER FACTORS AFFECTING AVALANCHE CONDITIONS

There are three primary weather factors that affect avalanche hazard the winter backcountry leader should be aware of—temperature, precipitation and wind. Monitoring these conditions prior to the outing and during the outing will inform the winter backcountry leader of changing conditions and how that may affect the avalanche hazard.

The BIG THREE weather factors affecting avalanche hazard are: Temperature, Precipitation, and Wind

Temperature

Although prolonged cold temperatures can have an effect on the snow with surface and near-surface facet development, it is a rapid rise in temperature that would result in an increase in the avalanche danger rating. This is due to reduced cohesion between snow crystals (most often associated in spring conditions) as well as an increase in load on potentially weak buried layers. Warm temperatures also facilitate snow settlement and the onset of slab development. While monitoring the forecast, the winter backcountry leader monitors the temperature, the forecast hazard rating as well as the terrain for the proposed outing. In spring conditions, it is not uncommon to have a hazard forecast where the Below Treeline (BTL) hazard rating is higher than in the Treeline (TL) or Alpine (ALP). As always, spring trips should start early and finish early due to the frequent rapid rise in temperatures.

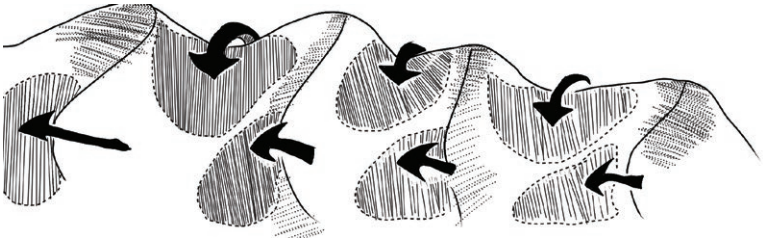
Precipitation

Precipitation can be in the form of rain or snow. If there is rain in the forecast, or it is experienced on an outing, not only will the skiing conditions be more challenging, but the snowpack will be experiencing a rapid load (in free water) that can quickly stress weaker layers. The result is a rapid increase in the hazard rating. Precipitation in the form of snow, although often associated with fresh powder and fun outings can see an increase in the hazard rating if too much snow accumulates too fast. That is, the winter backcountry leader would monitor the rate of snow accumulation as a means of assessing the changing hazard ratings. Generally, 30 cm of snow over 24 to 36 hours is often considered a rapid load resulting in an increase in the hazard rating. The winter backcountry leader will monitor the precipitation both as a forecast (pre-trip) as well as in the field to determine if conditions are deteriorating and alternatives need to be considered.

Wind

Not only does wind contribute to cooler feeling temperatures (wind chill), it has the ability to transport snow from the windward side of a slope to the leeward side of a slope creating a wind slab. At best, wind slabs are challenging to ski due to their breakable nature. At worst, a wind slab creates hazardous avalanche conditions due the propagation potential of the slab by the trigger – which can be a member of the group. With moderate winds (26

to 40 km/h or 8 – 11 m/s), wind can deposit up to six times the amount of snow that is falling on a lee slope. That is, if there were 5 cm of available snow to be transported on the windward slope, it could result in 30 cm on the lee feature often in the form of a much stiffer snowpack, or slab. Wind, of course, can also create cornices creating potential overhead hazard if underneath, and fall hazard if standing on one. The winter backcountry leader will monitor the wind, both forecast and in the field, to determine changing hazard conditions. The effects of wind are often underestimated if not neglected all together.



Persistent Weak Layers

Persistent weak layers (PWLs) are certain grain forms that maintain their shape within the snowpack for long periods of time and are associated with snowpack weaknesses. That is, they take much longer to break down and bond to adjacent layers than is commonly associated with new snow (stellars). Examples of grains that, once buried, may be considered persistent weak layers include surface hoar, facets, depth hoar, and crusts (often with faceting above and below the crust). Such grains may be a concern for weeks, months, or even the entirety of the season. The winter backcountry leader would monitor the avalanche bulletins from the start of the season as a means to keep track of PWLs – that is, identify where they are (elevation and around the compass), and how deep they are buried. It is easy to forget about a deep PWL (such as an early season rain crust) that has been unreactive for some time only to awaken in the spring, for example, due to additional load and warming

temperatures. When assessing a PWL, pay attention to the shear quality while performing snowpack tests. That is, if tests produce sudden planar or sudden collapse results, extra caution with terrain selection should be taken.

Pre-Trip Risk Assessment

Prior to proceeding with a winter backcountry outing it is important to complete a pre-trip risk assessment to determine the viability of the outing. The pre-trip risk assessment involves examining the weather forecast and data, the current weather conditions, the objectives of the outing, and the knowledge and experience of the winter backcountry leader and the group to determine a course of action. Periods of predictable and desirable weather matched with stable avalanche hazard conditions, little significant change in weather, realistic objectives, and appropriate leader and group knowledge would demonstrate a likelihood to proceed with the trip as planned. Periods of weather instability, poor existing conditions, rising avalanche hazard, unrealistic objectives, or a lack of knowledge on the part of the winter backcountry leader or the group might necessitate a re-examination of the anticipated outing and adjustment to the itinerary.

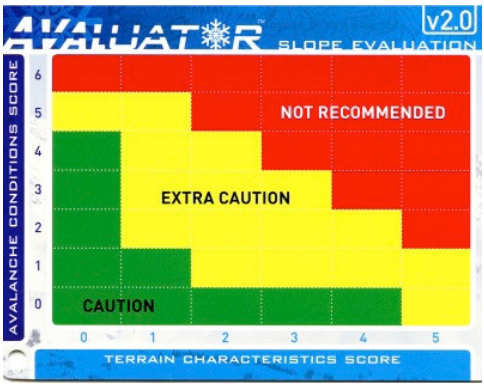
A winter backcountry leader is responsible for ensuring that risks are well managed and appropriate for the participants throughout the trip. When completing the pre-trip risk assessment and calculating the risks, it is important

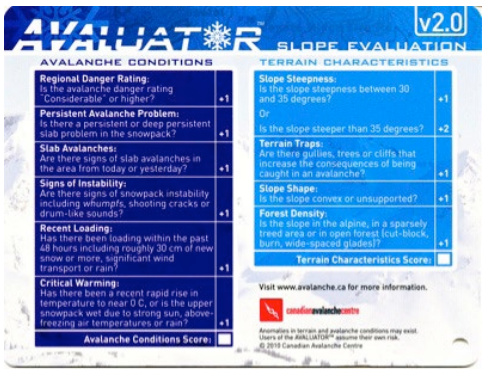
for the winter backcountry leader to determine their course of action based on their participants' abilities and risk tolerance. While the leader themselves may personally be comfortable proceeding with a winter backcountry outing during periods of weather instability, proceeding with the outing in less than optimal conditions may be beyond the comfort level of the participants.

WEATHER MONITORING DURING A WINTER BACKCOUNTRY OUTING

Even during periods of stable weather, winter backcountry leaders should routinely monitor the weather for changing conditions throughout the day. Key elements to monitor throughout the day would include notable changes in the wind strength and direction, significant changes in temperature, significant cloud formation, together with the type and rate of precipitation.

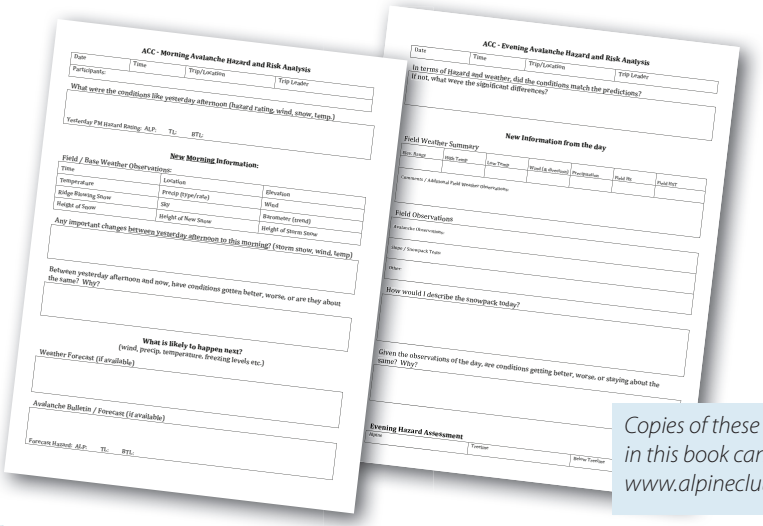
One tool to assist the winter backcountry leader in making informed decisions is the Avaluator slope evaluation tool. This tool asks the winter backcountry leader to directly observe temperatures (rapid rise) as well as loading (precipitation). Indirectly it also observes the effects of wind (signs of slab formation as well as rapid loading – lee features). Used with other features of the Avaluator tool, not only is the potential issue identified, but the impact of the sum of issues is used to help the winter backcountry leader make a more informed and objective decision of the hazard due to both weather factors as well as terrain configuration.





As a means to monitor weather and snowpack conditions with respect to assessing avalanche hazard, the winter backcountry leader would consider formally completing a Morning and Evening Hazard Assessment Form. The purpose of the form is for trip record keeping as well as to maintain situational awareness with respect to weather factors affecting avalanche hazard. It also asks the winter backcountry leader to assess the weather and avalanche hazard forecast (bulletin) as a means to help inform the outing with respect to anticipated changes throughout the day. Once compiled in the morning, the winter backcountry leader then assess the snowpack concerns together with anticipated hazard rating to determine if the terrain for outing is still suitable or if plan 'B' should be set into motion.

At the end of the day, an evening version of the morning form would be completed. This assesses what was observed during the day (did it match the predictions?) and re-sets the snowpack concerns and hazard rating based on these observations. The evening form is also a review of the operational day itself. This is an important step in identifying any human factors that may have been present and influencers of decision-making at any point during the day as well as asking if any other trip details could have been managed better. This is all with a goal towards improving the overall safety for future outings.


ACC - Morning Avalanche Hazard and Risk Analysis

Date | Time | Trip/Location | Trip Leader

Participants:

What were the conditions like yesterday afternoon (hazard rating, wind, snow, temp.)

Yesterday PM hazard Rating: ALP: TL: BTL:

New Morning Information:

Field / Base Weather Observations:

Time | Location | Temperature | Precip (type/rate) | Elevation | Ridge Blowing Snow | Sky | Wind | Height of Snow | Height of New Snow | Barometric (trend) | Height of Storm Snow

Any important changes between yesterday afternoon to this morning? (storm snow, wind, temp)

Between yesterday afternoon and now, have conditions gotten better, worse, or are they about the same? Why?

What is likely to happen next?
(wind, precip, temperature, freezing levels etc.)

Weather Forecast (if available)

Avalanche Bulletin / Forecast (if available)

Forecast Hazard: ALP: TL: BTL:

ACC - Evening Avalanche Hazard and Risk Analysis

Date | Time | Trip/Location | Trip Leader

In terms of Hazard and weather, did the conditions match the predictions?
If not, what were the significant differences?

New Information from the day

Field Weather Summary

Elev. Range | High Temp | Low Temp | Wind (& direction) | Precipitation | Fluid Hy. | Fluid Perf.

Cancelations / Additional Field Weather Observations:

Field Observations

Avalanche Observations:

Snow / Snowpack Traits

Other:

How would I describe the snowpack today?

Given the observations of the day, are conditions getting better, worse, or staying about the same? Why?

Evening Hazard Assessment

Name | Terrain | Below Treeline

Copies of these and any other forms in this book can be found at www.alpineclubofcanada.ca/forms

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Delivery of a Winter Backcountry Outing

A successful winter backcountry outing requires thoughtful management of the group, diligent management of potential risks, and administration of crucial documents such as waivers and acknowledgement of risk forms. In this chapter we will explore the ACC waiver administration process, the basic principles of group management, and the cornerstones of risk management in a winter backcountry outing context.

Waiver Administration

In accordance with The Alpine Club of Canada (ACC) policies, all participants must complete a waiver prior to participating in an outing. The importance of this document to the ACC cannot be overemphasized. The conduct of the winter backcountry leader when administering the waiver to the participants is of paramount importance, as the administration of the waiver by the leader can affect its legal standing.

The role of the waiver is to protect the ACC and outing participants against lawsuits in the event that a participant is injured or killed.

It also protects the ACC if a participant has any of their property or personal belongings damaged or lost. The document further protects the ACC from liability for natural hazards as well as the possible negligence of any of the other ACC member participants.

PREFERRED WAIVER DELIVERY PRACTICES

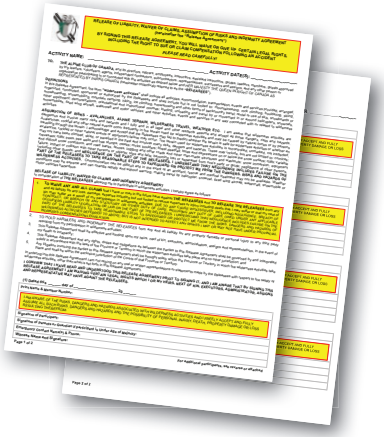
- Send waivers ahead of time to allow time for review.
- Ensure clear communication when delivering the waiver.
- Allow participants adequate time to read the waiver and provide them with the opportunity to ask questions.
- Ensure that participants are aware of the specific and general risks associated with the activity prior to administering the waiver.
- Have participants acknowledge verbally that they have read and understood the waiver.
- Ensure waivers are completed in full and are unaltered.
- Waivers should be administered and witnessed by the winter backcountry leader.
- Waivers should be presented in a standardized format.
- Waivers are ideally completed and signed in blue or black ink.

OTHER WAIVER DELIVERY CONSIDERATIONS

- Waivers do not guarantee protection from lawsuits.
- Waivers do not absolve leaders from acting unprofessionally.
- Waivers are often delivered annually to reiterate risks and ensure participants are accepting of them.
- Waivers are legal documents and cannot be altered in any way.
- Waivers do not expire.
- If the activity or risks change, a new waiver should be administered.

COMPLETED WAIVERS

Signed waivers must be retained by the ACC section for a period of seven years, after which time they can be destroyed. All signed waivers must be forwarded to the appropriate section member who is responsible for storing the documents, as soon as possible following the winter backcountry outing.



Principles of Group Management

A well managed group will be more likely to achieve the trip objectives, will foster a more cohesive group dynamic capable of resolving interpersonal conflicts, and will be better equipped to address and mitigate any risks associated with the outing. Participants in an effectively managed group will be aware of their responsibilities, will operate under the coordination and guidance of the leader, and will be educated and equipped for the day's activities.

Successful leaders diligently and deliberately set the tone for the outing early in the trip. This would start with the initial trip description and prerequisite requirements advertised in the section trip list. It is then further achieved through ongoing email and phone communication to clarify questions. Finally, an initial face to face group briefing at the start of the day is where the leader introduces themselves, explains and clarifies the goals for the outing, outlines their expectations of participants, and facilitates the opportunity for participants to introduce themselves to one another and the group.

GROUP TRAVEL EXPECTATIONS

Providing participants with clear expectations both before and during the winter backcountry outing will enable them to better manage their personal safety and achieve trip objectives. Common expectations may include:

- Pace and spacing
- Scheduled breaks for water/clothing changes, etc.
- Staying on trails and /or the leader's set track
- Buddy system (i.e. tree skiing)
- On slope – stop above the leader
- Communication

Terrain Expectations

» Potential hazards (convex rolls, terrain traps, start zones, other natural hazards)
» Crossing slopes (one at a time where necessary)
» Downhill travel expectations

Activity Expectations

» Equipment expectations
» Participant expectations
» Litter and human waste (pack out what you pack in)
» Leader involvement expectations

LEADERSHIP

High quality leadership and timely motivation by the leader helps ensure that participants act according to the expectations that have been set. Further, supervision enables the leader to identify risks and address them before accidents occur, and to closely monitor the group's well-being throughout the outing.

Leadership often means adapting to the situation (situational leadership) and can take the form of being directive (i.e. emergencies), coaching (educating participants new to the activity or specific concept), supporting (shared responsibility for tasks that the group or group members may be proficient in), and delegating (decision making is primarily the responsibility of the group or specific group members).

Depending on the outing objectives and participant experience, preferred supervision practices may include:

- Keeping the group's proximity close to allow for continued visual supervision and verbal communication.
- Checking participant systems such as shovel, probe and transceiver rescue equipment (at the trailhead), fitting of skins, clothing systems, etc.
- Continual monitoring of participant nutritional/caloric intake and hydration.
- Monitoring the group for signs of fatigue or distress.
- Monitoring the group dynamics to ensure continued participant motivation and enjoyment.

The winter backcountry leader may employ a variety of leadership styles on a single outing depending on the group experience, leader experience, outing objectives, level of hazard mitigation etc. The winter backcountry leader will be flexible and adapt their leadership to the situation.

SELF-LEADERSHIP

The notion of self-leadership is not just an inventory of one's technical competence in a specific activity, but also includes communication skills, group management skills, judgment and decision-making skills, tolerance for uncertainty, emergency response skills, and self awareness. These skills develop over time and typically progress from simple (low consequence) experiences to more technical (higher consequence) experiences. Self-leadership maintains a clear perspective of where one is at with respect to the inventory of leadership traits. When leading groups, the leader will select outings within their overall ability as a means of directing more of their energy towards the group versus themselves. As more experiences are gained, the leader may select more challenging outings in which to lead others as their overall leadership inventory now has more refined tools with which to manage the outing and the variety of unknowns that may be encountered.

EDUCATION

A significant component of group management involves ensuring that participants are educated and empowered to complete the day's activities under the guidance of the leader. In order for this to occur, leaders are often required to provide guidance and instructional inputs throughout the day. Typical instructional inputs may include topics specific to ethics, ecology, risk management, snowpack and terrain analysis, technical systems, local history,

personal experience and insight, etc.

Participants who are new to winter backcountry travel may require coaching on strategies to pack a day or overnight pack. This may take place prior to the trip but may end up being identified at the trailhead or during the outing. Further, the participant may need coaching on correctly fitting their pack (day or overnight) with respect to torso length, weight distribution between hips and shoulders, use of sternum strap, and shoulder strap adjustments. The winter backcountry leader will recognize a poorly fitted pack and assist in making adjustments to help increase the comfort for the participant.

Occasionally equipment may need repair while on the outing. The type of trip and specific equipment item may determine the type of repair to be performed (quick fix versus more extensive repair). The winter backcountry leader would have a repair kit suitable for the specific trip they are leading and have a general working knowledge of most repairs. Repair situations are often excellent educational opportunities for the novice participant as a means to building their self-leadership skills.

GUIDANCE

In addition to educating participants, the success of a winter backcountry outing also requires diligent guidance on the part of the winter backcountry leader. Guidance differs from educating participants in the sense that it motivates and enables participants to develop independent competency with specific skills. Well-guided participants will feel empowered to make their own decisions and manage their personal safety with the understanding that the winter backcountry leader is available to provide support and assistance where required.

Qualities of a strong leader capable of providing sound guidance include:

- Situationally aware of risks and safety concerns
- Enthusiastic, supportive and motivational
- Knowledgeable and capable of articulately sharing their knowledge
- Technically proficient in their systems applications

» Physically fit and able to complete the day's activities
» Sympathetic to the needs of the group
» Capable of resolving conflict and providing direct leadership if required

CONFLICT RESOLUTION

Effective leaders recognize conflict building, and tactfully and firmly address it before it escalates.

Inevitably occasional conflicts will arise within a group or between participants and leaders. Therefore, winter backcountry leaders need to be prepared and adept at resolving minor conflicts. It is also important to determine the source, or cause, of the conflict as it may help the leader mitigate similar situations on future outings. Basic strategies for resolving conflicts include:

» Being assertive and recognizing the conflict
» Addressing the conflict privately if possible rather than in front of the group
» Remaining calm and dedicated to resolving the conflict rather than winning an argument
» Acknowledging the feelings of all parties involved in the conflict and seeking further clarification specific to the issues at hand if required
» Determining potential resolutions to the conflict
» Selecting an appropriate resolution and seeking support from those involved in the conflict
» Proceeding with the resolution

PACING AND TRANSITIONS

When travelling, the winter backcountry leader is often in front not only setting a track in a safe and efficient manner, but also setting the pace for the group. The leader can think of pacing as their mechanism to manage the energy of the group to ensure they are having a positive experience as there may be participants with a variety of fitness levels. In general, the pace is set for the slowest member of the group. As mentioned, this helps to manage their energy as well as manage the overall group (not being too spread out), which would be part

of the leader's risk management strategy.

If the temperature at the start of the outing is cold, the leader may start with several warm layers on to ensure overall comfort but plan to take a layer break shortly to ensure members of the group are not overheating and possibly perspiring.

Plan transitions in appropriate places and use them as part of your rest or snack time strategy. When skiing, skins on or off are natural transitions to hydrate and or have a snack. Planning breaks with transitions will ensure a good flow to the day versus a day that feels choppy. When planning a break, avoid asking if participants need a water or layer break as often times they may say no due to not wanting to hold up the group. Instead, the leader would take off his or her pack and say that he or she is stopping for a water and snack break and then proceed to do so. Model what you are looking for. The leader will plan breaks to reduce the number of cascading stops which may otherwise occur.

TRACK SETTING

Depending on the mode of travel, the winter backcountry leader will set an appropriate track for the group that will ensure a comfortable climb rate (not too steep), use rounded corners where possible (versus sharp turns or kick turns), place turns or corners on flat terrain versus steeper terrain if available, work with the terrain to set a contoured track and avoid a track that has many ups and downs. This will add to the overall comfort of the group when travelling in the backcountry and increase the efficiency of the outing as a whole.

Setting a comfortable track is also combined with pacing to ensure the leader is managing the group's energy when travelling in the backcountry.

Risk Management

A winter backcountry outing may present a variety of risks throughout the day. It is the responsibility of a winter backcountry leader to recognize the risks, quantify them, and appropriately mitigate them to decrease the likelihood of an accident or injury occurring. In this section we will explore several crucial risk management components including situational awareness, hazard recognition and mitigation as well as the concept of participant demonstrated competency.

SITUATIONAL AWARENESS

Situational awareness refers to the winter backcountry leader's ability to recognize and mitigate hazards before they present a risk to the group. It is the responsibility of the winter backcountry leader to step back and evaluate all of the variables in a given situation, determine their interactions, and evaluate the potential for this to present a risk to the group. Situational awareness is closely tied to experience, whereby more experienced leaders tend to more readily recognize the events occurring around them and be better equipped to recognize potential risks.

In the context of a winter backcountry outing, situational awareness is the ability to recognize environmental, interpersonal, internal human factors, external human factors (other winter travellers), and the relationship that these factors have on one another as well as any impacts this will have on the safety and success of the outing.

HAZARD RECOGNITION

Closely linked to situational awareness is the winter backcountry leader's ability to recognize hazards, and determine their probability and severity. Winter backcountry travel in avalanche terrain is an inherently dangerous activity and therefore has some level of risk associated with it. The winter backcountry leader's role is not to entirely eliminate the risks associated with the activity, but rather to recognize them and ensure that they are well managed, mitigated or avoided. Common hazards for a winter backcountry leader to recognize include:

Environmental

- Rapidly warming temperatures (increased avalanche hazard, sun burn, dehydration)
- Very cool temperatures (hypothermia, loss of dexterity, lack of focus)
- High wind (increased avalanche hazard due to snow transportation, challenging communication, dehydration)
- Precipitation (increased avalanche hazard due to rapid loading, hypothermia)
- Snowpack (identify and monitor weak layers)
- Avalanche activity (sensitivity of weak layers)
- Terrain (terrain traps, reducing overhead hazard exposure, safe routes)
- Ice thickness and participant spacing for river and lake crossings
- Animal encounters (animal attacks, disease transmission)

Interpersonal Risks

- Conflict (disagreements or altercations)
- Group not following or listening to the leader

Internal Human Factors

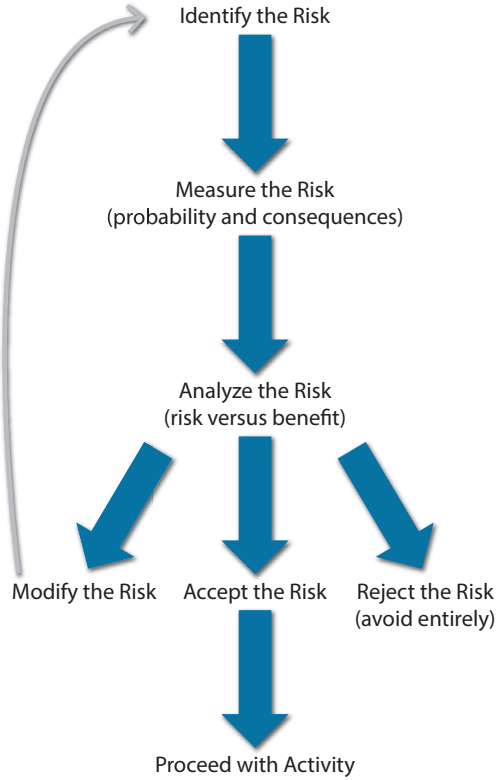
- Intrinsic motivation (participants not following directions of the leader or participants pushing the leader to take risks that are out of context with the trip objectives)
- Food, hydration, sleep, symptoms of drugs or alcohol
- FACETS - Familiarity, Acceptance, Commitment, Expert Halo, Tracks (scarcity), Social Proof - all mental shortcuts (heuristics) that may affect decision-making

» Group Think - trying to maintain group harmony and not speaking up (important observations might be missed)
» Risky Shift - group risk tolerances (decisions) may be higher than any individual would accept on their own
» Fear - clouds objective decision making
» Risk Tolerance - a level of risk one may take
» Trust - trust (or lack of it) in the leader or other group members may influence decision-making with respect to risk management

External human factors:

» Other users and groups (crowding, interruptions to the day's program, overhead skier hazard, dogs)

General Approach to Risk Management



HAZARD MITIGATION

Once hazards have been identified, their probability assessed, and their severity analyzed, the winter backcountry leader must determine an appropriate mitigation strategy. In some instances, this may involve avoiding the hazard entirely or modifying the situation to decrease the probability or severity of the hazard, or it may involve acceptance of the hazard and continuing forward. Examples of common hazard mitigation strategies in a winter backcountry travel context include:

- The use and familiarity of avalanche safety equipment by the leader and the group (transceiver, shovel and avalanche probe).
- Employing transceiver checks prior to participants commencing a winter backcountry outing in avalanche terrain.
- The use of the Avaluator slope evaluation tool as a means to monitor and assess terrain and snowpack conditions with respect to overall hazard.
- Identify exposure to terrain traps, overhead hazards.
- Identify terrain options to reduce the severity of consequences.
- Identify appropriate locations and strategies for river and lake crossing in a backcountry winter environment.
- Individual and group equipment checks as part of the leader's trail head procedure.
- Ensuring periodic breaks occur throughout the day to eat, drink and adjust clothing.
- Continually monitoring the weather to allow for adjustment of the program due to weather changes (temperature, precipitation, wind) for both day and overnight outings.
- Recognizing group conflict and quickly addressing it.
- Recognizing participant distress and addressing it.

Participant Demonstrated Competency

The ability to assess the demonstrated competency of a participant is a vital component of a winter backcountry leader's hazard recognition and hazard mitigation strategy. Prior to giving participants risk related responsibilities, such as avalanche hazard or terrain assessment, it is important that participants demonstrate competency with the skills necessary to do so. Until participants have demonstrated adequate competence, it

is imperative that the winter backcountry leader manage risk on their behalf. Common techniques used to support participant competence with specific skills include:

- Providing participants with the opportunity to practice skills in a risk-free context (i.e. using Simple terrain in which to practice terrain assessment).
- Visually monitoring participants to ensure skills are being practiced and applied correctly (i.e. companion rescue skills).
- Verbally testing participants to gain an understanding of their comprehension of the skill or concept (i.e. weather factors affecting avalanche hazard).
- Applying the skill progressively or incrementally.
- Providing the participants with constructive feedback and coaching if they are struggling with a skill or concept.
- Physically supporting the participant's application of the skill in instances where it will increase comfort, safety or success.
- Monitoring the participant to ensure the application of the skill remains consistent over time and complacency (human factors) and regression do not occur.

Ideally participants would demonstrate competency all the time, however, that is not a realistic expectation and often participants will need ongoing coaching, and / or instruction before they achieve confidence and / or independence with specific skills. For this reason, the winter backcountry leader will need to exercise good judgment and limit the level of responsibility offered to those who are unable to demonstrate competency with a skill. This ensures the level of risk presented to the participants remains consistent with the nature of the outing and the trip objectives.

As mentioned earlier, the winter backcountry leader may choose terrain that has few consequences as a means for such skill development. While learning, errors will be made. Providing an arena to make and learn from errors with little to no consequence reduces the overall vulnerability of the participant, and group, while providing valuable feedback and growth of specific skills. Once skills are acquired it is possible to move to terrain that challenges these skills while maintaining an appropriate safety bandwidth.

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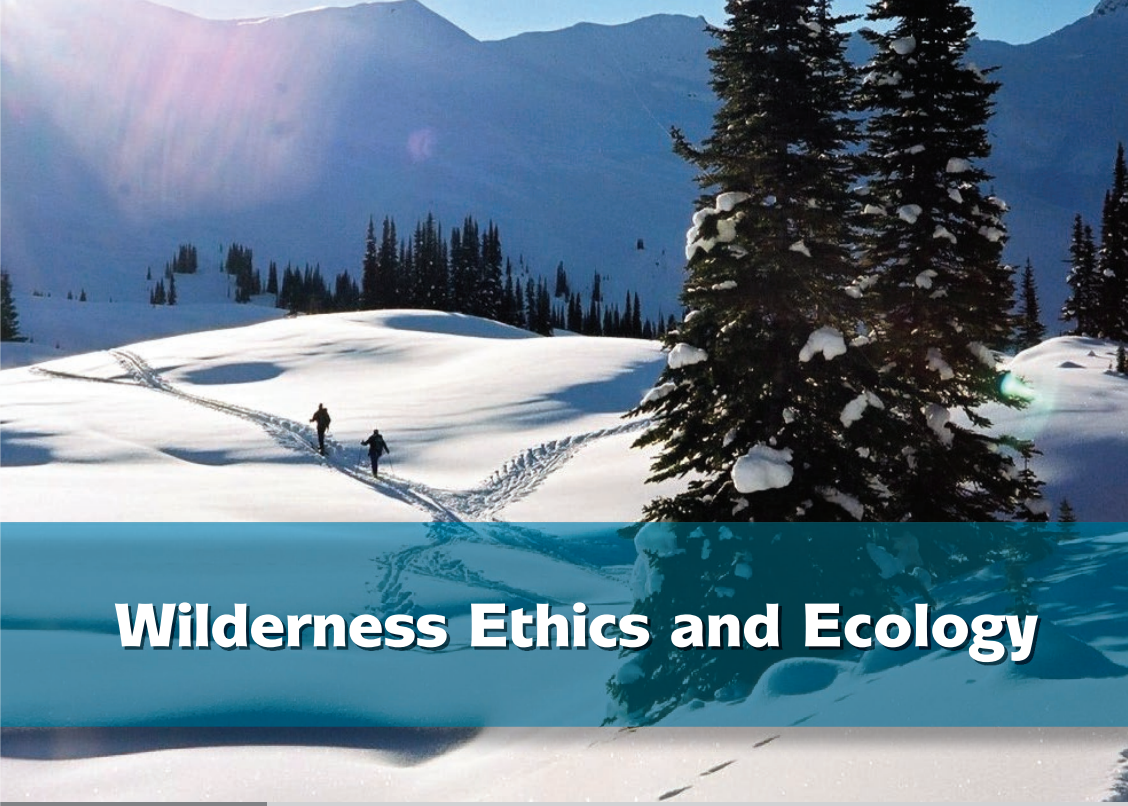


Wilderness Ethics and Ecology

While wildlife predominantly takes on a dormant state during winter months, there is much to learn and observe through winter travel. As a winter backcountry leader, understanding your environment and demonstrating stewardship is essential. This helps to ensure that the natural state of the environment is not negatively impacted and allows access to winter wilderness areas for future generations. In this chapter we will explore several principles of low impact travel, basic wildlife precautions and interpretive knowledge, all related to a winter environment.

Principles of Low Impact Travel

Minimizing our impact when we travel in the backcountry is essential not only for our ecological impact, but also aesthetic impact. The first step is to plan ahead and prepare for the winter environment as indicated by chapters one through three. Tracks on the snowy white canvas tell others where you have travelled and camped; that is until it snows again. For that reason, visible signs of travel and impact in the winter environment can be short lived (seasonal), however the winter backcountry leader should think and visualize what impacts might extend beyond and into the summer season.

WINTER TRAVEL

Snow is a moldable and low impact surface. Unlike the effects a group of travellers can have on an alpine meadow in the summertime, the winter provides a durable and protecting surface. When travelling in areas with low snow, remember what the surface may look like in other seasons. Stick to trails and more durable surfaces avoiding, for example, impacting alpine meadows.

Travelling in a smaller group and being aware of noise, especially in popular areas helps to mitigate the social impact for other user groups. This also helps by potentially reducing crowding in high use areas.

WINTER CAMPING

As in other seasons, where we sleep, cook and dispose of our human waste has the greatest potential environmental and aesthetic impact.

In the winter we can reduce our impact by:

- Camping 100 m away from fresh water sources such as lakes or streams.
- Concentrating our grey water (drained pasta water or dish water for example) in one location via a hole in the snow called a sump hole.
- Packing out any food scraps or leftovers, including compost.
- Collapsing snow structures that may pose a hazard for future travellers that we create through our campsite creation – such as large pits or snow shelters which will eventually collapse. Also, it is fun to see how strong your snow shelter really is!
- Should a campfire be built for emergency purposes or otherwise, put it out completely. Once cool, distribute the ashes.
- Double check or 'sweep' your campsite prior to departure to ensure that you have left it clean of waste.

HUMAN WASTE

Poor disposal of human waste has the potential to impact the cleanliness of our waterways and spread infection amongst backcountry travellers. Check for best practices in your area and requirements from land managers. Considerations include user days in an area. For example, 10 people for two days in one place equals 20 user days. A good rule of thumb is that over 20 user days in one area is a large impact of human waste to a wilderness area. The greater the number of user days the less an area can handle the human waste impact.

Consider what the environment looks like in the summer time; ask yourself what can this environment handle and is this a good place to camp?

Disposal of urine and feces can be addressed differently in a winter environment. Aesthetically it is best to concentrate urine in one area such as at a designated pee-tree. Females may prefer a privacy wall, which could be made out of snow blocks, hidden behind a tree, or dug into a pit. Pack out all toilet paper and feminine hygiene products. While burning toilet paper is an option with a hot fire, burning it with a lighter is often incomplete, leaving remnants of toilet paper bits. Disposing of feces with little environmental impact is more challenging in the winter. This is due to the spring water running through the snowpack eventually joining streams and waterways. Depending on the land manager and best practices for the area, options may include:

- Packing it out in a disposable bag for solid waste. Both individual and group systems are manufactured commercially with chemicals that work to solidify, decrease odour and eliminate the waste as a biohazard. Packing out solid waste is becoming more common and sometimes required in high use and winter areas.
- Digging to soil, then dispose of waste as per other seasons—100 m away from any water source or existing trails, dug 15-20 cm deep in organic soil and covered up.
- Digging a group trench or pit system in the snow with the thought that eventually sun will melt it out and the UV radiation will sterilize it. This is only appropriate where there will not be great aesthetic impact.
- With small user numbers, dispersal rather than concentration of feces may be more appropriate. Digging individual pit systems could then be considered.

GROUP SIZE

It is important for winter backcountry leaders to recognize that the size of the group will have an impact on both the environment and other users. The larger the size of the group, the more profound the impact will be on the environment and the more diligent the winter backcountry leader will need to be to ensure the impacts are minimized. Although the technical nature of the outing may dictate group size, consideration should also be given to travel in popular areas (social impact) as well as overnight outings (environmental impact). The winter backcountry leader would consult with the local land manager for regulations on group size to help make an informed decision on the number of participants suitable to the outing.

Wildlife Issues

Educating participants on local wildlife can be for informative or social reasons, as well as for safety reasons. Preparing your group in the unlikely event of a hazardous encounter with wildlife will build trust and educate on prevention and positive reactions should it be necessary.

While encounters with large animals such as bears, cougars or moose are possible, they are more commonly sighted in seasons other than winter. Smaller animals such as birds, rodents and hares are more commonly sighted in the winter, and affect our winter camping and travel practices.

Sightings and encounters with potentially dangerous wildlife must be treated seriously. All planned activities should be stopped and the group removed from the area.

Should you encounter a larger animal such as a moose or a bear that has wandered out of hibernation, give the animal space and back away. If there is aggressive behavior make your presence known, gather in a large group and back away slowly.

Never feed animals and ensure that human food is inaccessible. A fed animal often leads to habituated and hazardous animal behaviors. Food can be hung up in a tree, or more commonly buried (with the location marked) one metre in the snow before going away for the day. The main animals of concern in the wintertime for getting into your food are birds, and more specifically the common raven or crow. Pine martens and rodents such as deer mice may also investigate your kitchen. Sealing pots and dishes or securing them in snow shelves that are hard to get to may prevent contamination. Burying your food sacks in the snow is a sure way to avoid this,

as long as it doesn't melt out on a warm spring day.

Despite animals gathering weight or collecting food in the fall, winter can be a stressful time with colder temperatures and limited access to food. As winter backcountry leaders it is important to ensure that we do not further stress or impact the behaviours of animals. For example, the repeated flight of a grouse can create stress and compromise precious energy levels.

Interpretive Skills

The ability of the winter backcountry leader to share specific area knowledge, seasonal understanding and human cultural history with their group is a significant value-added benefit for participants. Interpretation is about creating meaning through firsthand experience with natural and cultural history. Ideally it is informative, promotes understanding and curiosity, creates experiences and is potentially even inspirational. It is not only about the content, but also about the presentation of content. Interpretation takes practice, including observing your surroundings, identifying flora and fauna, and learning specifics about the local ecology. Good interpretation matches the interests of your audience and should be an enjoyable experience.

Common interpretation interests for the winter backcountry traveller include understanding avalanches (covered in chapter 1), weather (covered in chapter 2), observed flora and fauna, winter adaptations, tracks in the snow, the night sky and human history in the area.

CANADIAN FAUNA: WINTER ADAPTATIONS

Adaptations allow for animal survival during colder temperatures, more challenging travel conditions and more limited food supplies. Animals may store food, pack on extra fat and reduce activity levels for the winter. Other adaptations include:

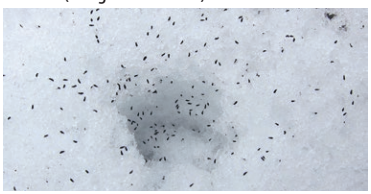
- Migrations (birds, butterflies)
- Hibernation (marmots, bears)
- Torpor (snakes, frogs)
- Whiter and warmer fur or feathers (wolves, grouse, snowshoe hare)
- Snowshoe-shaped feet to better move over snow (alpine hare, grouse)

Snowshoe Hare (Lepus americanus)

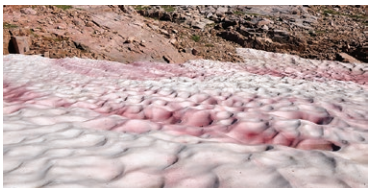
Moose (Alces alces)

Grey Wolf (Canis lupus)

Caribou (Rangifer tarandus)



Snow Fleas (Order Collembola)



Watermelon Snow (Chlamydomonas augustae)

Some favourite Canadian winter creatures and their adaptations include the:

Snowshoe Hare - Snowshoe hares molt twice in a year, changing from brown or grayish with white underbellies to white with black-tipped ears. Their large furry feet act as snowshoes. In winter they eat evergreen leaves, buds on shrubs and sometimes even lichen.

Moose - Long legs can help moose move through powdery snow, but can be challenged with collapsing snow in the later winter. Moose will often stay at mid-elevations during the winter, unlike other ungulates which drop to valley bottoms.

Grey Wolf - While wolves often struggle with travel on early season light snow, they excel as the snow develops a strong crust in the spring (the opposite to moose).

Caribou (both woodland and mountain) - Caribou move below the treeline in winter and when the snow gets too deep, they adapt by eating lichen on trees instead of the ground. Their hooves grow both hairier and larger for the winter. The ratio of a caribou's hoof size to that of their weight is more than twice that of a moose.

Insects - Numerous insects have adapted to live in winter and snowy conditions such as snow fleas, which hide under snow laden vegetation and rocks in early season and reach adult maturity mid-winter.

Watermelon Snow - Watermelon snow is pink to red and found on the top of the snow in the springtime. The red colour is caused by millions of single-celled photosynthetic blue-green algae containing a red pigmentation. This algae is a primary producer for insects and worms. The algae resist freezing in winter by living at the bottom of the snowpack. Using free water they move up to the top of the snowpack in the spring in search of light.

ANIMAL TRACKS

Animal tracks in the winter can be a source of complete fascination for the naturalist. This leads to questions such as what is this animal, where is it going and why? It is even more exciting when you encounter one animal hunting another.


Grey Wolf (Canis lupus)


Caribou (Rangifer tarandus)


Deer Mouse (Peromyscus maniculatus)


Snowshoe Hare (Lepus americanus)

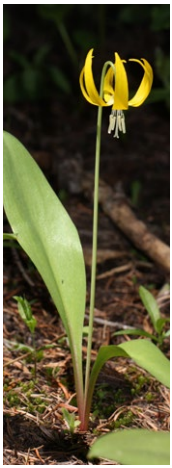

Cougar (Puma concolor)


Moose (Alces alces)

CANADIAN FLORA: WINTER ADAPTATIONS

At mid-latitudes, plants survive large seasonal fluctuations with both temperatures and precipitation. They also must adapt to potentially significant daily temperature fluctuations in shoulder seasons, especially for alpine plants.

However, under the insulated blanket of snow, plant species lie dormant with little to no sunlight over the winter season. They live in temperatures quite constant and close to freezing, awaiting the spring sun to begin another yearly growth cycle. Those not covered by snow endure far greater challenges with wind, snow abrasion and drought.



Avalanche Lily, also known as Yellow Glacier Lily (Erythronium grandiflorum)

Moss Campion (Silene acaulis)

White Mountain Avens (Dryas octopetala)

Kinnikinnik (Arctostaphylos uva-ursi)

Crocus (Crocus vernus)

Plants living in colder, more mountainous environments have adapted to short growing seasons, and long winters. For example, with water all frozen and little access to moisture, plant adaptations include growth in dense cushions (Moss Campion), waxy leaves (Kinnikinnik) and extensive root systems (White Mountain Avens). Other winter oriented adaptations include:

- Growing low to the ground to avoid wind and moisture loss
- Metabolizing at low temperatures to start early season growth
- Early season blooming (such as with the Avalanche Lily and Crocus poking through the snow)

Englemann Spruce (Pinus engelmannii)

Old Man's Beard (Usnea lapponica)

Sub-Alpine Fir (Abies lasiocarpa)

Witch's Hair (Alectoria sarmentosa)

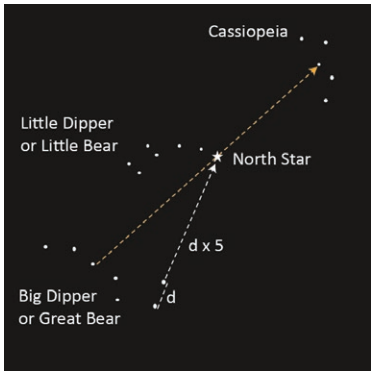
Winter offers an interpretation opportunity to narrow the focus to only what is exposed above the snowpack, for example; trees, lichen and hardy bushes such as slide / mountain alder. It is believed that treeline is most significantly influenced by low soil temperatures, wind and drought over the winter.

Slide / Mountain Alder (Alnus viridis).

THE NIGHT SKY

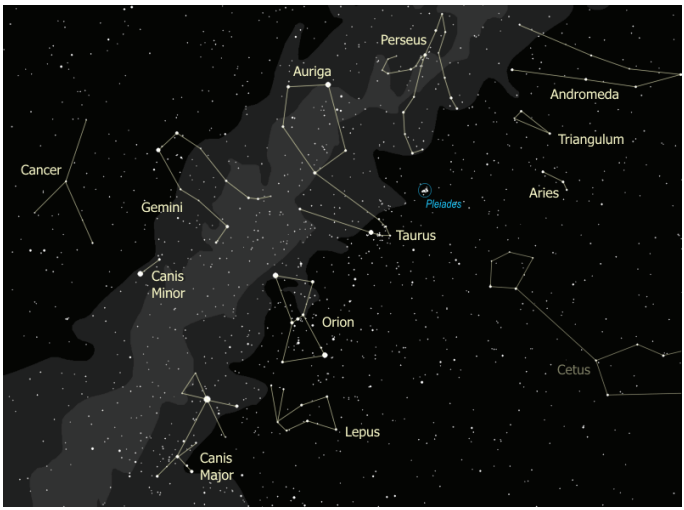
Understanding basics of the night sky can not only help with identifying north and therefore aid in navigation, but it may also be an endless source of fascination. With shorter days, longer nights, and distance from urban lights, discussions of the night sky are often entertaining.

Start with finding the North Star (Polaris) and the Milky Way. Polaris sits at the handle end of the Little Dipper, also called Ursa Minor. Given that this constellation is not especially luminous, you can also look halfway between the Big Dipper of Ursa Major and the W of Cassiopeia. The Milky Way shows the axis of our galaxy, of which our sun is only one star of potentially 100 billion.



Major winter night sky constellations include:

- Ursa Major – The Great Bear (the Big Dipper being a smaller component)
- Ursa Minor – The Little Bear (the Little Dipper being a smaller component)
- Cassiopeia – The Queen
- Draco – The Dragon
- Cepheus – The King
- Andromeda – Daughter of Cassiopeia



CULTURAL AND HUMAN HISTORY

Insight into local cultural and human history of the area in which you are travelling can help to build your team and create a greater understanding of the area. Invite others to contribute their knowledge, questions and interests.

Commonly shared cultural or human information may include:

- Aboriginal history in the area pre and post-European contact
- Current Aboriginal Territory and Cultural Information
- Early settlement of Europeans
- History of adventurers in the area including first ascents or descents, winter travel and wilderness living
- Formation of parks, protected or conservation areas, current land managers and associated regulations and best practices
- Current local ethical debates or issues
- Other activities that occur in the area
- Stories of winter travel, camping, travelling in avalanche terrain or risk management scenarios, learning from others' successes, challenges and mistakes

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Basic Navigation Skills

Navigation is an essential part of travelling in the backcountry. The winter backcountry leader will be practiced at a variety of navigation techniques using a variety of tools including the map and compass together with GPS and altimeter. This chapter will explore map and navigation concepts as well as some tools used to help the winter backcountry with navigation on an outing.

LEVELS OF NAVIGATION

When travelling in the backcountry the leader is constantly navigating in both good weather and poor. Depending on the weather (visibility), the winter backcountry leader may rely on certain techniques more than others. As visibility deteriorates the winter backcountry leader will recognize the need for more precise navigation to maintain their desired course, and hence slow down to ensure accuracy. The levels of navigation are generally described as being Rough, Standard, or Precision.

Rough

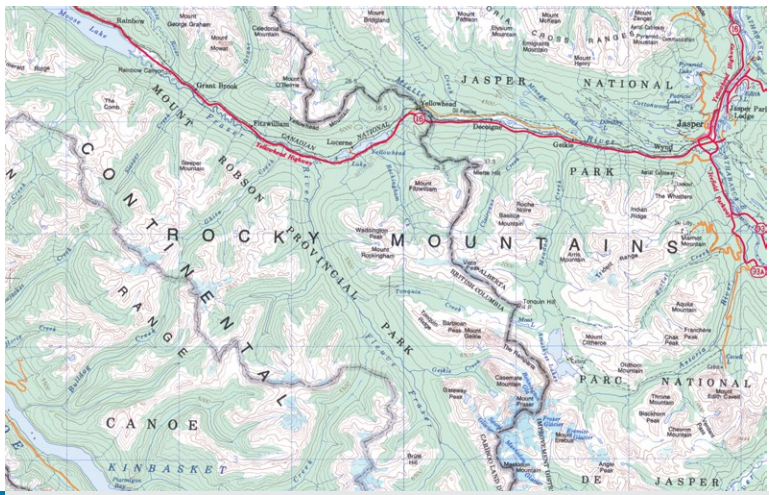
» Good visibility
» Good landmarks
» Map reading only

Standard

» Intermittent visibility
» Fewer landmarks
» Map and occasional use of compass/altimeter/GPS

Precision

» Poor visibility
» Landmarks rare
» Intense use of map/compass/altimeter/GPS



Topographic Maps

Together with a variety of maps available, there is a variety of information maps may tell us. Maps can be used to help describe social information (towns, cities, roads, etc.), industry information (i.e. forestry information), demographics (socio-economic information), geographical information and more.

The winter backcountry leader will be familiar with the topographic maps which describe the physical landscape including elevation changes (relief), rivers, lakes, glacial features, vegetation etc. Topographic maps typically include features such as roads, trails and buildings, which can be important for the winter backcountry leader.

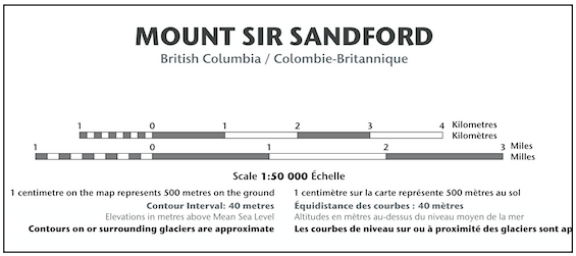
Topographic maps are produced from both private sources (i.e. GemTrek) as well as from the Government of Canada: Natural Resources Canada www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9771 and available from private distributors (i.e. Map Town) or downloadable on-line.

Also available are phone apps from which the winter backcountry leader can download topographic maps. The resolution and functionality of these apps vary, but they are becoming a more common supplement to paper copies as well as traditional GPS units. Remember, the batteries will never die on your paper map (versus the batteries on your phone to use your mapping app).

MAP SCALES

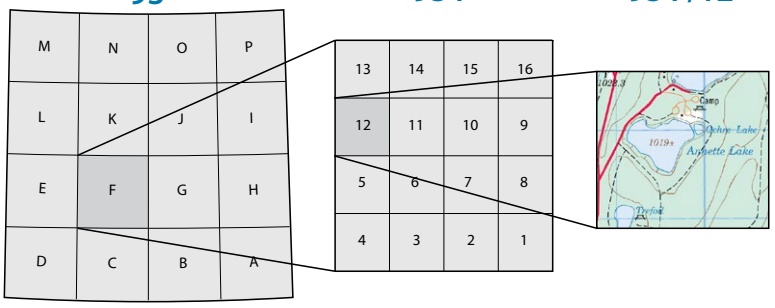
The scale of a map describes the distance in the field relative to that on a map. For example, on a map with a scale of 1:20,000, one unit of measure on the map is equal to 20,000 units in the field. For example, 1 cm on a map = 20,000 cm (200 m) in the field. Maps with large scales (i.e. 1:100,000) will cover a large area and will tend to not show as much detail required for backcountry navigational purposes as maps with a scale of 1:50,000 or 1:20,000. For backcountry navigation purposes, maps with a scale of 1:50,000 would be considered standard for route planning.

When considering where the topographic maps come from, it begins with how Canada is broken down into zones called



primary quadrangles with a scale of 1:1million. A primary quadrangle is further broken down to 16 smaller scales of 1:250,000 and again a further 16 scales to give us the 1:50,000 maps the leader would use for backcountry navigation.

National Topographic System: Map Zones of Canada



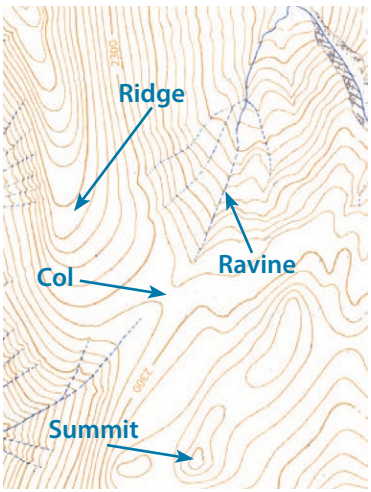
CONTOUR LINES

Contour lines are imaginary lines linking together all points sharing the same elevation. The perfect example is a landscape filled with paddy fields. The contour interval defines the altitude difference between two contour lines. This interval varies between countries and between maps—it is 10 or 20 m on large-scale maps.

The contour interval is defined in the map's legend. The smaller the interval, the greater the map's precision.

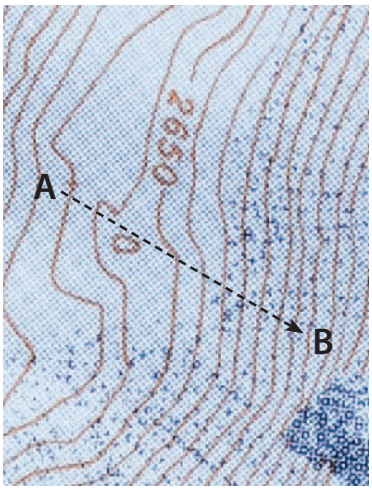
Identifying Terrain (land relief)

The closer the contour lines, the steeper the slope. The more widely spaced the contour lines, the gentler the slope. Main contour lines, which appear in bold, make it possible to identify slope direction. Normally, every fifth contour is a main contour line.



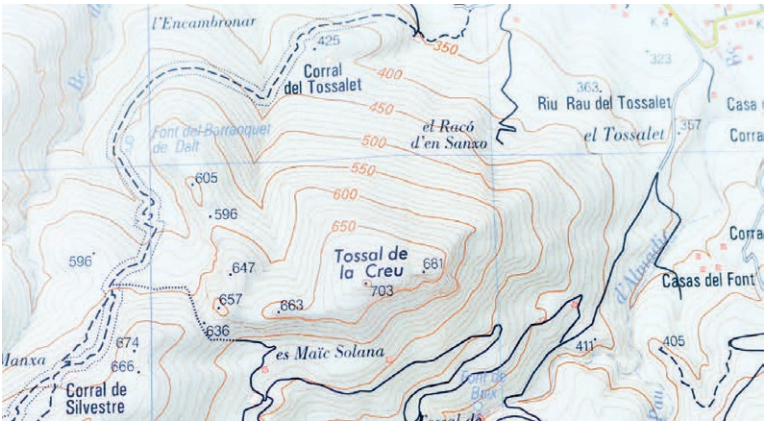
Determining a Slope's Direction

To better identify a slope's direction, altitude is indicated on the main contour lines, normally with the top of the number pointing toward any summits. In this example, B is located above A. Caution! This convention does not hold true for all maps, namely Swiss and Spanish ones.



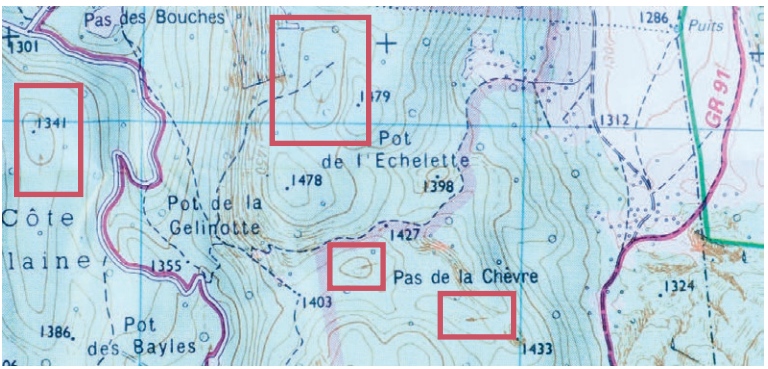
IDENTIFYING A SUMMIT

It's easy to identify a summit if its name and altitude appear on the map. The summit is the point where the concentric circles formed by the contour lines converge. It is also the point where the shaded and non-shaded zones separate. Here, the 700-index line makes it clear that point 703 is higher.



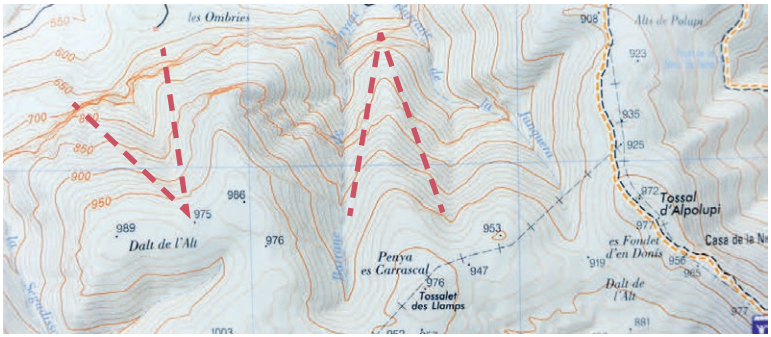
LOCATING A DEPRESSION

Contour lines do not always allow you to distinguish a summit from a depression. On higher-quality maps, depressions are called out by an arrow indicating the low point.



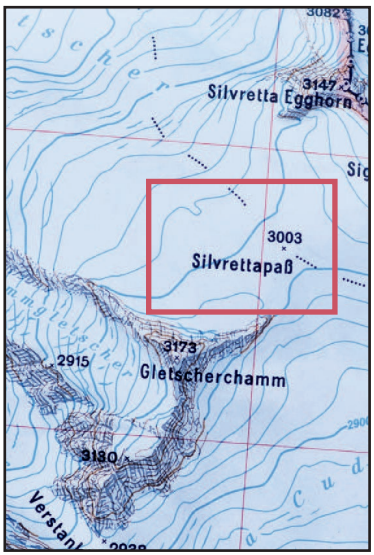
DIFFERENTIATING A VALLEY FROM A RIDGE

This is not as easy as you might think. Fortunately, streams (drawn in blue) flow through most valleys and depressions. Even when no water runs through them, valleys and depressions usually lead down to a stream or a river. When we know a slope's direction, the contour lines representing a ridge appear as Vees pointing downward; meanwhile, the contour lines representing a ravine appear as Vees pointing up toward the summit.

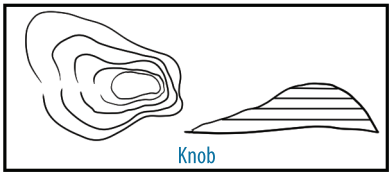


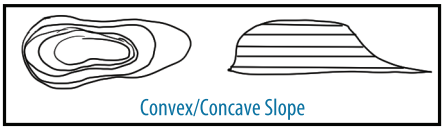
RECOGNIZING A COL

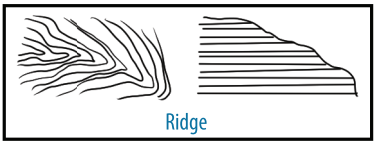
Contour lines never cross a col; they avoid it. You can confirm this on the map by noting the presence of summits to either side of a col.

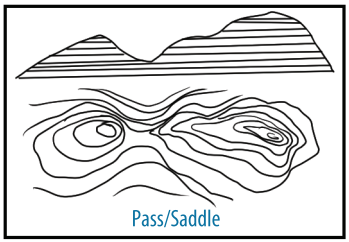


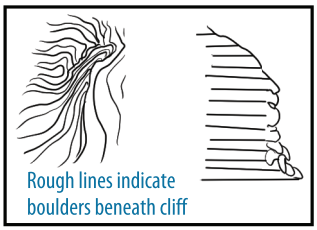
Contour Lines and Terrain Shapes

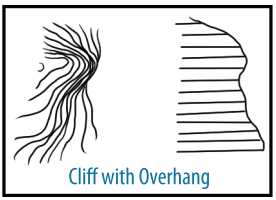












SLOPE ANGLES AND AVALANCHE TERRAIN

Continuing with the idea of contour lines that represent specific elevation intervals, they can also give the winter backcountry leader an idea of how steep a slope may be. If the distance between contour lines are far apart, this represents a slope that may not be particularly steep. If the distance between contour lines is very small, that indicates more elevation gain in a relatively short horizontal distance, thus a steeper slope.

When considering calculating slope angle, there are a few tools the winter backcountry leader can use.

Slope angle can be calculated by taking the rise between two points on a map (how much elevations gain is there), and dividing it by the run (the horizontal distance between the same two points on a map). The units need to be converted so they are the same for both rise and run. That is, if the contour intervals are in metres and horizontal distance is in kilometres, it might be easier to

convert the horizontal distance to metres. Simply dividing the rise over the run will result in a slope gradient.

For example, the vertical distance between two points is 80 m and the horizontal distance is 2 km when measured on a map. From this we now have 80 m / 2000 m resulting in a gradient of 0.04. On our highways, we would see this expressed as a per cent gradient. In this example it would be 0.04 x 100 = 4.0 % gradient.

Although gradient can be helpful in some cases, the winter backcountry leader is interested in slope angle as this has relevance to avalanche terrain. To determine this, take the inverse tangent of the rise / run. Using the previous example, this would be 80 m / 2000 m = 0.04. The inverse tangent of 0.04 = 2.3 degrees.

Okay, what's with all this math? It is understandable that calculating slope angles can be tedious and even intimidating for some. The winter backcountry leader must pay attention to this detail when in the trip planning stage as a means to recognize when travelling in avalanche terrain in the critical slope angles between 30 and 45 degrees.

Fortunately, there are some rules of thumb when looking at contour intervals and determining slope angles. The following chart gives slope angles for maps with 100 ft. contour intervals, 20 m contour intervals as well as 40 m contour intervals. As most good quality compasses have a measuring scale along one edge, typically in centimeters, the winter backcountry leader can count the number of contour lines per centimeter from point A to point B on a map (or along a specific slope) and refer to the chart for an estimated resultant slope angle. Given 30 degrees is a critical slope angle for the winter backcountry leader, on maps with 100 ft contour lines, 10 contour lines per centimeter is just over 30 degrees. Maps with 20 m contour intervals will have 15 contour lines per centimeter for a slope angle of approximately 31 degrees. Maps with 40 m contour intervals, will have 7 contour lines per centimeter for slopes of 29 degrees.

100′ Lines	Slope	20 m Lines	Slope	40m Lines	Slope
1cm	Degree	1 cm	Degree	1cm	Degree
5	17	7	15.6	4	17.7
6	20	8	17.7	5	21.8
7	23	9	19.8	6	25.6
8	26	10	21.8	7	29.2
9	28	11	23.7	8	32.6
10	31	12	25.6	9	35.7
11	34	13	27.4	10	38.7
12	36	14	29.2	11	41.4
13	38.5	15	30.9	12	43.8
14	40.5	16	32.6	13	46
15	42.5	17	34.2	14	48.2
16	44	18	35.6	15	50.2
17	46	19	37.2	16	52
		20	38.7	17	53.7
1:50,000					

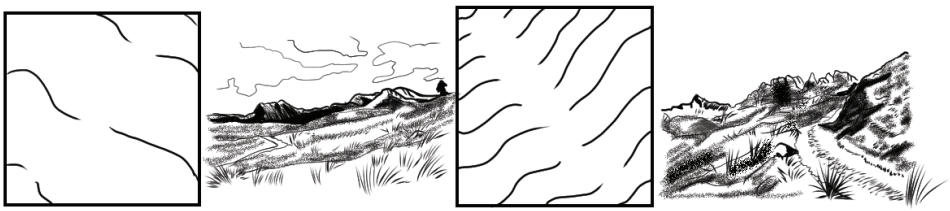
INTERPRETING MAP FEATURES TO TERRAIN

The winter backcountry leader must be able to interpret map information and relate it to actual terrain. One of the challenges with this is that map information is a two-dimensional representation of terrain. Important to the success of interpreting map features to terrain is having the map oriented correctly. In other words, north on the map should be facing north on the terrain. This can be done using a compass or lining up terrain features that are very obvious (i.e. cliffs, well defined peaks, etc.).

When practicing this skill, begin with obvious map features and visualize what the actual terrain shape would look like. Progress to more detailed and nuanced terrain shapes as your skill and confidence improves. A winter backcountry leader with good map interpretation skills can quickly and easily follow their position in terrain relative to the map.

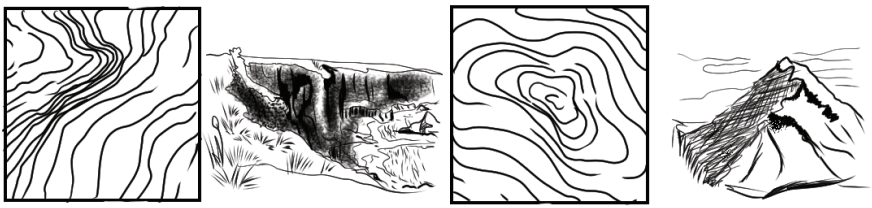
INTERPRETING TERRAIN TO MAP FEATURES

Just as it is important for the winter backcountry leader to interpret map features to terrain, it is equally important to be able to identify terrain features on a map. This allows one to help identify and follow their position on a map. As with the previous section, start with obvious well-defined features and progress to more subtle and nuanced terrain. In periods of challenging visibility, the winter backcountry leader will slow down and take their time in identifying a terrain feature as one can innocently, and incorrectly, convince themselves of certain features and misplace him or herself on a map.



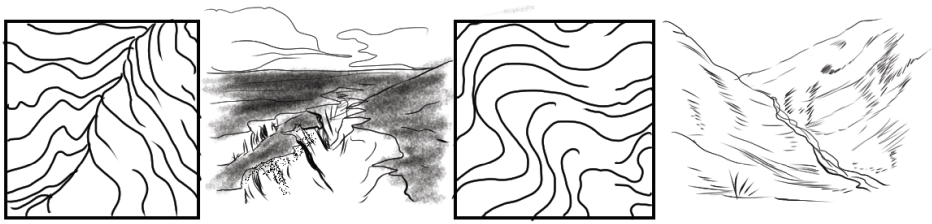
Gradual Slope

Steep Slope



Cliff

Peak



V Contour

U Contour

GRID REFERENCES

When describing a specific point or location on a map, there are two systems the winter backcountry leader would be aware of and able to use. The first is using a six digit UTM grid reference while the second system describes the position as latitude and longitude.

UTM Grid References

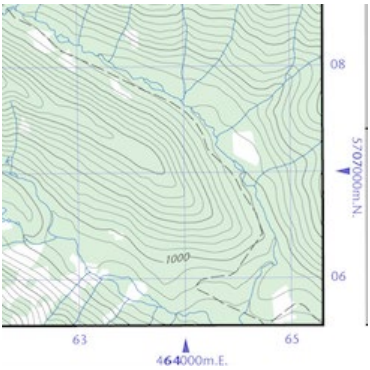
The blue horizontal and vertical lines on a Canadian 1:50,000 topographic map represent squares of 1000 m x 1000 m. These lines are numbered on both the horizontal and vertical sides of the map and are part of the Universal Transmercator (UTM) grid system. Describing a position at the intersection of each of these blue lines represents an accuracy of 1000 m. To obtain better resolution for points that do not fall conveniently at these intersections, the blue squares are further divided into 10 horizontal and vertical segments. Thus, the resolution is now 100 metres and offers more accuracy in describing the winter backcountry leader's position. So, the winter backcountry leader would describe the number associated with the blue line on the map (i.e. 93) and then count how many tenths further the position would be. If halfway between 93 and 94, the position would be described as 935. This process is done for both horizontal and vertical blue grid lines.

To be consistent with describing one's position, the convention of describing horizontal position first followed by the vertical position is followed (in the door and up the stairs). A location of 935127 says the horizontal position is half way between 93 and 94, with the vertical position seven tenths past 12 towards 13. The intersection of these two lines is one's position.

Conveniently, the 1:50,000 topographic maps that are commonly used have each blue square measure 2 cm (or 20 mm). This means, each tenth a blue square is broken down to measures 2 mm on the map. This allows for more accurate measurement and description of location or desired position on a map.

It is important to note that these six numbers repeat themselves many times if they were used in isolation. The grid zone on the map describes where on the planet this map is referring to in terms of east and west and north and south (more on this in the GPS section). This is why marine operators or pilots do not

necessarily use a UTM system to describe their position. Instead they use latitude and longitude as will be described next. For the winter backcountry leader, the trip plan and participant trip information would outline the specific map sheets used which make it easier for those on the trip to discuss coordinates in terms of a six-digit number.



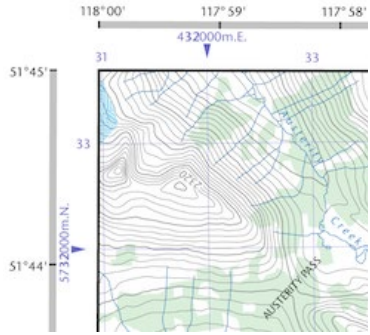
Latitude and Longitude

When describing one's position using latitude and longitude, the winter backcountry leader is utilizing a system of dividing a sphere, or the planet earth. A circle is made up of 360 degrees. If we insert imaginary lines from pole to pole, these are called lines of longitude. Greenwich, England is the reference point and is described as zero degrees longitude. Lines of longitude continue 180 degrees east and west. Lines of longitude are approximately 111 km apart at their widest point and converge at each pole.

Lines of latitude run parallel to each other with the equator representing zero degrees latitude. Lines of latitude run 90 degrees north and south of the equator and are approximately 111 km apart.

Given the distance between each line of latitude and longitude, each degree is further broken down to 60 divisions called minutes. Minutes are further divided into 60 segments called seconds. This allows for more precise navigation. It is important to note your longitude as east or west and your latitude at either north or south.

Therefore, a description of a location on a map could be described as 120° 20' 45" E longitude and 50° 35' 15" N latitude. By defining east or west longitude together with north or south latitude, there can only be one location like this on the planet. This is particularly useful for pilots particularly if the winter backcountry leader needs to call out for rescue resources. As such, the winter backcountry leader should be prepared to describe their position using latitude and longitude.

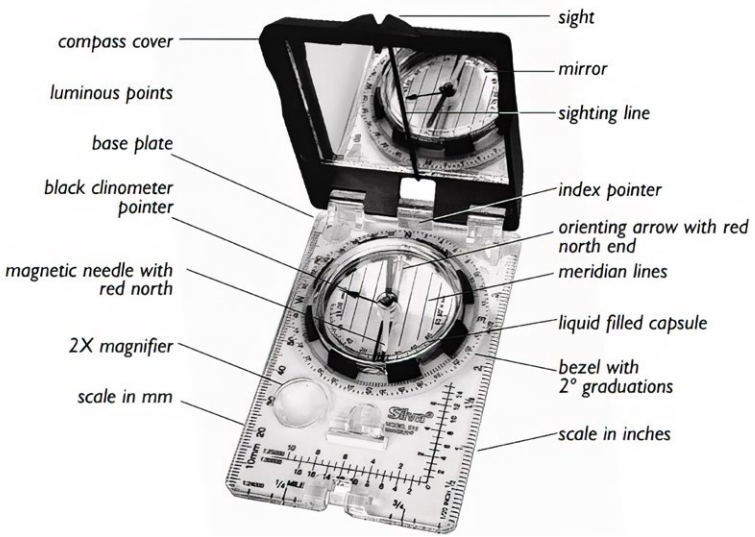


Compass

Although the compass is considered a standard navigational tool, it has limited use on its own. The compass is most useful when used together with a map and navigation is further enhanced with the addition of an altimeter.

There are a number of compasses the winter backcountry leader may consider, however a high-quality compass with a sighting mirror, inclinometer and declination adjustment should be considered as standard by the winter back country leader. A good quality compass with these features would run in the $60 range and be considered an essential tool for backcountry navigation.

The following diagram outlines the compass described as well as the parts that are commonly referred to in describing its use.

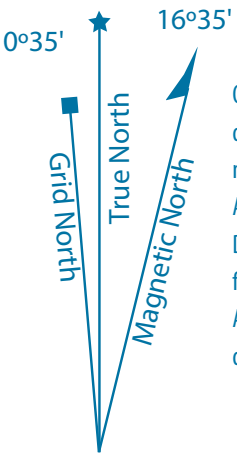


THE THREE NORTHS

When looking at a map, the leader should notice the diagram indicated on the following page. This diagram identifies the three norths one should beware of:

- True North – where the lines of longitude converge at the geographic north pole
- Grid North – the blue lines running vertically on your map (grid lines)
- Magnetic North – a magnetic point approximately 2200 km from the geographic North Pole

DECLINATION



Only use this diagram to obtain numeric values. Approx. Mean Declination 2012 for centre of map. Annual change decreasing 12.9′

The difference between magnetic north and grid or geographic north is called declination. It is the angle away from grid or geographic north that the magnetic needle on a compass is pointing. Magnetic north and the resultant declination is not fixed, as molten metals under the earth's crust are constantly moving. On your map, an average annual change in declination is provided as a means to help the leader calculate the present declination figure. This annual change assumes magnetic north changes the same amount each year – or is linear in change. Unfortunately, it may change more one year than another. Fortunately, we can use either a phone app to determine the declination at our position of interest, or the leader can use the Natural Resources Canada website (https://www.geomag.nrcan.gc.ca/mag_fld/magdec-en.ph) to enter the date, and the latitude and longitude of the center of the map to have the current declination calculated. Using this website or a declination phone app is encouraged as part of the leader's pre-trip planning process to ensure accurate navigation.

Working with a compass where declination cannot be set

In British Columbia, for example, where declination is measured to the east, if one were to transfer a bearing taken from the map to the field this value would be subtracted. If one were to resect a position and transfer a bearing taken from the field to the map, this value would be added. If declination were to the west (as in eastern Canada), this process would be reversed.

As we typically work with Grid North on topographic map sheets, we calculate the declination as the difference between magnetic north and grid north.

Working with a compass that allows the leader to set the declination eliminates adding or subtracting this value every time the map and compass are used together.

TAKING BEARINGS

The compass can be used to identify a direction to features in the field as well as relate field information to a map. The winter backcountry leader will be familiar and practiced with taking bearings as a means of navigation or determining their position.

A compass needle can be affected by magnetic objects the leader may be wearing or metal anomalies in the area where travelling.

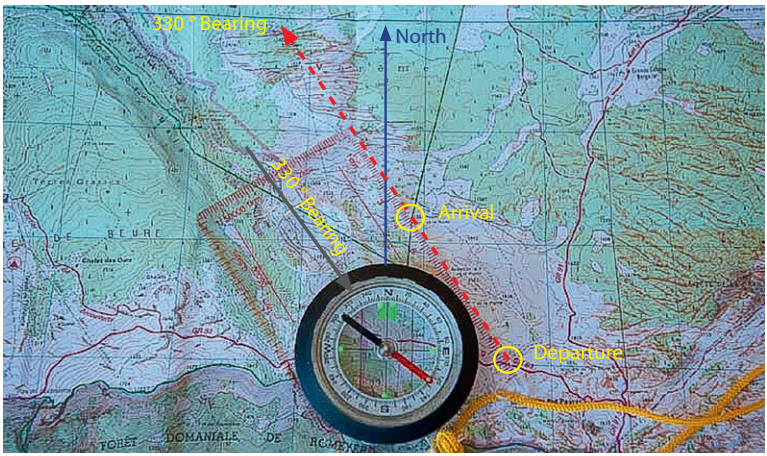
Taking a Bearing in the Field

When travelling in the back-country with reasonable visibility, the leader would consider taking bearings of the feature he or she is travelling towards in the event the cloud cover increases and obscures the desired destination or reference point.

To do this, the leader would simply hold the compass in from of them at eye level and sight through the sighting notch with the sighting line on the mirror in alignment with the front and back bearing indicators on the base plate. Doing this reduces potential error (parallax error) in bearing accuracy. Once the feature has been identified, the compass housing is rotated so the magnetic orienting arrow is in alignment with the magnetic needle. The number at the bearing indicator is the bearing one would follow if visibility were reduced and travelling by compass were necessary. In this case, the leader would hold the compass in front of them and rotate their body so the magnetic needle sits overtop the magnetic orienting arrow. When travelling, it is then important to keep the magnetic needle inside the orienting arrow in order to stay on the correct course, or direction.

Transferring a Bearing from the Map to the Field

On occasion, the leader knows their position on the map and wants to travel to another specific location or grid reference on the map. To do this the leader would place their compass on the map

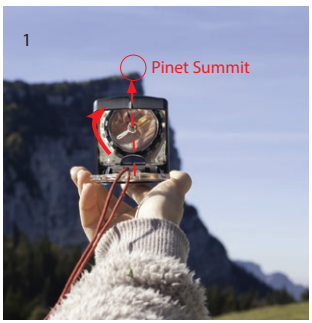


from their known point towards the point they are travelling. The next step is to rotate the compass housing so the grid lines on the housing are parallel with the grid lines on the map. It is important to turn north on the housing towards north on the map otherwise the bearing will be 180 degrees off (backwards). Once the housing and grid lines are parallel, the number indicated at the bearing indicator is the bearing the leader would follow to the next desired location. In this instance, follow the travelling description as per the above example.

The process described assumes the leader is using a compass with declination adjustment. If not, the leader would determine the bearing and subtract the magnetic declination (assuming east declination) before proceeding to ensure they end up at the correct location.

Transferring a Bearing from the Field to the Map

The winter backcountry leader may find that they need to take a bearing from a known feature in the field and transfer that to the map to help determine their position. To do this, follow the steps as described in the taking a bearing in the field. To transfer this to the map, the leader will place the top edge of the compass against the feature on the map of where to they took their bearing. Be sure to lay the compass in the direction you were looking. Using that feature as a pivot point, the entire compass is rotated until the grid lines in the housing are parallel with the grid lines on the map. The leader could then draw a line on the map along the edge of the compass and be relatively sure they are somewhere along that line. This is typically the first step in resecting one's position as will be described in resection on the following page.



Errors in Taking Bearings

The compass used for most backcountry navigation has a practical accuracy of +/- 1.0 degrees. Spending more will increase accuracy in a linear fashion while cost goes up exponentially. The solution to improve accuracy is both practice as well as travelling in shorter more manageable segments to reduce potential error.

The following chart indicates how compass bearing error translates into distance errors. Again, the mitigation strategy is to use shorter segments (legs) to navigate towards. This will be further discussed in the route card section.

Error Angle (degrees)	Distance (kilometers)	Error (meters)
1	1	17
1	5	87
1	10	170
2	1	34
2	5	170
2	10	340
5	1	87
5	5	425
5	10	850

RESECTION

If the leader is unsure of their position on the map or wants to confirm where they think they are, they can resect their position using a variety of techniques.

Often called triangulation, resection uses three or more distinct terrain features from which a compass bearing is taken and transposed to the map. Ideally these features are 60 to 90 degrees apart. The intersection of these three lines indicates your position. If the leader ends up with a triangle, they can be sure they are somewhere in that triangle. As a rule of thumb, the larger the triangle, the greater the error when transferring a bearing from the field to the map. Using distinct terrain features that are easily and distinctly identified on the map offers the greatest margin of accuracy.

If the leader is on a significant terrain feature (i.e. a ridge), he or she may use that feature together with their altimeter to determine their position. As will

be discussed, altimeters should be recalibrated at known points to ensure the best accuracy.

If the leader is travelling along another known feature such as a creek or trail that is identified on the map, taking one or two bearings to distinct terrain features from the field to the map will resect one's position. The intersection of the resection lines with the trail or creek identifies the leader's position on the map.

As will be discussed, the use of a GPS is another way of confirming one's position. However, the winter backcountry leader will be proficient in their map and compass skills in the event a GPS is not functional (i.e. the batteries fail).

Altimeter

An altimeter can be useful to the winter backcountry leader as a tool to not only read elevation, but can also be used to offer an indication of weather systems. Air pressure and altitude are related. That is, as one increases their altitude (travel higher), the air (barometric) pressure will decrease and vice versa.

As a low-pressure air system approaches (associated with deteriorating weather), the barometric pressure will decrease and the resultant elevation will increase. Conversely, as a high-pressure system approaches (associated with fair weather), the barometric pressure will increase and the resultant elevation will decrease. It is highly likely that the winter backcountry leader may experience a change in their altimeter (elevation) reading without moving (as in an overnight trip from evening to morning). This is due to changes in barometric pressure, which results in changes in altimeter readings. It is also possible to experience daytime changes in barometric pressure (and hence altitude) with daytime heating and nighttime cooling.

It is important, then, to calibrate (set) one's altimeter not only at the trailhead at the beginning of a trip, but at known points throughout the day. These known points can be significant features on a map and help to ensure accurate elevation readings during the outing.

GPS Use

GPS technology has advanced over the years to where GPS units are smaller and provide more information to the user including showing one's position on a map on the GPS screen, rate of travel, estimated time of arrival to a specific point, etc. The usefulness and accuracy is contingent on the GPS unit acquiring multiple satellites to refine its position. The more satellites a GPS can acquire, the more accurate the navigational information displayed. On some map phone apps, the winter backcountry leader can fix their position without being connected to the internet and using the internal phone GPS system. Pretty amazing.

The winter backcountry leader should avoid becoming overly reliant on a GPS and be practiced in the traditional map and compass navigation techniques. GPS units require batteries and the ability to acquire satellites. Use in a forest canopy or narrow valley may inhibit satellite acquisition. If using a GPS to navigate from point A to point B, the GPS will set a direction but cannot read the terrain – the winter backcountry leader still needs to be terrain aware.

Using both map and compass together with a GPS allows the leader to be much more versatile in their navigation techniques. In a whiteout for example, the GPS can indicate the leader's position thus confirming direction and rate of travel. This may allow the leader to travel at a faster rate and with more confidence than strictly using map and compass. The GPS can also mark points along a route (waypoints) such as hazards or specific safety or travel features, which can be useful for future trips or if the outing is an out and back trip. It is also possible to enter waypoints of a particular outing in advance (or via computer connection) so the winter backcountry leader has their route all set to go in the event of poor visibility conditions.

With a GPS, it is important to input the correct map datum (found at the bottom of a map) as this will affect the accuracy of the position data displayed. Wrong map datum can introduce errors of up to several hundred metres, which may be critical depending on where one is travelling.

OTHER APPS AS NAVIGATION AIDS

One of the advantages of the digital age and available apps for one's smart phone is that there is more information available to assist the winter backcountry leader with navigation. One of the challenges is that there is lots of information and apps available and one needs to filter out those apps that are less useful. This takes a bit of time, and a good way to spend a stormy evening where you have an internet connection. There are a few navigation apps the winter backcountry leader may find useful and want to search for:

- Declination – apps that let the user drop a pin on your location for the current declination.
- Map apps – there are a variety of map apps, including some that are free, that allow one to download topographic maps. Different apps have different functionality and map resolutions.
  - Canada Topo (free)
  - Topo Maps (paid) – there are a couple of versions of this. Map resolution is excellent.
- Sunrise and Sunset – this may be useful for determining potential start times and daylight times for winter outings. Particularly useful for early season trips.

Whiteout Navigation

It would be unusual for the winter backcountry leader not to encounter a situation where he or she must navigate while having few reliable terrain features for reference. This is commonly associated with poor weather and referred to as whiteout navigation. This can also be encountered below treeline in both good and poor weather with the forest canopy obscuring a view of terrain features. This situation may be referred to as green out navigation. The winter backcountry leader would be practiced with navigating in low visibility conditions as a means to reliably maintain their position on a map while on an outing.

DEAD RECKONING

Pretend you are driving a submarine. You have no windows and can only rely on the speed at which you are travelling, the time you have travelled as well as your direction (and in our cases we can also use our altimeter). Doing this, the winter backcountry leader is travelling by dead reckoning in an environment in which there is no reliable visibility to identify terrain features to interpret your position.

To be successful with this, you must know where you are starting from or you may become hopelessly lost. With a known point, a direction and a rate of speed the winter backcountry leader can estimate their position on a map as they travel.

For dead reckoning, the winter backcountry leader can use the time estimates described in the time calculations section later in this chapter.

AIMING OFF

In some cases, the leader may be looking to navigate to a specific feature that could easily be missed if there were any navigational error. In these instances, it may be useful for the leader to introduce a known error or aim off, to arrive at a feature and then know the desired destination is to the left or right (depending on the direction they aimed off). This might be the intersection of two creeks. In this example, the leader arrives at a creek but is unsure if the intersection is up or down stream. Introducing a known error where they know they will arrive upstream of the junction allows the leader to simply arrive at the creek and then follow it down stream to the desired junction.

HANDRAILS

When navigating the leader may find him or herself able to follow a distinct feature that runs parallel to the direction they want to travel. This may be a cliff band, ridge or creek. If the leader is able to identify this feature on the map together with their position, the leader may follow it and use it as a handrail to travel towards the desired destination. This technique speeds up the navigation process as a terrain feature followed rather than the use of a compass. The leader needs to determine, however, when they are at the desired destination or when to get off the handrail and continue with traditional map and compass navigation.

Time calculations

At some point when considering an outing for a group, the winter backcountry leader would want to know approximately how much time the trip will take. There are many variables that can influence time estimations such as group fitness, method of travel (ski, snowshoe etc.), density of forest one may travel through, visibility, day pack versus multiday pack and equipment, depth of snow for breaking trail, simple challenging or complex terrain, etc. There are however, a few time estimates the winter backcountry leader can use to estimate how long a particular outing may take:

Elevation:

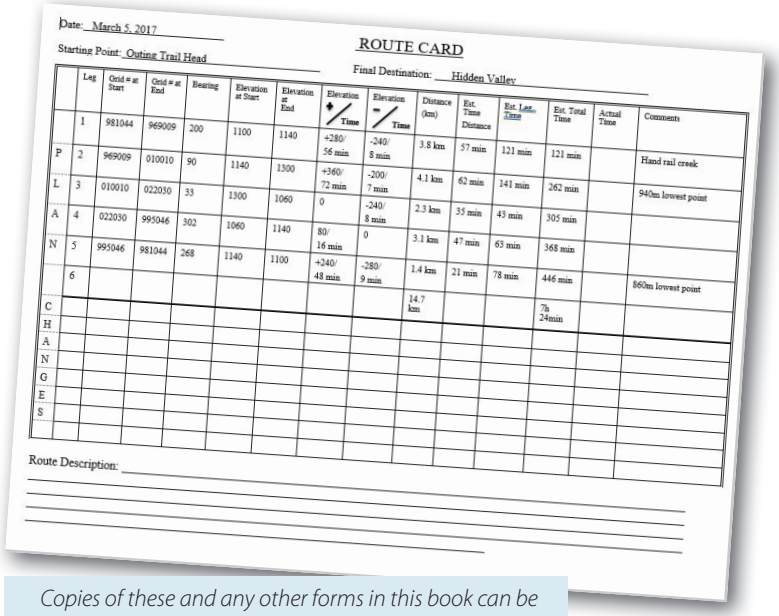
» Approximately 1 hr for every 300 m (1000 ft.) of elevation gain
» Approximately 10 min for every 300 m (1000 ft.) of descent

Horizontal travel:

» Approximately 4 to 5 km /h on firm terrain or on an existing track
» 3 to 4 km /h on terrain with light trail breaking (boot top)
» 1 km /h on terrain with deep trail breaking

Other considerations:

» If using a route card – add 10 min for each leg transition.
» Breaks – estimate approximately 10 min for breaks each hour.
» Given similar conditions, it is typically faster to travel through simple terrain versus complex terrain.
» Travelling with a multiday pack will typically be slower that travel with a day pack.
» Travel slower with those new to the activity to preserve energy for the entire outing as they will likely be less efficient in their movement skills.
» Travel through relatively open forest is faster than through dense forest.
» Poor visibility requires a slower rate of travel to maintain accurate navigation than travel in good visibility.



Date: March 5, 2017

ROUTE CARD

Starting Point: Outing Trail Head

Final Destination: Hidden Valley

	Leg	Grid # at Start	Grid # at End	Bearing	Elevation at Start	Elevation at End	Elevation ↑ / Time	Elevation ↓ / Time	Distance (km)	Est. Time Distance	Est. Lee. Time	Est. Total Time	Actual Time	Comments
	1	981044	969009	200	1100	1140	+280/ 56 min	-240/ 8 min	3.8 km	57 min	121 min	121 min		
P	2	969009	010010	90	1140	1300	+360/ 72 min	-200/ 7 min	4.1 km	62 min	141 min	262 min		Hand rail creek
L	3	010010	022030	33	1300	1060	0	-240/ 8 min	2.3 km	35 min	43 min	305 min		940m lowest point
A	4	022030	995046	302	1060	1140	80/ 16 min	0	3.1 km	47 min	63 min	368 min		
N	5	995046	981044	268	1140	1100	+240/ 48 min	-280/ 9 min	1.4 km	21 min	78 min	446 min		860m lowest point
	6													
C									14.7 km			7h 24min		
H														
A														
N														
G														
E														
S														

Route Description:

Copies of these and any other forms in this book can be found at www.alpineclubofcanada.ca/forms

ROUTE CARDS

A route card differs from a trip plan in that the route card describes the daily navigational details that are often broken down into shorter legs. During clear weather, navigation is typically straightforward. However, if visibility is poor, more precise navigation is required and the use of a route card will help speed up the leader's travel in that the navigational details have been identified in advance and as such, the route card becomes the cheat sheet.

Depending on the complexity of the outing, the route card may have several legs to help guide the winterbackcountry leader along the desired path envisioned on a map. As described earlier, shorter legs help reduce navigational errors. The winter backcountry leader will identify significant features on a map to help break the overall daily outing into manageable and identifiable segments called legs. Such features could include lakes, creeks, ridges, cols, valley junctions, meadows, etc. If travelling with an altimeter, these features can also be combined with elevation to further refine the desired leg start or end point.

The route card combines the

navigational concepts described in this chapter. It identifies grid references, bearings, elevation, time estimates and significant features for the leader to refer to. Not only will it describe the estimated time for a specific leg, the route card will add the time for each leg to offer an estimate of the total time required for an outing. Even in periods of clear weather, the winter backcountry leader should consider working through a route card for the desired outing to determine if there is enough time to complete the trip with the group and their skill level. The winter backcountry leader should also ensure there is a margin of extra time to account for rest breaks that may take longer than anticipated, or extra time for novice travellers.

References and Further Reading

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Touche, F. (2004). ***Wilderness navigation handbook*** (illustrated edition ed.). CA: Touche Publishing.

Notes:

Notes:

Camping in a Winter Environment

As a winter backcountry leader, you have the opportunity to foster a love of winter travel and camping. Surprising to many people, you can live quite comfortably with the right equipment and techniques. Connection to good self-care, care of others and care of our environment forms collaboration and teamwork. Building winter campsites can require high effort and high reward in what can be an incredibly creative process. In this chapter we will explore site selection and preparation, winter shelters, staying warm, winter kitchens, meal planning, fire building and leave no trace considerations.

Site Selection and Preparation

The primary consideration in choosing a site to camp is the absence of major hazards, and in particular avalanche paths and run out zones. Beyond this, choosing a site will depend on:

- Exposure to wind and snow loading
- Temperature and wind chill
- Other hazards such as snow bombs or tree wells
- The type of equipment you have, and
- The skill level of the participants

Once a site is chosen, consider designating camp areas. Choose the ideal places for the kitchen, tent or snow shelter, latrine sites for human waste and equipment storage area(s). Establishing systems or patterns of organization of equipment with your group early on will help for consistency from day-to-day camping and help others with the inevitable, "Did you see my ___?" A tidy camp reduces the chance of misplacing gear and organizes both individual and group processes.

Common options for equipment storage areas include vestibules, inside wind walls (such as anchored down backpacks), kitchen shelves and a sharps "garage." When storing equipment in your garage such as skis, snowshoes, ice axes, poles and so forth, store them upright and in a concentrated area so they can be easily found if it snows.

Building and maintaining a winter campsite can be hard work. One common injury is a strained back when shovelling snow. Instructing others how to properly use a shovel can save equipment and prevent injury. Moving snow over ones' shoulder may twist and strain one's back. This motion should be avoided.

ABOVE AND BELOW TREELINE CONSIDERATIONS

Treeline is marked by the transition from green to white on our topographic maps, and is defined as a thinning of the trees to less than 25 per cent of total coverage. Where the concentration of trees is scarcer, winter travellers and campers are more exposed to the elements of wind and the transportation of snow. Additional hazards exist, such as the formation of cornices on ridge tops and the greater exposure to avalanche paths.

Camping Above Treeline

Camping above the treeline can offer a night of calm and serenity, or on the other extreme a night of noisy tent-flapping and bracing against your tent poles to prevent collapse. Exposure to wind and snow transport can mean increased pressure and management of systems during storms from snow loading and spin drift.

The winter backcountry leader will anticipate needs, by building wind walls and developing winter camping techniques such as vestibule cooking or snow shelter building that will inevitably come in handy.

Camping Below Treeline

With greater concentration of trees, there is more protection from wind and snow transport. However, other hazards exist such as tree wells and snow bombs. Snow bombs are large chunks of snow either falling when branches

can no longer sustain the load, or when warming weakens the ability for the snow to hold on. That being said, boughs of trees will reflect the heat, and tree wells can offer an already partially dug out cave for kitchen creation or shelter. In addition, being below treeline offers access to fire-building, which will be addressed later in this chapter.

TENT PLATFORMS

Work hardening an area means to stomp it out and is the first step in ensuring a good night's sleep. Start with stepping side by side in your skis or snowshoes to compress an area. If desirable, you can pass over a second time with your boots. Work hardening an area for your tent ensures that there is a flat surface to sleep on and prevents creating big indents as you crawl into your tent. A tent platform should not be dug deep; this creates a bathtub effect in which possible snowdrifts can accumulate and cold air sinks into.

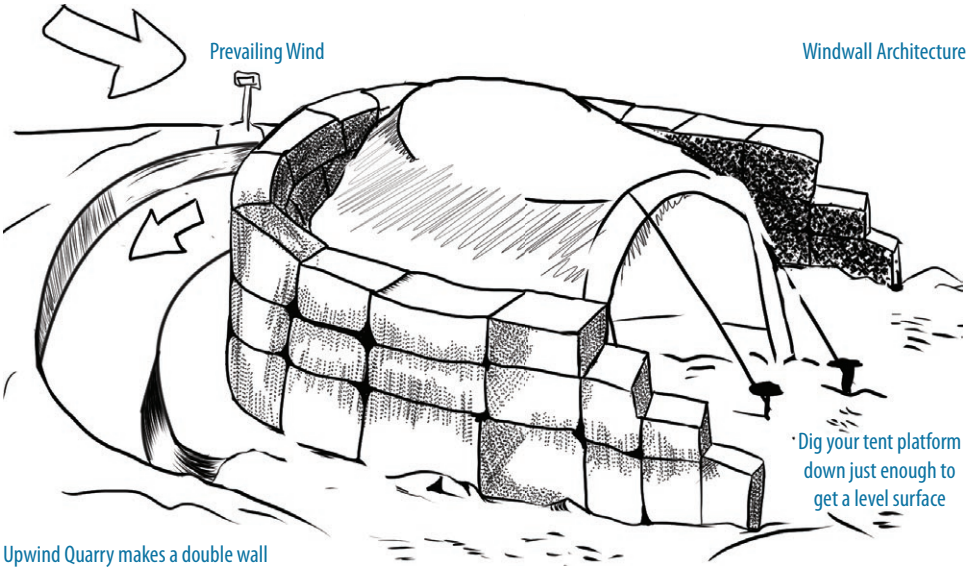
It can be tricky to estimate the size of your tent platform. You can lay out your tent or fly and then imagine the extensions of your guy lines. Perhaps even think bigger, as it is nice to leave a compressed area both for anchors and walking around your tent. If

you will be building a wind wall, you need to think even bigger! Orient your tent platform so that when your tent is set up it will be inline (not perpendicular) to the direction of the predominant or suspected wind.

Work hardening a tent platform in the spring helps reduce snow melt. If it is very sunny and warm you could return from your day's travel to find your tent on an elevated pad. In addition, watch for your guy lines and anchors melting out.

QUARRY AND BLOCK BUILDING

Building a quarry means work hardening or stomping out an area to harvest snow blocks from. Creating a quarry may not be necessary with firmly packed coastal or spring snow, however it is especially important with low density, sugary snow. Snow blocks can be used to build wind walls for your kitchen or tent and are also essential in certain snow shelter designs, as will be described below. Once stomped out, as described above for tent platforms, it is beneficial to give the quarry time to set up. The time allotment depends on the quality of snow, and could take a few minutes to hours to firm up. If building wind walls, work harden a large area (trace the outside of your wind walls to save time moving blocks). Blocks are best when they are made of dense snow, have flat sides, are thick, and are a size and weight that can be easily transported. The exact dimensions will vary based on snow conditions, available time and length of stay at a camp. A shovel and a snow saw are great tools to use when building blocks.



WIND WALLS

A wind wall is typically built in the shape of a horseshoe, with the bottom of the horseshoe oriented into the direction of the wind. This creates a windbreak and reduces snow loading on the tent or kitchen area. If storm bound, it is essential to build the wind wall with spacing between the tent and the anchors to the tent guy lines, to allow for walking around the tent to both tighten guy lines and shovel out accumulated snow.

As wind hits and moves around the wind wall it will break it down and steal its moisture. To avoid getting holes in your wind wall, build up solid blocks laying down the widest parts of the block on top of each other. In addition, the next layer of blocks can be staggered, allowing for fewer holes in the wall. When done to your satisfaction, fill the spaces in between the blocks edges and corners by packing snow in cracks and building up an outside wall that is smooth.

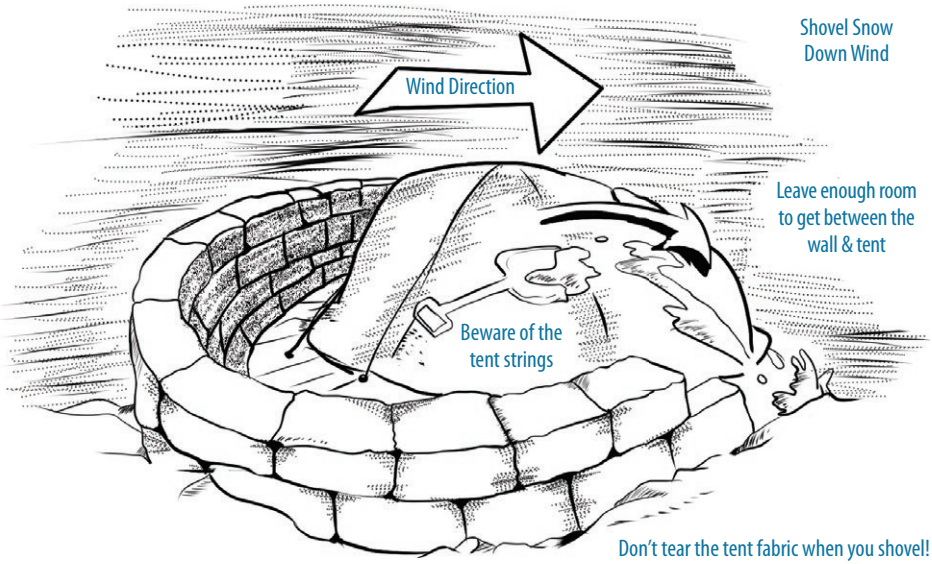
Winter Shelters

Choosing which type of winter shelter is the most appropriate for your situation will depend on your available time and resources as well as participants' skills.

Even if planning on camping in tents, knowledge of snow shelters and emergency shelters is important for the following potential reasons - storm bound, very cold temperatures, equipment failure or an emergency situation.

While there are some "it-depends" factors based on snowpack attributes, exposure to wind, snow loading and participant skill, the following chart outlines some of the basic comparisons between types of winter shelters. One of the potential takeaways from this chart is that if you are winter tent-camping in cold temperatures, such as -30 Celsius for example, and your group is not well prepared for these conditions, building and sleeping in a snow shelter such as a snow cave or quinzee could help mitigate potential cold injuries and ensure a better night's sleep.

Type of Winter Shelter	Time to Construct	Dryness Level During Construction	Shelter Warmth	Weathering a Winter Storm
Tent or Fly Camping	Quick	Dry	Not as warm	Not as strong
Snow Cave	Time Intensive	Potential Wet Factor High	Very Warm	Very Strong
Quinzee	Time Intensive	Potential Wet Factor High	Very Warm	Very Strong
Snow Trench	Time Intensive	Small Wet Factor	Warm	Very Strong
Emergency Shelters	Very Quick	Small Wet Factor	Warm	Depends on Design
Igloo	Very Time Intensive *if a novice	Dry	Very Warm	Very Strong

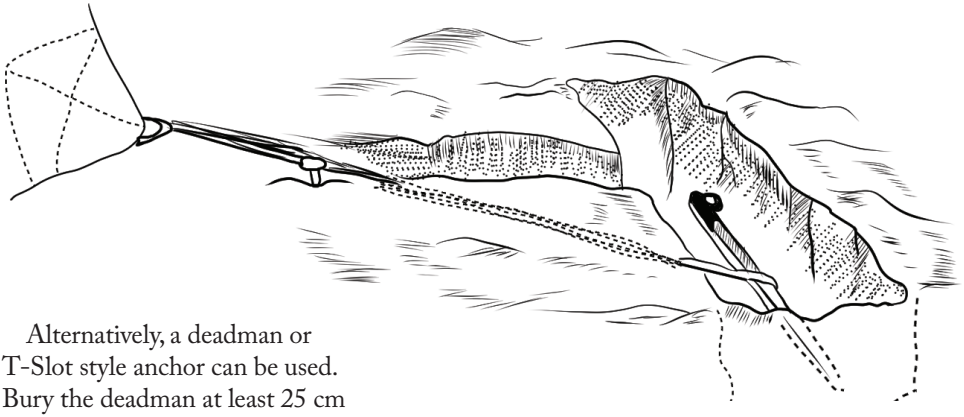


TENT

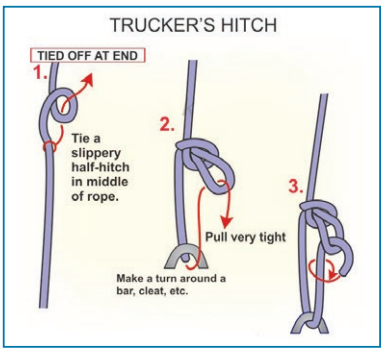
A four-season tent is built to withstand wind and snow, while keeping its occupants warmer with less mesh (as seen on two- and three-season tents) and more fabric. A four-season tent often has a large vestibule. The advantage of using a tent for winter camping is that setting it up is relatively quick and you can stay dry while you put it up. A disadvantage is that it is colder than most snow shelters and may not withstand the pressures of a storm. There are numerous techniques for setting up your tent for bomber performance!

First, orient your tent (along with the platform) so it is in line (not perpendicular) to the direction of the predominant or suspected wind, with your main vestibule entrance / exit facing downwind.

A solid set up includes anchoring all guy lines so they are taut. A common mistake is not setting up your tent in advance with enough guy lines attached to both the fly and the tent body. For anchor points, think critically if it makes sense to use your lodged skis, poles, ice axe, snowshoes and any other rescue-response gear. These tools may also be useful to gather water, use the latrine, etc. Note that an upside down ski pole is far easier to dislodge in the morning than one with the basket down.

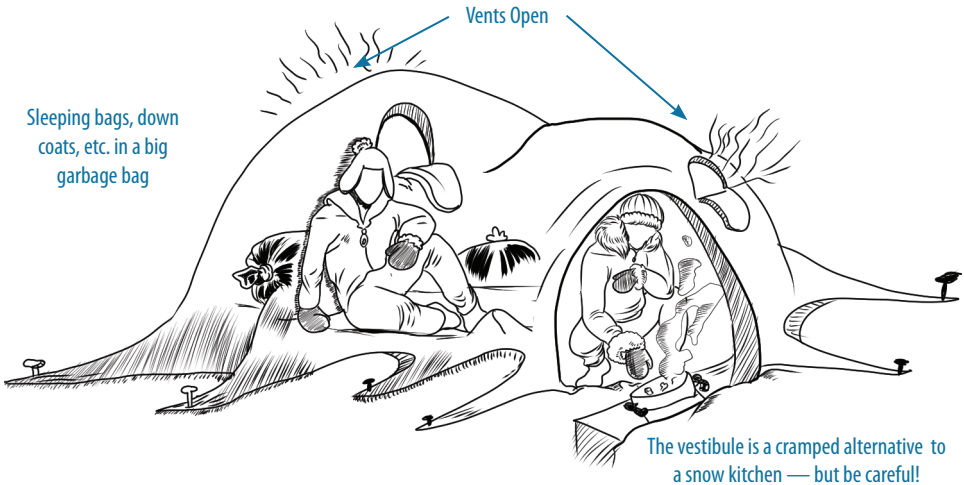


Alternatively, a deadman or T-Slot style anchor can be used. Bury the deadman at least 25 cm deep and loop the guy line around it. Pack snow on top of it afterwards. Using a stick if you are at or below treeline is advantageous as in the morning you can loosen the frozen guy line by tugging or flossing it back and forth, and then leave the stick buried in the snow. Should this not be an option, you can girth hitch a piece of gear, such as a stuff sack full of snow or a crampon you are not using and dig it out when you leave.



To tighten your guy lines from your anchors to your tent, one hitch that is both easy to release when rhimed or frozen and is easily adjustable is the trucker's hitch. Note that guy lines will loosen with loading or as temperatures change and will need to be tightened.

Once your tent is set up, dig out a vestibule cold sink and storage. This makes it easy to take off and store boots, gives more space for organizing gear



The vestibule is a cramped alternative to a snow kitchen — but be careful!

and creates a potential space for vestibule cooking. Your vestibule cold sink also helps maintain transitioning between the outside snowy environment and non-snowy inside of the tent. Consider storing your extra gear in the back vestibule and /or caching your backpack(s) outside if there is no room. Backpacks should be anchored down with a ski or pole.

In the winter, it is even more important to have ventilation in your tent for managing moisture. Air vents at both ends of the tent allow for moisture to escape, reducing the frost and ice on the ceiling or water raining on you from the inside of the tent throughout the night. Airflow can also be increased by ensuring spacing between the tent and the fly near the snow.

It is important to remove snow loading on the tent by shaking it off and shovelling accumulated snow around the tent. Note that by using your shovel blade directly on the fly to clear off snow, you risk the potential of ripping your fly. If it is a major snowstorm, you may need to take shovelling rotations to clear the snow. Sometimes people will carry two sets of poles to reinforce the strength of their tents. Warning,

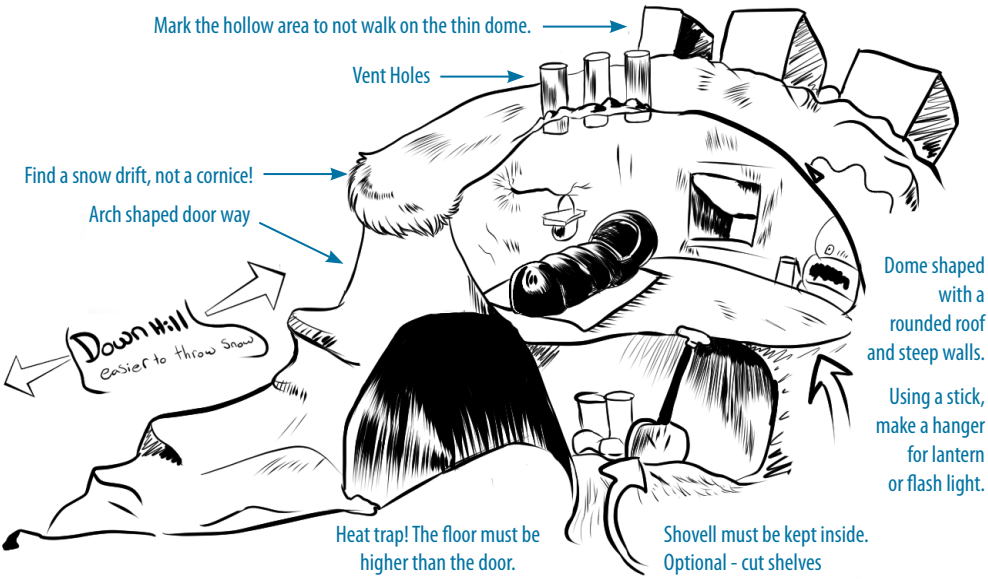
if it gets quiet and humid, snow has most likely covered your tent as a dome, and there is danger of reduced air exchange. It is time to get out and shovel.

Fly Camping is a name given to simple tarp or tarp-like shelters. Although these shelters are not as strong as a four-season tent, they are a lightweight and versatile single-wall option for sleeping or for a kitchen.

SNOW CAVE

Essentially, you are digging-in to create a den similar to how other animals create home sites. Find an area where snow has already accumulated, ideally with a slope beneath for ease of excavation. Probe to find out how deep the snow is and for any obstructions like small trees or large boulders, while being careful not to step on top of your intended cave. Consider the orientation of the predominant wind for the location of your entrance into the cave. Built correctly, a snow cave is incredibly strong and can comfortably house from one to four people (or more). It can also last as a base-camp for multiple days.

Excavating snow for a snow cave takes time and it is hard to stay dry, but the warmth and comfort of the final product is worth the effort.



As indicated in the drawing on the previous page, design principles of building a snow cave include:

» An entrance that is below the sleeping platform, creating a cold sink.
» A sleeping platform, which is above the top of the entrance door to maintain heat.
» An inside dome, or arch shape which gives structural stability.
» Ventilation through holes poked through with the end of ski poles or sticks allow for slight circulation.
» Wall thickness of approximately 50 cm or more. The roof should not be significantly thicker than the width of supporting walls.
» Smoothing out the inside roof and walls so there are no small peaks. This ensures that when the cave warms up, and the roof forms a thin sheet of ice, water does not drip on the sleepers.

Snow extrication strategies:

» Draw out your entrance door, and where your sleeping platform will be. The door can start quite big, as you can always fill the top of it later with snow blocks.
» Divide and conquer tasks and spell people off.
» Once you have moled in and up inside the cave, cut out blocks of snow instead of loose snow. This makes transportation of snow along the assembly line easier.

As added finesse to your snow structure, you can build small shelving on the inside, warm it up with a candle or candle lantern and create a hallway for taking off boots and storing personal gear at the foot of the sleeping platform. Properly constructed, pee-drain holes in the snow cave surprisingly do not smell and offer an easy night time option. An alternative for winter camping in general is the use of a pee bottle – it avoids a trip out into the elements. Dumping the pee bottle should be done in the designated pee area to avoid snow contamination.

Safety considerations include:

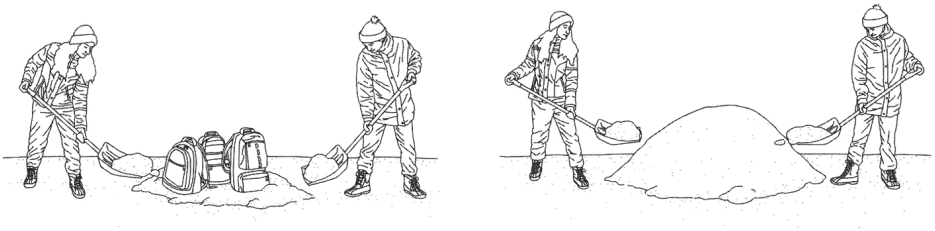
» Take care not to dig your snow cave on avalanche prone slopes. Look for smaller wind-loaded or cross-loaded features in non-avalanche terrain.
» Once inside the snow cave, you cannot hear outside noises.
» Obstructions such as trees or boulders create a weak point in the cave walls.

» If stormy, sealing the entrance with your packs helps to limit spindrift. Continue to check for snow blocking the entrance and potential shovelling duty.
» Always leave a shovel on the inside in case of getting snowed in.
» **Warning:** Never cook inside your snow cave. There is not enough ventilation for the carbon monoxide emitted from your stove. This odorless and poisonous gas will make you feel sleepy and has been the cause of death of winter campers.

QUINZEE

A quinzee is the type of snow shelter people often associate with snow-fort building that can be built on flat ground thus avoiding avalanche terrain (assuming it is not built at the bottom of a run-out zone). Construction work-hardens powder snow, so the shelter can be successfully built even in very powdery conditions when no other snow shelter would work. It is best suited for when there is not enough accumulated snow for a snow cave. Essentially, you pile up a huge mound of snow and dig into it in a similar fashion to the snow cave. It is strong, warm, can be used for multiple nights and can comfortably house one to four people. The disadvantages are the same as a snow cave, as it is both time intensive and hard to stay dry during construction.

Estimate the size of your mound based on the circumference of the number of people sleeping and then add a minimum of 50 cm for walls. Stomp out this circle and begin piling loose snow. The key is to create a dome shape mound, as opposed to a cone shape. Once you have the desired size and shape, work harden the outside with your shovel. A construction trick the winter backcountry leader may use is to build a pile of bags (packs) in a dome shape, cover

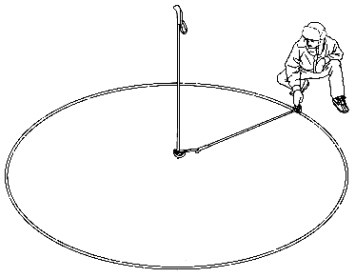


with plastic or a tarp and bury this. Much less snow is used to build the pile, and the quinzee is easier to excavate afterwards as less snow is required to be removed.

As with the snow cave, dig in with the entrance door near the ground. The key difference is the all-around thickness of walls of approximately 50 cm. You can insert ski poles, a probe or sticks to a chosen depth (70 cm for example) from the outside, to guide the inside "mole" on wall thickness and direction. Once taken out, they are good ventilation holes. Otherwise, the same principles apply; cold sink, design structure (dome / arch), height of sleeping platform above top of entrance, ventilation, wall thickness and smoothing out the inside roof and walls. **All of the same safety considerations from the Snow Cave description apply.**

IGLOO

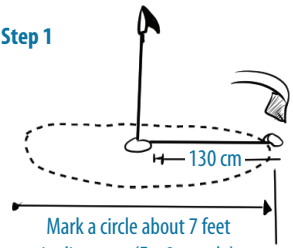
Igloos are another form of snow shelter, which offer great protection from the elements with the right firm and wind-hammered snow conditions. Learning how to properly construct an igloo takes time and practice to build. However, this may be worth the learning curve!



A pair of ski poles can be used to define the circular base of an igloo.

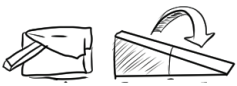
All of the same safety considerations from the Snow Cave description apply.

Step 1

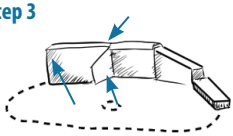


Mark a circle about 7 feet in diameter. (For 3 people)

Step 2



Step 3



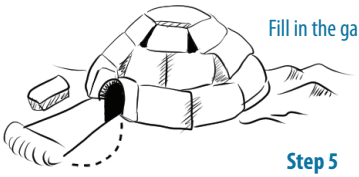
Cut and stack blocks with 3 sintering points of contact

Design and cut a nice-fitting cap

Fill in the gaps with chinking

Step 4

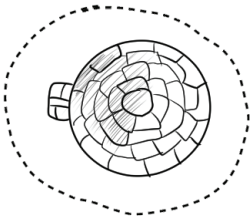
When stacking, make sure the blocks tilt inward.



Begin doorway by digging down

Step 5

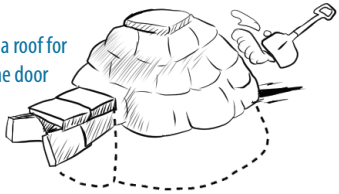
Birds-eye view



Step 6 - Completed

Toss some soft snow on the finished igloo

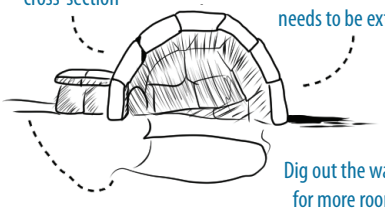
Add a roof for the door



Dig out the floors and angle the walls for more sleeping room

Architectural cross-section

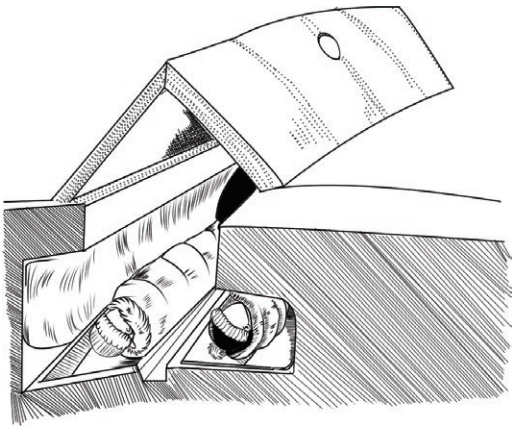
Tilt on side blocks needs to be extreme



Dig out the walls for more room

SNOW TRENCH

An A-frame snow trench is a hastier snow shelter than the previous two, and you will most likely stay dryer during construction. Work harden an area to quarry blocks and give it time to set up. Work harden a second area about the size of your body length square. Dig a shoulder width and just over body length trench in the middle of it. Widen beneath the pit digging down to form a bulb which will be your sleeping platform. At the foot of the sleeping platform dig a deeper pit. This will be your entrance door and cold sink. From your quarry, cut large blocks and place them in an A-frame over the trench. You can chisel the edges down to make the blocks fit more firmly in place. Add blocks to close off either end of the A-frame, and over your entrance door. Fill in the spaces in between the blocks for a full roof seal. Note that it is possible to dig out the bulb after the roof to ensure better final touches on the roof, but then you get wetter during construction. **All of the same safety considerations from the Snow Cave description apply.**



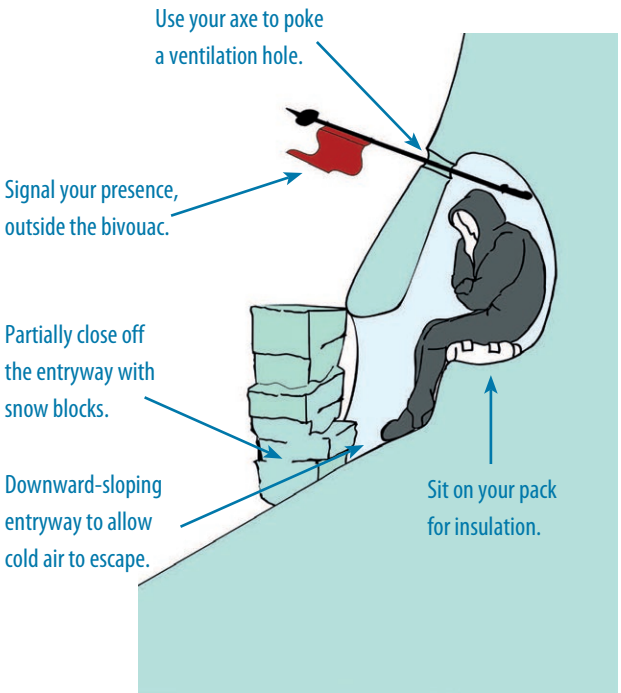
EMERGENCY SHELTERS

In case of an emergency, shelter from the elements is essential for treatment for the individual(s) in need, for group management and preventing the situation from becoming worse. There are a great variety of emergency shelters and bivouacs, and many can be aided with the use of a tent fly or tarp. Prevention of cold injury and maintenance of warmth is key. Should it be possible, descending below treeline is a good first step for protection from the elements.

Above Treeline

Should descending below treeline not be possible, here are a few options for hasty emergency style bivouac shelters (without the aid of a tarp):

Hasty one to two-person caves can offer respite from the elements, should it not be possible to descend to treeline. **All of the same safety considerations from the Snow Cave description apply.**



Below Treeline

Below treeline emergency shelter designs are varied, but essentially utilize the environment as a backdrop for the shelter – sometimes in combination with a tarp or fly for protection and /or fire (as described below). A hasty shelter should be quick to build and maintain individuals' warmth. However, it may not necessarily be about getting a good night's sleep. One tried and true technique is to use a tree well, which is already a partial cave, to your advantage. Dig it out further creating enough room for your group to sit and build a fire. Creative use of a tarp can aid in warmth and protection from the elements. The heat from the fire will reflect off of the walls

of the snow and down from the boughs of the trees. Be careful of dropping snow bombs as the heat from the fire melts them out.

Staying Warm

SYSTEMS

Staying warm and sleeping warm is all about developing systems for equipment and self care. There are many different systems and what works for some may not work for others, as each produce and distribute heat differently.

Warmth can be maintained or generated through:

- Movement - for example shovelling, swinging or pumping your arms or legs, running on the spot, sit-ups in bed or going pee at night.
- Good nutrition and hydration by eating and drinking enough. Hot drinks and fatty foods will also help maintain warmth.
- Proper layering systems—base layer(s), insulation layer(s) and shell.
- Proper clothing materials that wick moisture and maintain warmth when damp including natural materials such as wool or down and synthetics such as polypropylene and fleece.
- Protection from the elements such as—contact with the cold snow, wind stealing away your body heat and staying dry.
- Chemical heat such as heat packs.
- Adding heat such as—sharing body heat (warmer with three people in a tent than two), or throwing a hot water bottle at night down by your toes.

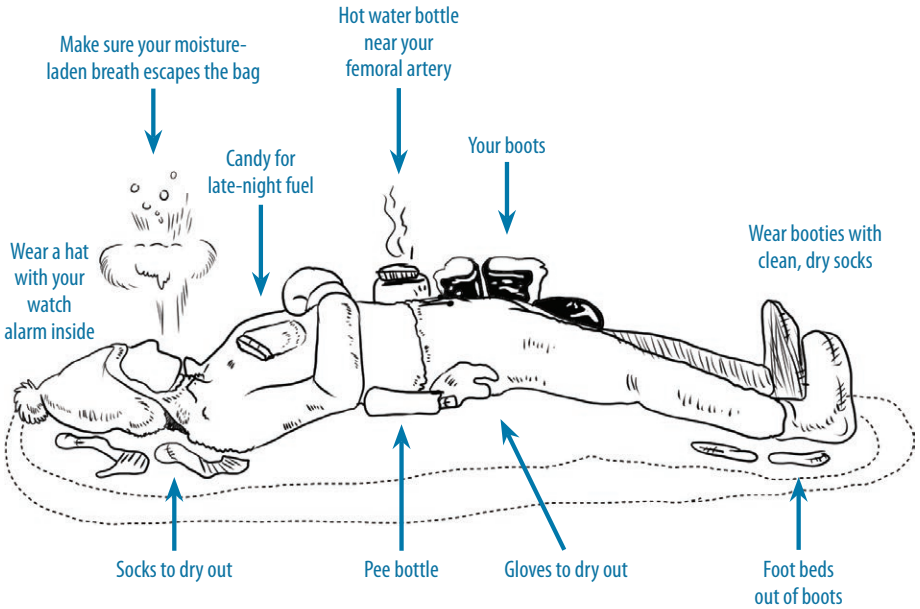
EXTREMITIES

Extremities such as hands, feet and ears are often the first to get cold, and can take some effort to rewarm. The key is to maintain warmth and prevent them getting cold in the first place. As a winter backcountry leader it is important to create a culture where people feel comfortable talking about their needs and acknowledging potentially cold extremities. This could prevent a major first aid scenario. If cold, rewarming should happen as soon as possible.

Having multiple pairs of gloves, using the same layering system as for your body (liner, insulation and shell), will help to maintain hand warmth. Designate a pair of gloves that can be more easily dried to be used for shovelling or shelter building. This isolates the moisture in one set of gloves that can be later dried if desirable. Attempt to always wear gloves when touching metal, such as a shovel, camp stove or fuel bottle because of the conducting property of metal and cold temperatures.

Maintenance of warm toes and feet is the product of good self-care. Aside from the suggestions for maintaining and generating warmth above, some tips are:

» Balance sock thickness with boot space to promote circulation and insulation.
» Keep boots loose, or loosen up boots when you get to camp.
» Keep feet dry throughout the day.
» Change socks when you get to camp.
» Designate a pair of thick wool socks as your bed socks and store them in your sleeping bag.
» Check your feet at night to ensure they have feeling, colour and capillary refill.



SLEEPING

Sleeping warm has to do with your personal heat production, diet, equipment and your sleep system. The key is to get into your sleeping bag warm, similar to adding hot water to a Thermos™ and to wear the right amount of layers (base and insulation) for you. A good sleeping pad (winter rated) is also important. Many winter campers will double up their sleeping pads with the first

layer of their sleeping "sandwich" being an closed cell foam pad, and the second being an air / foam mattress, such as Thermarest™. Whether down or synthetic, a dry bag will harbour more heat. When cinching down the neck baffle, mummy hood and pull-string around your face, make sure your your moisture laden breath is escaping to the outside, and not inside of your bag.

Putting items inside your bag may help keep them warm, dry them out or ensure they function in the morning - for instance socks warming and drying on your chest at night, also toothpaste tube or medicine such as epinephrine. Some types of stove pumps will not work if super-cold so should be wrapped in a bag and similarly protected in one's sleeping bag. Note that the more items and moisture you add inside your sleeping bag, the less warm you will be; it is a balancing act.

Some people will tuck their boot liners under their knees or use them as a pillow, along with their big puffy jacket.

There are many other techniques, such as:

- Wear a toque to bed.
- Wrap an extra layer around a colder body part.
- Add warm water bottles.
- Go pee at night if nature calls.
- Use a warm water bottle to "iron" moisture out of damp layers.
- Dry out your sleeping bag in the open air when possible.

Meal Preparation for a Winter Environment

KITCHENS

A good kitchen set-up will protect individuals from the elements, be relatively comfortable, manage moisture and carbon monoxide and of course enable the production of great food. Systems of organization will help efficiencies from day-to-day and evening to morning. Good hygiene is essential; everyone should wash hands with soap and snow, or use hand sanitizer prior to cooking and after using the washroom. It is good practice to wear liner gloves when cooking; cold will transfer easily through metal fuel bottles and pots for instance, cooling your hands. In addition, the use of a folded ensolite pad to sit or stand on will help maintain your overall temperature. A winter camping specific kitchen equipment list can be found in chapter one.

Open Air Cooking

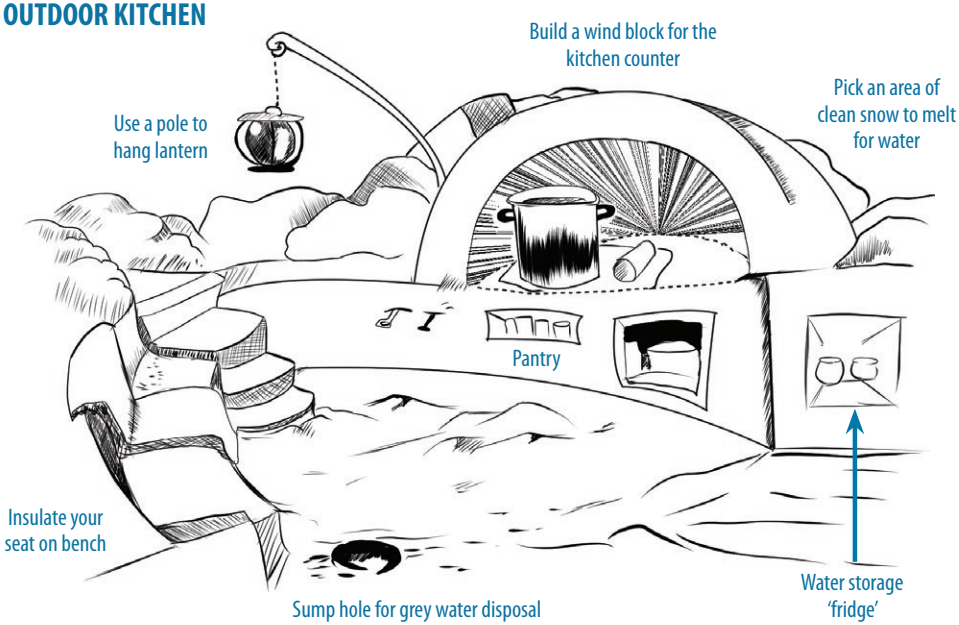
Cooking in the open air offers a more spacious and social kitchen, while enjoying your surrounding environment. It can be proximal to your tent, or placed just outside of the snow shelter. An outdoor kitchen can be built quickly for utilitarian purposes and be as simple as digging a hole in the snow for your feet and a small wall above a cooking counter to protect the stove from the wind. Note that the construction of stairs (rather than ramps) may reduce slips or spilling of dinner. In the case of a large group or a basecamp a creative and time intensive kitchen design can be worth the effort.

Design attributes of an open air kitchen may include:

- Wind walls or natural features for shelter.
- A cook space with countertops (between waist and chest height), an undercut trench at the base of the counter for the toes of your boots, shelves cut into the counter for storing food, group dishes and personal dishes at night, utensils used in cooking lodged into the wall of your countertop and a designated clean snow quarry for meltwater.
- A sitting area for socializing, planning or group eating. This could be in the form of a large group table or countertop. Multiple entrances / exits help with flow.
- A fridge. Dig a small cubed shelf into your counter from the floor of your kitchen. Meltwater in pots (making for an efficient morning) can be put in this cubby (ideally on an insulated surface) with the door sealed by a block of snow. Water will be kept close to 0 degrees Celsius overnight, and stay mostly un-frozen.
- A sump or grey water hole, for cooking water (say pasta water) or dishwater. This hole can be dug in the corner of your kitchen floor.

When leaving your kitchen for the night, make sure that you are ready for potential overnight snowfall. Belongings are in shelves or in your fridge, and your food is protected from potential visiting critters.

OUTDOOR KITCHEN



Sheltered Cooking

Sheltered cooking includes cooking in your tent or vestibule or making an open-concept (three-sided) cave for protection from the elements. Likewise, a front foyer to your snow cave (not inside the cave) may fulfill the same function, while maintaining enough ventilation. Air flow helps to reduce moisture build up and eliminate the danger of carbon monoxide poisoning.

Vestibule cooking skills are excellent for getting out of stormy weather and staying warm. However, not so excellent for enjoying the company of other team mates, stretching out, enjoying the views and avoiding tent fever. As mentioned previously, air flow in your tent is especially important while cooking. Open up the mesh tent zippers and the upper zipper of the fly. Be aware of the proximity of your cooking shelf to the tent body and fly. Tent material burns hot and quick! Be conscious of avoiding stove flare-ups or flame height if priming your stove. Hanging an isobutane stove system such as a Jetboil™ from your tent ceiling or on a vestibule cooking shelf is another tent cooking option.

STOVE AND FUEL CONSIDERATIONS

Stove and fuel types are not created equally for cold temperatures.

- White gas stoves are the most efficient and versatile in cold weather.
- Alcohol stoves work well in the cold, however are seldom used because of lengthy cooking times.
- Isobutane stoves work only when the fuel source is warm. These stoves may function in warmer winter camping situations or if cooking in one's tent after warming up the fuel source.
- Propane stoves do not work effectively in the winter.

Knowing your stove and testing it out beforehand will ensure smooth operation. In the field stove maintenance equipment and knowledge will inevitably be helpful.

Melting snow for cooking and drinking water requires significantly more fuel as does the general operation of the stove in colder temperatures. For example, should you typically pack approximately ⅛ litre of white gas per person per day in the summer (or ⅓ litre per group of three), in the winter you should expect to pack ¼ litre per person per day (or a little more than ½ litre per group of three). Keep in mind that white gas stove pumps may need to be rewarmed prior to use.

Extra waterproofed lighters and matches are always good insurance. Keep in mind that lighters operate better when warm and dry; an inside chest pocket is a good home place for your lighter, otherwise, they can be warmed up quickly.

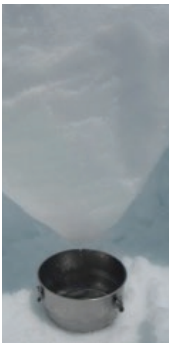
You will not want to set up your stove directly on the snow, as it will melt down and eventually put itself out. One lightweight option is the back of a shovel blade, however this both takes this shovel out of rotation and the stove will slide around quite a bit on this uneven surface, needing consistent attention. Another option is to bring along a flat, square homemade stove board; this can be made out of thin plywood or a foil-tape wrapped insulation.

MELTING SNOW

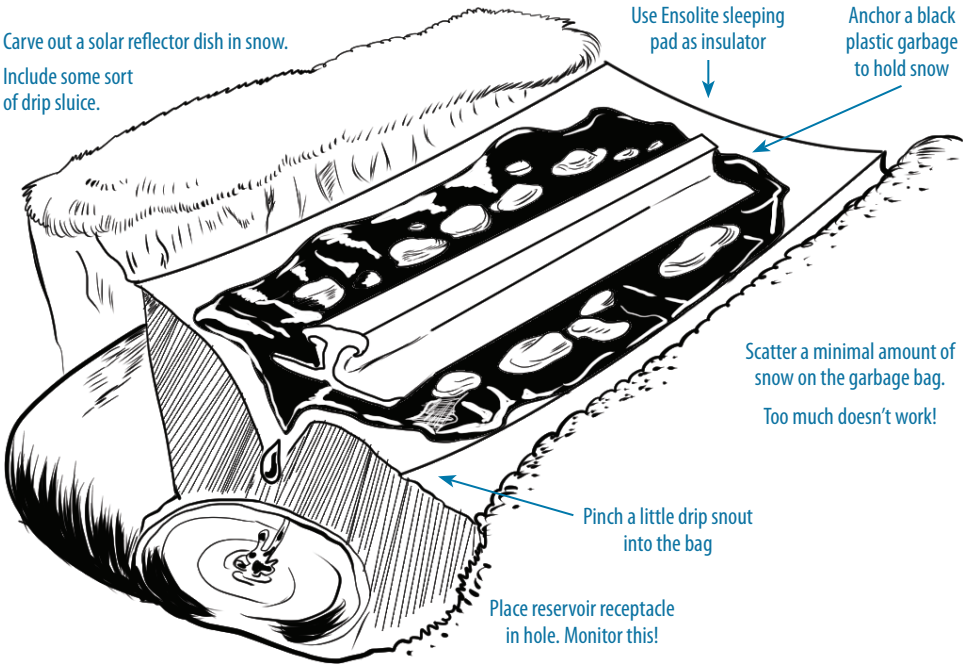
If lucky, you may find a running stream or an open part of a lake in the winter. Accessing this will save you time and fuel. However, be careful with collapsing snow or ice into the water source. Building an access to the water source is better as a two-person job, in case of a collapse of snow or ice. If melting snow, make sure to save a little water (that is free from electrolytes or drink flavouring) and start off with that in your pot. Slowly add snow until there is enough meltwater at the bottom of the pot. From there add

high-density snow, covering it with a lid. This system will prevent you from burning the snow. Burnt water truly tastes awful. Designate an easy-to-access part of your kitchen where you will harvest snow for water. Keep this area free from travel or storage of goods to maintain a clean source.

When winter camping in the springtime, the use of solar stills can save time and fuel. Two examples of effective solar stills are shown in the two images. A dark garbage bag, shaped to collect the sun's energy and funnel melting snow into a pot is one such option; this requires occasional and ongoing attention. Another type of still can be created when there is free water running through the snowpack. Form a mound of snow and carve a cone underneath for water to soak through and into a pot. This does not need to be monitored, but takes more time in initial construction.



SOLAR STILL



MEAL PLANNING

The winter backcountry leader will recognize that good food can often make or break the trip.

Often being lightweight is a priority with self-propelled travel, and thus non-perishable, easy to cook, dehydrated or freeze-dried food is preferable. On the other hand if a shorter trip, towing a sled, or tolerating extra weight, frozen meals will stay frozen and can be defrosted quickly saving time and fuel. Fresh produce will not sustain in winter conditions.

Food planning is most often done on a meal-by-meal basis by charting out breakfast, lunch, dinner, snacks for each day and hot drinks and treats for motivation and morale. Portions can be established via weight or by counting calories.

Nutrition and performance are directly linked; a great starting point is to balance your macronutrients—carbohydrates, fat and protein. Carbohydrates, such as pasta, oatmeal and bread satisfy a quick transition from food intake to energy production and warmth. Protein, such as nuts, seeds, salami and jerky help to build and repair your muscles and maintain energy production. Fat, such as butter, fatty nuts and oils helps to maintain warmth and longer term energy output (such as when sleeping). Experienced winter campers will eat more fat than usual, dropping spoonfuls of butter or coconut oil, for example, into their coffee in the morning or tea at night. Hydration is also important in that people often drink less when they are cold; build hydration into your menu by offering soup appetizers and post meal hot drinks. Commercially dehydrated or freeze dried foods often taste great and save in your preparation time.

When meal planning consider:

- Allergies and food preferences
- Energy requirements will be different based on metabolism, size, age, gender, etc.
- Environmental influences—cold, damp and /or windy weather
- Activity levels and duration
- Length of trip and micronutrient needs (vitamins and minerals)
- Preparation and cooking time, division of labour and equipment required
- Hydration needs
- Vehicles for water (thermos, insulated water bottles, etc.). Note that by storing the water bottle upside down, frozen water will rise to the top and you can still open the lid.

Fires

Knowing winter fire lighting techniques could be essential in an emergency situation. Fires can offer both physical and psychological comfort to your group.

The winter backcountry leader will consult local regulations with respect to permissible fires and certain fire restrictions and be conscious of environmental impacts a campfire can have. In addition, note that fires in alpine environments are generally discouraged as they have significant impact both via harvesting limited wood and through scarring the environment.

A small fire lighting kit is an essential part of your equipment list. This should contain waterproofed matches and/or a lighter and fire starter. There are numerous store bought and homemade fire starters that work effectively. Also essential is a knife. A fixed blade knife is best for making shavings and splitting wood.

Preparation is key for starting and maintaining a fire in the winter. Dry wood is everywhere below the treeline, but it can take some effort to gather it, both under the snowpack and under the canopy of large trees. When in a forest with larger evergreen trees, lower small branches underneath the canopy will be dry and dead making for good fire starting material. Gather dead wood of various diameters for the different stages as your fire builds in intensity and strength. In addition, look for pitch or collected sap on the outside of the bark; this is very flammable and a great natural fire starter. Construct a platform on top of the snow of twigs upon which your fire will get started.

Gather a large bundle of very small diameter branches that fan outwards. Tilt this bundle upside down, light it and move the flame upwards and around, rotating the bundle, while being aware of your hand. This torch will hopefully become your starting point to either your classic log house or tipi design.

Creating a feather stick is another great way to start a fire. This will only work with dry and dead wood. This takes practice with finding the right angle of your knife blade to the wood grain as well as the right amount of downward pressure on your knife. With practice, you will create a collection of shavings, still attached to the stick. Rotate the stick slightly and continue eventually creating a feather-like look on one side of the stick.

Remember to slowly build upon the fire, adding larger diameter fuel, while maintaining air flow to the flame

Low Impact Travel and Camping

Principles and practices of low impact travel and camping are explored in Chapter 4: Wilderness Ethics and Ecology.

References and Further Reading

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Van Pelt J. & Fulsaas K. (Eds). (2010). ***Chapter 3: Camping and food.*** In Van Pelt J. & Fulsaas K. (Eds.), ***Mountaineering: the freedom of the hills*** (41-72). Seattle, WA: The Mountaineers Books

Notes:

Notes:

Companion Rescue

When travelling in the backcountry, the use of terrain as a mitigation tool to avoid slopes with the potential to avalanche is of primary importance. If the intention is to ski, ride, or simply travel in the backcountry, there is always a level of risk associated with these activities. In spite of the winter backcountry leader's best efforts and decision making to facilitate a safe outing, there may still exist a small level of risk. For this reason, an understanding and proficiency of companion rescue will contribute to a successful rescue of a member in the group given time is limited due to asphyxia. This chapter will explore aspects and considerations of companion rescue including group management, transceiver use as well as probing and shovelling techniques.

Group Management

As a winter backcountry leader, it may seem that in such a position you would be taking charge of the companion rescue should such an incident occur. This would likely be correct if it were one of your participants involved in an avalanche. What if it were you, the winter backcountry leader? Who would lead and organize the search? Although there are countless companion rescue scenarios with countless solutions, it would be helpful to at least discuss the possibility with your group and prepare them to assume a leadership role for your successful recovery should you be the one involved in an avalanche.

In any rescue scenario, safety of the rescuers is of paramount importance. The priorities are the safety of the searcher(s), the group (if not actively involved in the actual search), and finally the victim. While there is often an innate desire to help, the rescue leader needs to monitor the situation and ensure they and their group are not going to make matters worse by potentially becoming victims themselves.

CHOOSING A LEADER

The role of the winter backcountry leader in companion rescue is to organize resources and participants. In short – be in charge and delegate tasks. When faced with a rescue scenario, the novice members of the group will appreciate assertive confident direction in a task for them to perform. If it is the winter backcountry leader that is buried, the group will have to assign a leader to facilitate the process – this is a challenging step for most peer groups. At some point in very short order, someone will step up and start giving directions – they have just become the leader.

Ideally the leader facilitates the organization of the rescue, however, you as the leader might be the most experienced person in the group and should be active in the search in order have the best chances for a successful recovery.

Together with taking a head count to determine precisely how many participants are involved in the avalanche, the leader will be assessing the scene to determine if it is indeed safe to enter the avalanche runout to conduct a rescue. Again, safety of the group is important and needs to be considered. If the search area is threatened above by avalanche terrain that has not yet slid, it may be deemed unsafe to enter and search for the buried victim.

Together with facilitating a successful rescue, the leader's role is to not make the situation worse. That is, maintain the overall safety of the rescue group.

WHEN TO CALL FOR HELP?

This is one of those it depends scenarios. If there are only a couple of searchers available, it may be best to start the companion rescue immediately and call as soon as you have a moment. If you have a larger party, it may facilitate calling for outside assistance immediately. In either case the information that needs to be conveyed to outside rescue resources would be:

- Who you are
- What happened and how many involved (buried)
- Where did it happen
- What specific assistance and/or resources are required
- Describe they were wearing transceivers (or not)
- When did it happen
- Where were they last seen
- How many are actively searching
- Local weather conditions
- How many in your party

Avalanche Transceivers

Historically avalanche transceivers were comprised of a single antenna that was used to both transmit and search. These were typically referred to as analog transceivers. Although the search range for an analog transceiver is greater than a digital transceiver, the user had to process the audible receiving sounds as getting louder or quieter in order to determine the search direction. In effect, the user was the processor determining both direction and distance.

With advent of dual and triple antenna transceivers, the incoming signal is received by one, two or all three antennas (depending on distance to the sending transceiver) which is sampled and processed with a resultant direction and distance displayed to the user. In this way, the user simply follows the arrow and makes the number go smaller. This technology has both simplified transceiver searching for the user as well as reduced overall search time. It has also reduced the search anomalies experienced by single antenna transceivers such as false maximums which took extra time to recognize and solve.

It should be noted, and the winter backcountry leader be aware, that ACC policy precludes the use of single antenna avalanche transceivers. A PDF copy of the *ACC Transceiver Policy* can be found on this webpage: www.alpineclubofcanada.ca/adventures/trip-administration/.

Most modern digital transceivers allow for their operating software to be updated thus ensuring current transceiver technology and avoiding owning and working with a redundant unit as technology improves. Further, transceivers should receive a full diagnostic check (different from the check performed at power up of the unit) on or before the recommended intervals as suggested by the manufacturer.

All modern avalanche transceivers, regardless of brand and country of origin, transmit on the same frequency (457 kHz) and are, therefore, compatible.

PRINCIPLES OF USE – SEND (TRANSMIT)

Modern transceivers have up to three antennas. They are located along the long X, Y and Z axis of the transceiver. The transmitting signal is sent via the long antenna while all three are incorporated in the search phase. In the transmit phase, the signal is sent in all three dimensions around the long axis of the transceiver and appears pushed in at the ends. A cross section of the signal would look like a monkey ears or a butterfly.

The signal is transmitted in a series of pulses. The pulses are randomized to reduce the effect of signal overlap – a condition where two pulses are taking place at the same time thus giving the allusion of a single transmitted signal. In such cases, some transceivers will detect this and instruct the searcher to stand still as displayed on the LCD screen. Naturally, the more transmitting signals there are, the greater the likelihood of signal overlap making searching more challenging.

PRINCIPLES OF USE – SEARCH (RECEIVE)

In search (receive) mode all three antennas are active with the strength of the signal to the X and Y antenna used by the processor to determine a directional vector in which to travel. The third, and smallest, antenna in the Z-axis does not aid in the search until approximately three to 10 metres from the buried transceiver. This antenna helps determine the burial depth of the victim and improves the accuracy of the fine search phase.

It is important for the searcher to keep moving so the processor can receive information relative to the position of the searcher and victim. If the searcher is standing still, the receiving transceiver is unable to determine if he or she is getting closer to the victim due to no change in relative signal strength.

INTERFERENCE

As described, transceivers send and receive a radio signal. As such, they are sensitive to objects that can interfere with their ability to function. This includes metallic objects (i.e. cigarette packaging foil), metal objects, radios, electronic camera, GoPros, cell phones, hand held GPS, etc.

Best practices suggest a minimum distance of 20 cm while in transmit mode and 50 cm while in search mode. If using a cell phone to call out for help while a search is in progress, the cell phone should be 25 metres away from the searching transceiver.

Interference affects the ability to effectively conduct a transceiver search.

GROUP CHECKS

Prior to embarking on an outing, it is important to know that all members of the group have transceivers that properly transmit and receive a signal. This process is referred to as a full function check and is typically done once at the beginning of an outing and involves two separate and distinct steps. Following these steps in sequence reduces the likelihood of a participant's transceiver inadvertently being turned off.

Participants switch their transceivers to search (receive) while the winter backcountry leader's transceiver is on send. The winter backcountry leader moves away from the group (increases his or her distance) until the group members no longer have a signal. During this process, the group members will indicate by raising a hand when they lose the winter backcountry

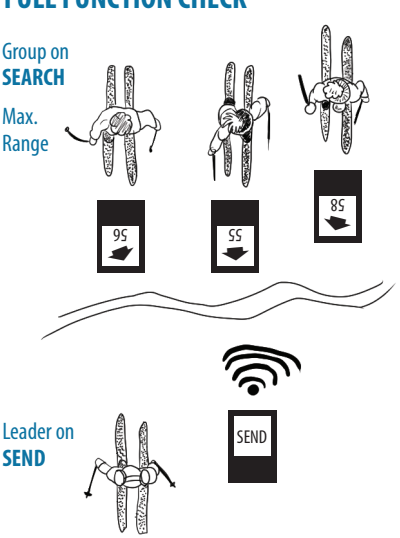
leader's signal, which indicates the range for their transceiver.

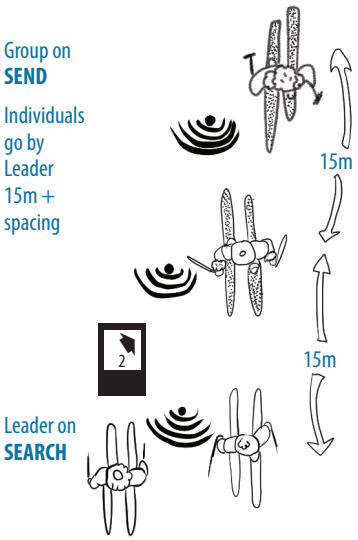
The second step is for the participants to switch their transceivers to send (transmit) while the winter backcountry leader switches his or hers to search (receive). The participants, approximately 15 m apart, move past the winter backcountry leader at a distance no closer than 2 m. The leader confirms the participant's signal as they pass by.

Subsequent transceiver checks on the same outing may be performed as a transmit check. This can be done with a transceiver that has group check mode as well as with a transceiver without a group check mode.

For transceivers with group

FULL FUNCTION CHECK





check, the winter backcountry leader will switch his or her transceiver to group check while the participant transceivers are in send (transmit). Participants are spaced at least 2 m apart and travel by the winter backcountry leader at a distance no closer than 1 m. The winter backcountry leader confirms the transmitting signal from each participant as they pass by.

For transceivers without a group check function, the leader is approximately 30 m away from the group and in search (receive) mode. The group members are in send (transmit) and spaced 10 to 15 m apart and travel past the winter backcountry leader no closer than 2 m. The winter backcountry leader confirms the signal of each participant as they pass by.

Transceiver Batteries

It is important to follow the manufacturer's recommendations for both the type of battery to be used as well as replacement based on the percentage indicator typically displayed at power up.

Good quality alkaline batteries are commonly recommended as they are manufactured to more precise tolerances and tend not to leak as readily. Battery leakage (acid) damages the contacts as well as the circuitry within the transceiver. When changing batteries, be sure to change all the batteries in the transceiver versus some of them. As alkaline batteries slowly discharge, the remaining output capacity is displayed at power up. The user will typically see the power display slowly diminish over time (days). More power is consumed in search mode than in transmit mode. The user then should always maintain a healthy margin of battery power. Partially used batteries can be relegated to one's headlamp or GPS, for example.

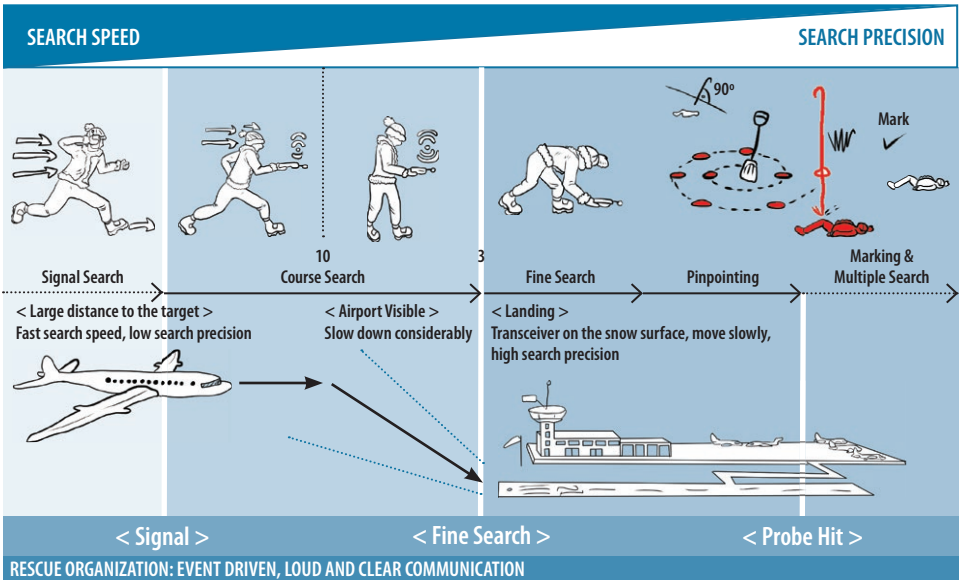
Rechargable batteries may not have the optimum voltage output and may suffer from a very sharp drop off (discharge curve). That is, you may have a reading of 80 per cent battery capacity at the start of the day, but when checked a short time later, the reading may be zero.

Some transceivers accept lithium batteries. Check your transceiver manual if this is the case for your transceiver and follow the directions specifically. Although a better battery for cold conditions, lithium batteries suffer from a sharp drop off curve as well. Typically manufacturers ask that only new lithium batteries be installed (versus used ones). The transceiver then calculates the time remaining on these batteries as an indicator for the user (hard to do with partially used batteries).

Stages of a Transceiver Search

Together with the information already considered in Group Management, the stages of a transceiver search include:

- Signal Search
- Coarse Search
- Fine Search (which is followed by probing and shovelling – important components of the search and recovery, but they take place after the transceiver fine search)



SIGNAL SEARCH

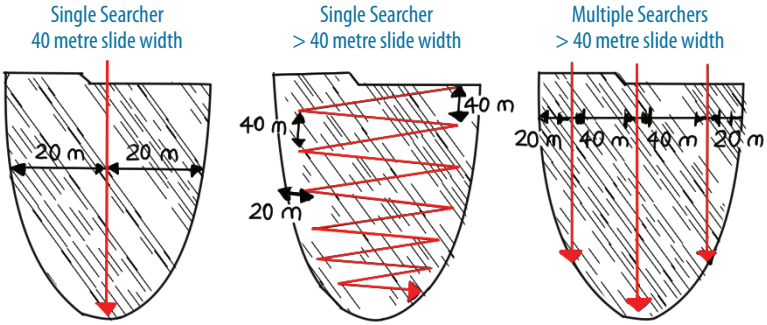
At this stage the winter backcountry leader must ensure everyone in the group has turned their transceiver to search. Failure to do so will result in lost time with searchers honing in on the member of the rescue party who has their transceiver on send. Signal search is the stage where you are looking to acquire a signal – that is, your transceiver is not yet giving you a distance or direction because the victim is out of range.

Depending on resources available this may be performed by a single searcher or a group.

At the signal search phase the searcher is moving fast and will slow down towards the end of the Coarse Search and Fine Search stages

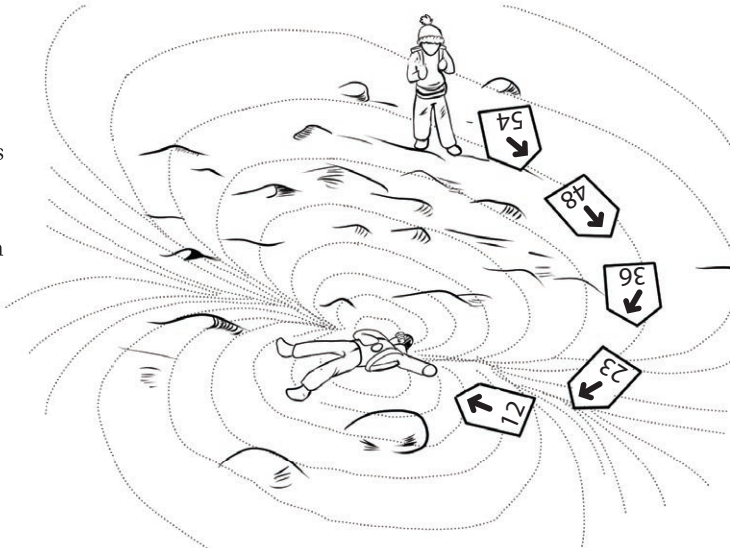
The distance between points of the zig-zag (single searcher) or between two or more searchers is approximately twice the effective range of the searching transceivers. Be conservative in your estimation of transceiver range (i.e. 40 m) to ensure you are adequately and efficiently covering the search area.

Remember to search with your eyes and your ears. Focusing solely on your transceiver may miss important surface clues that will speed up the recovery (i.e. a hand sticking out of the snow!)



COARSE SEARCH

This is where you have now acquired a signal and are following the induction lines as described earlier in the Avalanche Transceiver section. Call out "I have a signal" to alert other rescuers to prepare for probing and shovelling. Important steps are to hold the transceiver in front of you and follow the arrow and make the numbers get smaller. When your numbers indicate 10, this is your reminder to start to slow down and slowly position your transceiver closer to the snow to reduce the extra range that holding it near your chest will result in.

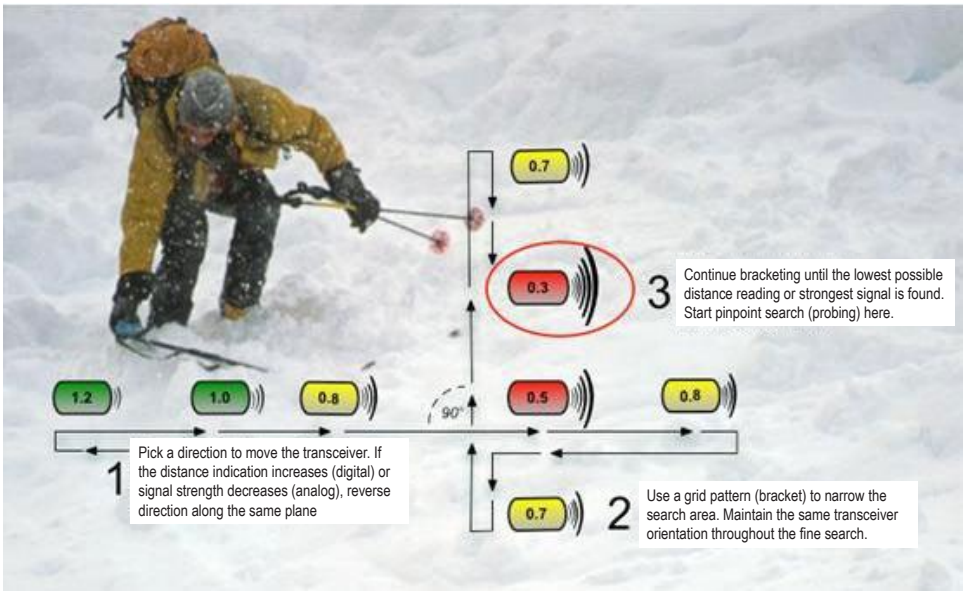


FINE SEARCH

The fine search typically takes place in the final 3 m of the transceiver search. The transceiver is held close to the snow and the searcher moves at a much slower pace to ensure fine search accuracy. At this stage, depending on the transceiver being used, directional arrows may no longer be displayed. This means you are getting very close. During this search phase you may go past your lowest number displayed and see the numbers start to increase. Move your transceiver back to where you had the lowest reading and, with your transceiver oriented in the same position, move at right angles to the left and right to determine if further low readings can be achieved. This is called bracketing.

Do not spend too much time bracketing, especially for burials less than one metre as your probing will be a faster method to find the victim.

Ideally, the searcher will be moving slow and low as they enter the fine search and hone straight in on the lowest number without the use of bracketing. This is commonly referred to as the landing strip approach.

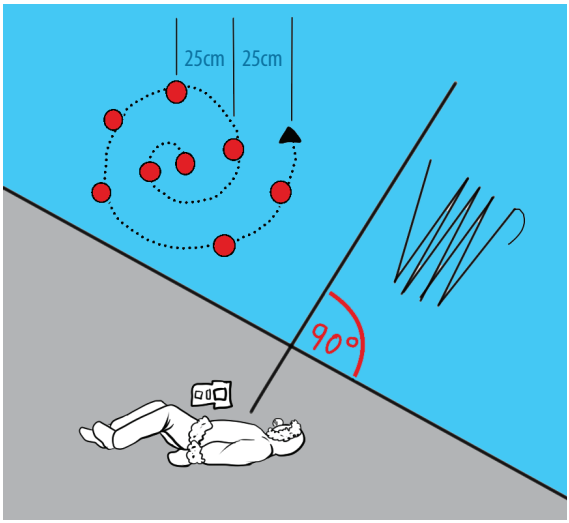


PINPOINTING (PROBING)

Probing is the stage in which you pinpoint the victim. Once you complete the fine search and have found the lowest reading on your transceiver, this indicates the likely spot to probe. Indicate this by placing some object on the snow at this spot (do not use your gloves, these should be worn during probing and shovelling to keep your hands warm and functional).

Efficient methodical probing is essential for a pinpoint (or probe strike) of the buried victim. Be sure to probe perpendicular to the slope and in a spiral with probe holes approximately 25 cm apart and the spiral in 25 cm increments. Once you have a probe strike, leave the probe in place and prepare to begin shovelling.

Remember the lowest reading your transceiver gave you (i.e. one metre) as this is the approximate depth of the victim. You should probe to a depth slightly greater than this.

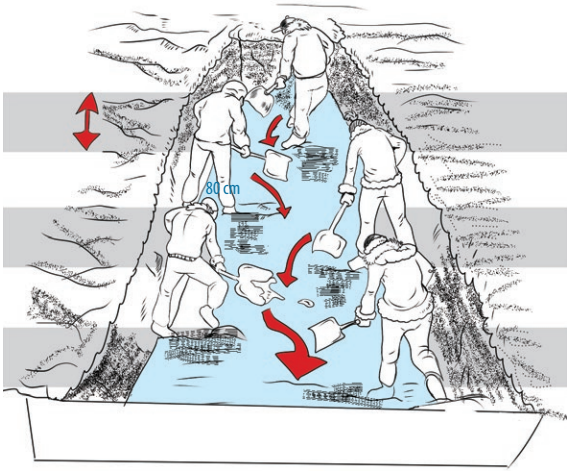


SHOVELLING

The current best practice for shovelling is the V-Shaped Conveyor method developed by Manuel Genswein. Important in this technique is the movement of snow along the conveyor away from the probe versus throwing snow away from the probe. One rescuer is positioned at the apex of the V (at the probe) with the other rescuers positioned along the V approximately 80 cm apart like a flock of geese fanning out. The shovellers are positioned so that each shoveller is responsible for an 80 cm corridor across the V. The shovelling is demanding and tiring so be sure to rotate positions frequently.

Once the victim has been reached it is imperative to excavate the snow towards the head to remove snow from the chest, clear the airway and administer first

Efficient shovelling and organization is critical in reducing time spent recovering a buried avalanche victim.



aid. At this stage, another shoveller may assist the V-point shoveller to widen this area and expedite the excavation to the victim's airway. The remaining shovellers will continue to excavate the rest of the victim and prepare a ramp for removal of the victim.

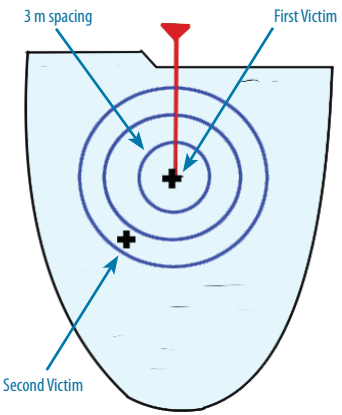
MULTIPLE BURIALS

Modern transceivers treat multiple burials (signals) as solving two or more single burials in succession (one at a time)

In the event of multiple burials, the general transceiver search steps remain the same. Most modern transceivers have some kind of function that will indicate a multiple burial scenario. Leaders and participants should refer to their transceiver user manual for information on how multiple burials (signal) may be displayed. Typically, the searching transceiver will lock on to the strongest signal as the first transceiver to be located. This may not necessarily be the closest transceiver of the two to the searcher, as it may be a function of transceiver antenna orientation (both sending and searching transceivers) that influences this.

With multiple burials (signals), there is a greater chance of signal overlap. This may momentarily pause a searching transceiver in that its processer knew it detected two signals, but momentarily it now sounds like only one signal. Leaders and participants should consult their transceiver user manual as to what kind of information their searching transceiver will display in such instances and how it continues with the search.

Multiple Burials
Circle Search Method



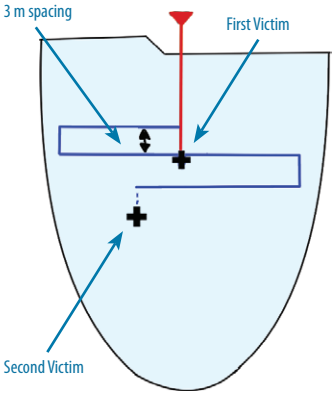
Most modern digital transceivers have some kind of marking function where, once a probe strike is achieved (pinpoint), the searcher can mark the transceiver and continue searching for the other buried victim. This mark function effectively masks the pinpointed signal (victim) and another signal is acquired. Different transceivers have slightly different methods of how the mark function works, hence it is imperative for the user to practice and understand their transceiver functions.

In the event the user's transceiver does not have a marking function, or a marking function does not work, the searcher may employ either the Micro-Search Strip Method or the Three Circle Method. These two techniques facilitate a means of systematically moving away from the victim (transceiver) that has been found, to acquiring the signal of the victim (transceiver) that is yet to be pinpointed.

In some instances, the winter backcountry leader may consider turning off the transceiver of the first recovered victim. Although the advantage would result in one less signal to influence the search for other victim(s), the winter backcountry leader would want to be absolutely certain there is no further danger of another avalanche that could result in a re-burial. If this were the case, it may be very difficult to re-locate the originally recovered victim as there would be no transceiver signal to hone in on, thus reducing their chances of survival.

It is important that companion rescue be a practiced skill to be successful. This skill should be trained each season to be most effective.

Multiple Burials
Micro Strip Method



First Aid

Chapter 8 describes the steps to be taken next, which include ABCD's as well as gentle handling of the victim if they have been buried for an extended time and are hypothermic.

References and Further Reading

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Notes:

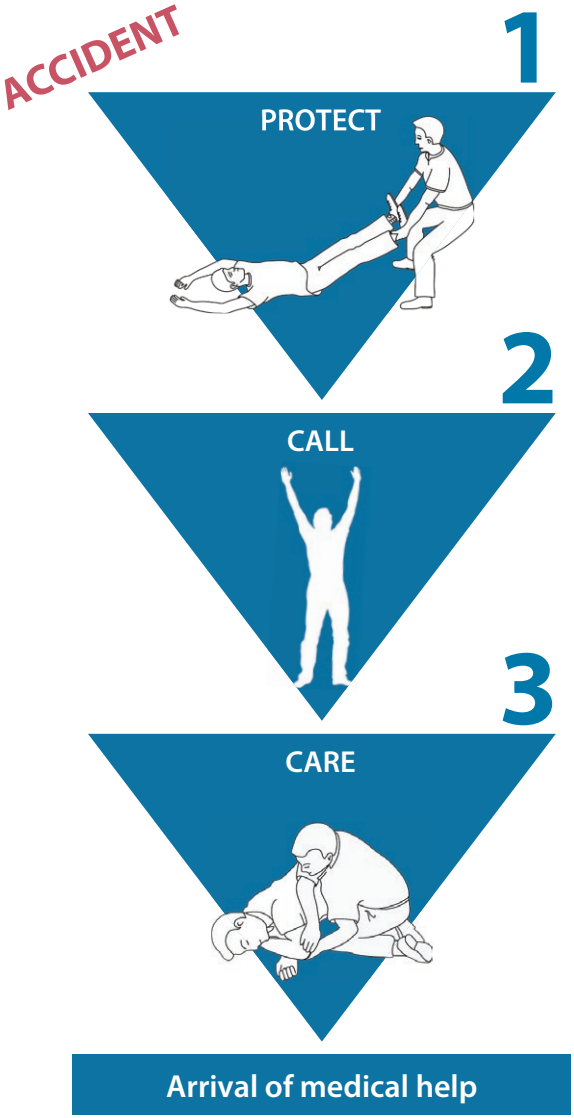
Notes:

Responding to Emergencies

Despite best laid plans, winter backcountry leaders may at times be required to respond to accidents or emergencies within their group or other recreational groups in the area. It is therefore imperative that winter backcountry leaders maintain first aid currency and be properly equipped to manage minor emergencies and if necessary seek the assistance of organized rescue for major emergencies.

Managing Emergencies

There are many approaches to managing emergencies and in this chapter we will explore the basics of first aid, emergency communication, and how to manage the group if an accident occurs as well as winter backcountry survival essentials should you be forced to spend the night out. The basic principles outlined in this chapter are not a replacement for formal first aid training; all winter backcountry leaders should possess first aid training beyond the standard first aid training level together with CPR certificates as well as recognized avalanche skills rescue training as described in Chapter 7.



In most backcountry scenarios, there is no 911 service and the members of the victim's party must provide a much more extensive level of patient assessment and care for a much longer period of time, usually hours to possibly days, before the patient can be transferred to professional medical care.

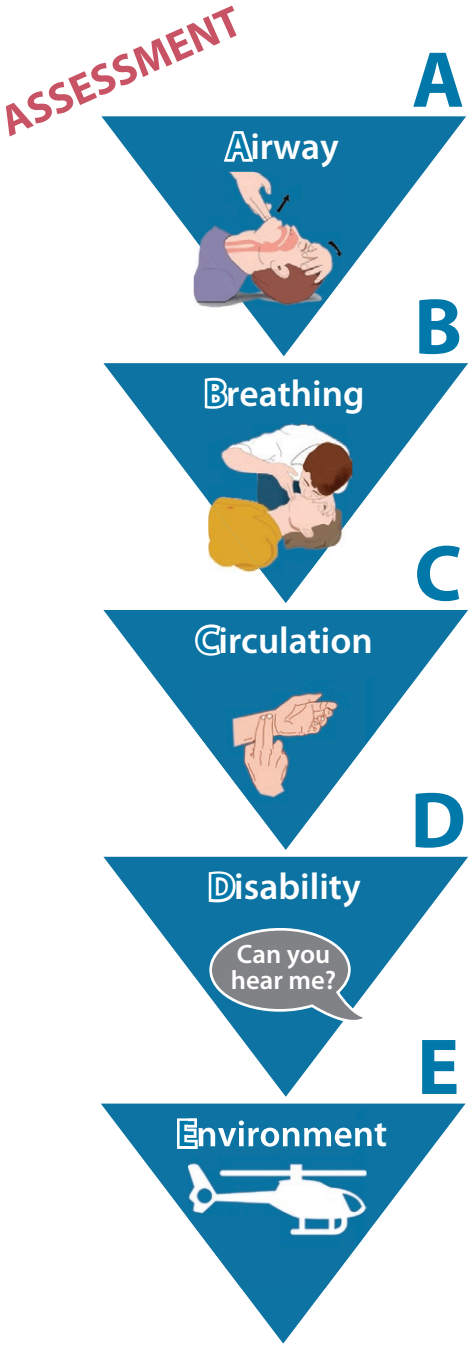
Essential first responder skills in a backcountry emergency include the ability to improvise with less-than-optimal material and resources at hand and possibly transport the victim safely for short distances for safety reasons. As mentioned, care may be required for the victim and rescuers over an extended period of time, during which hypothermia prevention for all concerned, for example, may become a major issue that also needs to be addressed during the emergency response.

Performing First Aid

Once the scene has been assessed and deemed safe, or the patient has been moved to a safe location and a call for organized rescue (if required) has been made, the winter backcountry leader can then provide initial first aid to the victim. Depending on the severity of the injury the general first aid procedures include:

- A (airway), ensuring the patient's airway is unobstructed;
- B (breathing), establishing that the victim is breathing and determining the quality of breath;
- C (circulation), checking for a pulse and the general heart rate over the period of one minute in addition to a quick check for severe bleeding;
- D (disability), determining the victim's level of consciousness and awareness, checking for sensation in all extremities; and
- E (environment), determining the effects the weather will have on the ability to treat the patient, effectuate a rescue, and manage the remaining group members.

Documenting patient information, in the event of an accident, can be beneficial in determining whether the patient's condition is improving or deteriorating, can be useful for organized rescue and emergency medical services, and can occupy a member of the group during an emergency.



Due to the nature of winter backcountry travel in avalanche terrain, the most common accidents involving avalanche victims are asphyxia (avalanche burials) which may be accompanied by trauma and involve bleeding and/or fractures, hypothermia and cold related injuries (frost nip and frost bite). The first priority after determining responsiveness of an avalanche victim is the airway. In many cases the airway may have been blocked with snow and the victim will have been without adequate air supply. Avalanche victims with cold related injuries (hypothermia) may require extra care and attention.

As discussed in Chapter 7, time is an important factor in the recovery of an avalanche victim as it correlates to one's chances of survival. For this reason, practiced CPR skills of the winter backcountry leader are important in the resuscitation of a buried non-breathing avalanche victim. In the event the subject has been buried for an extended period of time (i.e. greater than 35 minutes), hypothermia related injuries need to be considered. For such victims, gentle movement and handling becomes important as a preventative measure against inducing an abnormal heart rhythm. Rewarming and rapid transportation to hospital care complete the field management of such victims.

In the case of bleeding, direct pressure should be applied to the wound site using sterile, non-stick dressings, and if practical the wound elevated above the heart. When dealing with bleeding injuries, the winter backcountry leader should ensure they protect themselves and their victim from blood-borne pathogens by wearing gloves. In the case of fractures, small bones should be splinted, immobilized and sensation below the break should be confirmed. Fractures of long bones, such as the femur, require immediate evacuation and may necessitate gentle traction to ensure continuous blood flow below the break to the extremity of the leg.

HYPOTHERMIA

As a winter backcountry leader, recognizing the onset of hypothermia and taking preventive measures can reduce the severity of the problem. Quite simply, hypothermia is the lowering of one's body temperature. This may be due to several factors such as wind, dehydration, lack of food, exhaustion, wet clothing, immersion in cold water (lakes, rivers, creeks etc.), alcohol consumption, injuries, etc. Typically heat is lost through convection, conduction, evaporation, radiation and respiration.

Wind in particular can play a significant role in the effect of cold temperatures. Wind chill is the perceived lowering of temperature due to wind. The winter backcountry leader would recognize the effects of wind chill and take mitigating measures to reduce or eliminate the onset of such cold related injuries.

In mild cases of hypothermia, this may be treated with warm fluids, replacing damp clothing, food, rest, etc. In more severe cases, treatment may require active re-warming through a variety of methods such as the use of suitably insulated chemical heat packs applied to the neck, armpits and groin. Important is insulating the victim from the ground (conductive heat loss), the removal of wet clothing together with shelter from wind and precipitation – i.e. wrapping the victim in a guides tarp, "burrito style" with continued monitoring of vitals. As mentioned earlier, in severe hypothermia gentle movement and handling of the victim is important. In such cases, the winter backcountry leader should contact local organized rescue services for immediate evacuation.

Different stages of hypothermia

- **Moderate hypothermia: 35 to 32° C.**
  - Intense shivering
  - Taciturnity, difficulty speaking
  - Stumbling, risk of falling
  - Cannot execute complex movements

  This is the only stage of hypothermia during which it is possible to warm a victim back up in the field.
- **Severe hypothermia: 32 to 28° C.**
  - Shivering stops
  - Walking becomes impossible, muscles become rigid
  - Tendency to curl into the foetal position
  - Impaired consciousness, stupor
  - Cardiopulmonary slowdown
- **Deep hypothermia: 28 to 24° C.**
  - Hypertonic coma
  - Dilated pupils
- **Less than 24° C: lifeless appearance.**
  - Cardiac and respiratory arrest
  - Probable death, but death may occur at higher or lower temperatures
  - Heart and respiratory rates very low
  - Major risk of cardiac arrest

How wind increases the cold's effects (i.e., wind chill)

The sensation of cold increases when wind hits dry unprotected skin. With their notoriously cold weather, Canadians have developed a wind-chill index that expresses how cold feels on exposed skin. For example, a temperature of -15° C combined with 60 km/h wind will feel like -30° C without any wind.

Wind Chill Factor / Index											
Wind speed (km/h)	What to look for when estimating wind speed	Temperature measured in ° C (first row) and perceived temperature (other rows)									
		0	-5	-10	-15	-20	-25	-30	-35	-40	-45
10	Wind perceptible on face; wind vane begins to move.	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57
20	Small flags flap in the breeze.	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62
30	Wind blows loose paper, large flags flap and small tree branches wave.	-6	-13	-20	-26	-33	-39	-45	-52	-59	-65
40	Small trees begin to sway, and large flags extend and flap strongly.	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68
50	Large tree branches move, tele-phone lines whistle and it is hard to use an umbrella.	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69
60	Trees bend, and walking against the wind is difficult.	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71

Source: Environment Canada

Recommendations
Slight increase in discomfort. Dress warmly. Stay dry.
Uncomfortable. Risk of hypothermia if outside for long periods without adequate protection. Dress in layers of warm clothing, adding an outer wind-resistant layer. Wear a hat, mittens or insulated gloves, a scarf and insulated, waterproof footwear. Stay dry. Keep active.
Risk of frostnip or frostbite: check face and extremities for numbness or whiteness. Risk of hypothermia if outside for long periods without adequate clothing or shelter from wind and cold. Dress in layers of warm clothing, with a wind-resistant outer layer. Cover exposed skin. Wear a hat, mittens or insulated gloves, a scarf, neck warmer or face mask, and insulated, waterproof footwear. Stay dry. Keep active.
High risk of frostbite: check face and extremities for numbness or whiteness. Risk of hypothermia if outside for long periods without adequate clothing or shelter from wind and cold. Dress in layers of warm clothing, with a wind-resistant outer layer. Cover all exposed skin. Wear a hat, mittens or insulated gloves, a scarf, neck warmer or face mask, and insulated, waterproof footwear. Stay dry. Keep active.
Very high risk of frostbite: check face and extremities frequently for numbness or whiteness. Serious risk of hypothermia if outside for long periods without adequate clothing or shelter from wind and cold. Be careful. Dress very warmly in layers of clothing, with a wind-resistant outer layer. Cover all exposed skin. Wear a hat, mittens or insulated gloves, a scarf, neck warmer or face mask, and insulated, waterproof footwear. Be ready to curtail or cancel outdoor activities. Stay dry. Keep active.
DANGER! Outdoor conditions are hazardous. Stay indoors.

Note: see http://www.ec.gc.ca/meteo-weather/default.asp?lang=En&n=5FBF816A-1

FROSTBITE

Frostbite is a condition where part of one's body freezes or almost freezes. As such, there are three stages of frostbite a winter backcountry leader should be aware of. The most common areas of frostbite a winter backcountry leader may experience in their participants is fingers and hands, toes and feet, nose and cheeks.

Superficial frostbite

1st degree:

- Whiteness, followed by redness upon rapid warming
- Decreased sensitivity, which returns quickly after warming
- Healing in three to four days, without any residual effects

1st degree

2nd degree:

- Whiteness, followed by redness upon slower warming
- Loss of sensitivity, which returns more slowly
- Blisters filled with clear fluid, moderate edema
- Healing in 10 to 15 days, persistent hypersensitivity to cold

2nd degree

Deep frostbite

3rd degree:

- Pallor (rapid frostbite) or cyanosis (slow frostbite)
- Loss of feeling
- Major edema in the dead zones upon reheating
- Large, bloody blisters

After 10 days:

- Black areas of dead tissue, either limited to the skin or extending to the bone. Loss of the extremity.

3rd degree

Prevention is, of course, the first treatment. Contributing factors to frostbite are tight fitting clothing (i.e. gloves), or boots, tobacco, previous or recent frostbite, and as mentioned previously windy or damp conditions.

Treatment, particularly in the field, will depend on the severity. For a nose or cheek that has just turned pale white, simply warming with one's hand will help remedy

the affected area. Replacing wet socks, gloves and clothing are helpful in that the wet clothing will act as a heat sink and continue to cool the affected area rather than insulate and keep it warm. In more severe instances such as third degree (deep) frostbite to one's feet or hands, blisters should remain intact and the affected limb should not be warmed if there is any chance it might freeze again before evacuation has taken place. In such cases, immediate evacuation of the victim becomes a priority for the winter backcountry leader.

The primary factors that would make a cold injury more severe (make it worse) are temperature (cold temperatures), duration (time of exposure), velocity (wind or water). The winter backcountry leader would recognize that removing themself and their participants from these conditions is important in reducing the severity of cold related injuries.

BLISTERS

One of the other common first aid considerations a winter backcountry leader may encounter are blisters of the feet due to poor fitting boots or socks, dirty socks, foreign objects in ones footwear, and simply friction between one's foot and footwear.

Again, prevention is the key to reducing the severity of blisters. The winter backcountry leader may suggest to participants that they alert him or her in the event of a hot spot – that feeling where an isolated portion of one's foot feels warm or hot. This often describes the onset of a blister and early treatment will often allow the participant to continue with the outing with little or no effects to the affected area. On longer traverses, changing socks offers blister prevention from accumulated salts in dirty socks.

Blisters to the feet may create a greater impact than generally recognized. Stopping to address hot spots or blisters should not be recognized as disruptive to the outing, but rather a preventative stop so as to facilitate the outing continuing as planned.

Treatment may be as simple as applying tape to the affected hot spot, or using a commercial 'blister pad' that introduces a barrier to the affected skin. In more severe cases, moleskin and the construction of a donut ring may be required. In instances where the skin has been broken, properly cleaning and bandaging will help prevent infection. Blisters should remain intact and unbroken as a means to prevent infection.

The winter backcountry leader will monitor the group by asking if anyone is developing hot spots so it can be addressed before it becomes a more severe blister. Further, the leader would inform the group that if at anytime a hot spot is felt or detected it should be treated immediately and not

be viewed as an inconvenience to the leader, the group, or the outing in general. Stopping to address the affected area is a good thing and shows good self-care.

BURNS

On outings where stoves and / or fires may be used, the winter backcountry leader should be prepared for first aid that involves burns. In spring conditions, severe burns to the face, eyes, lips and hands may be a result of solar reflection from the snow.

The important consideration with any burn is the risk of infection. Fire or stove burns would be immersed in cold, clean water or covered with a cold damp cloth for about 10 minutes followed by covering with dry sterile non-stick dressing. Depending on the severity, evacuation may need to be considered.

For sunburns, prevention is the key by the application of good quality sun block as well as lip block. In cases of sunburn, a clean cool compress and avoiding further exposure to the sun is used as a means of treatment. Although this can be difficult on longer outings, preventative measures should be taken to mitigate continued exposure.

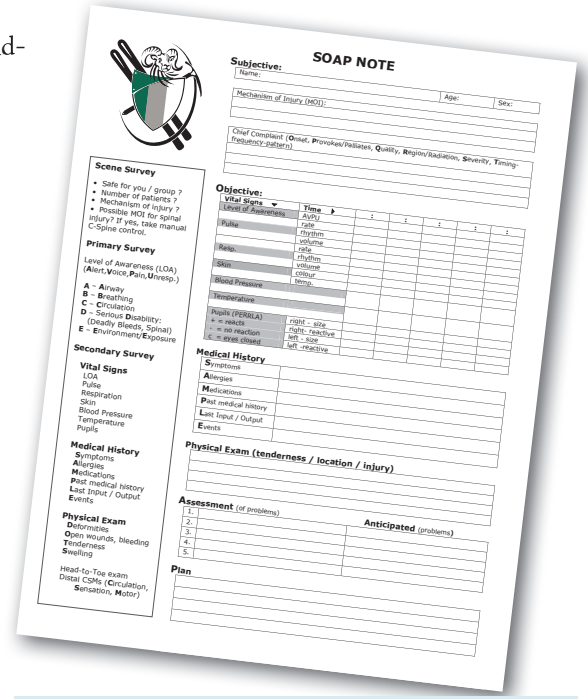
Names	Layers	Appearance	Healing Time	Complications
First Degree Burn Superficial	Skin	Redness	2 – 3 days	Increase risk of skin cancer
Second Degree Burn Superficial Partial Thickness	Extends superficial into dermis	Red with clear blister	1 – 2 weeks	Local infection
Second Degree Burn Deep Partial Thickness	Extends deep into dermis	Red with white bloody blisters	3 – 4 weeks	Scarring contractures and skin grafting
Third Degree Burn	Extends through the entire dermis	Stiff and white/ brown	Prolonged	Scarring, contractures and amputation
Fourth Degree Burn	Extends through the skin, tissue, muscle and bone	Black or charred	Requires excision	Amputation, functional impairment, gangrene and death

Common items to include in a first aid kit for a day or multi-day winter outing include:

- Latex gloves
- Antiseptic wipes
- Pressure bandages or dressings
- A good selection of adhesive bandages
- Sterile non-stick pads
- Adhesive elastic bandage
- Non-adhesive elastic bandage
- Medical tape
- Steri-strips
- Moleskin or second skin
- Small scissors
- Nail clippers
- Compact moulda-ble splint
- Triangular bandages
- Sun block sunscreen

Longer multi-day outings may supplement the above contents with:

- Survival blanket or tarp
- Aspirin
- Imodium (diarrhea medication)
- Vitamin C
- Spare sunglasses
- Zinc oxide
- Tylenol
- Ibuprofen


SOAP NOTE

Subjective:

Name: Age: Sex:

Mechanism of Injury (MOI):

Chief Complaint (Onset, Provokes/Palliates, Quality, Region/Radiation, Severity, Timing-Frequency-pattern)

Objective:

Vital Signs — Time

Level of Awareness — AVPU

Pulse — rate, rhythm, volume

Resp. — rate, rhythm, volume

Skin — colour, temp.

Blood Pressure

Temperature

Pupils (PERRLA) — right - size, right- reactive, left - size, left -reactive

+ = reacts, - = no reaction, C = eyes closed

Medical History

Symptoms

Allergies

Medications

Past medical history

Last Input / Output

Events

Physical Exam (tenderness / location / injury)

Assessment (of problems) — Anticipated (problems)

1. 2. 3. 4. 5.

Plan

Scene Survey

- Safe for you / group ?
- Number of patients ?
- Mechanism of injury ?
- Possible MOI for spinal injury? If yes, take manual C-Spine control.

Primary Survey

Level of Awareness (LOA) (Alert,Voice,Pain,Unresp.)

A - Airway
B - Breathing
C - Circulation
D - Serious Disability: (Deadly Bleeds, Spinal)
E - Environment/Exposure

Secondary Survey

Vital Signs
LOA
Pulse
Respiration
Skin
Blood Pressure
Temperature
Pupils

Medical History
Symptoms
Allergies
Medications
Past medical history
Last Input / Output
Events

Physical Exam
Deformities
Open wounds, bleeding
Tenderness
Swelling

Head-to-Toe exam
Distal CSMs (Circulation, Sensation, Motor)

Copies of these and any other forms in this book can be found at www.alpineclubofcanada.ca/forms

Emergency Communications

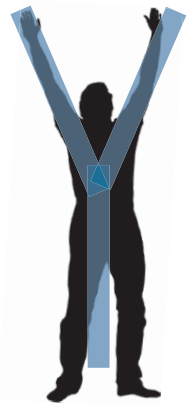
If organized rescue is deemed necessary, communication should be initiated immediately and the following information provided to the local agency:

- The caller's name and telephone number, if the communication is being initiated by phone
- The nature of the accident and the number of patients
- The severity of the patient's injuries, if known
- The level of consciousness of the patient
- The exact location of the patient
- The time of the accident
- The local weather conditions
- The size of the group
- Any first aid actions that have been initiated

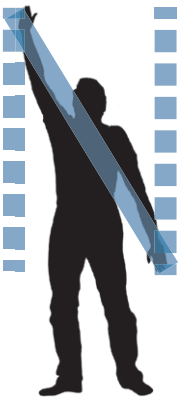
Table to keep in first aid kit:

WHO?	Your first and last name, and where you can be reached
WHY?	Nature of the accident, number of victims, seriousness of the situation. Is the victim conscious?
WHERE?	Location, route, altitude, etc.
WHEN?	Time of the accident
CURRENT WEATHER CONDITIONS?	Winds, visibility, etc.

Ensuring that contact information for organized rescue is readily accessible is of crucial importance if an emergency necessitates this service. Phone numbers, radio frequencies and communication devices should be kept together and placed in an easily accessible location in the winter backcountry leader's pack. Further, the leader should instruct participants in the use of all communication devices at the start of the outing so they can initiate the call for help if required.



Call for a rescue (Yes)



No need for a rescue (No)

Communication Devices

Whether on a day trip or a multiday outing, preparing for emergency communication is an important step should such an event take place. Communication devices can include:

- Radios (FRS and VHF)
- Cell phones
- SPOT
- inReach
- Satellite phones

Each device has its advantages and disadvantages including cost, ability to connect, and one or two-way communication capabilities. It is important for the winter backcountry leader to recognize where the outing is to take place and the effectiveness of the chosen communication device being considered.

	Type of Comm.	Advantage	Disadvantage	Cost
Cell Phone	2-way	Conversation	Cell shadows	Low
Radio – VHF	2-way	Conversation	Radio shadows License to use Permission for frequencies	Low to Medium
Radio – FRS	2-way	Conversation – short range	Frequencies outside normal commercial agencies (wardens, lodges etc.)	Low
SPOT	1-way	OK or help signal	1-way communication Satellite coverage	Medium
inReach	2–way (text)	2-way text	May be unsure if or when msg is received	Medium +
Sat Phone	2-way	Conversation	Satellite coverage	High

Emergency Survival Winter Skills

In the event of an accident or unplanned night out, basic skills in fire lighting and improvised shelter construction can reduce the seriousness of the event the winter backcountry leader is managing.

EMERGENCY SHELTERS

The type of emergency shelter one might consider may depend on the location (above or below treeline), resources at hand (tarp, bivy sac, tent, snow etc.) and how long the planned stay is (overnight, multiple nights). Start with simple solutions to determine if they will meet your needs before moving on to more complex and time-consuming options. On multi-day trips, the group may have tents with them, which eases the complexity of the emergency shelter scenario. If the tents blew away in a storm for example, the complexity and seriousness of the situation has increased in magnitude. It will be surprising how quickly time will pass when looking to construct an improvised shelter for the group. Enlisting and using the resources of participants will help expedite the construction process. Be sure to offer encouraging directions to participants to help keep morale up. Chapter 6 has described a variety of shelters in varying complexity. The winter backcountry leader will have practiced a variety of shelter types as a means to adapt to various locations and situations. Often a guide's tarp can be used in a variety of ways to provide shelter and conserve heat in a winter environment.

The winter backcountry leader will be resourceful in adapting to the situation to construct an efficient shelter to manage the emergency at hand for the duration required.

FIRE LIGHTING

Not only does fire provide warmth and an opportunity to either cook or melt snow for water, but it also offers psychological comfort in the event of an emergency. The winter backcountry leader with practiced fire lighting skills will have the ability to keep his or her group comfortable in an emergency situation. If it appears that the group will be spending the night out in an emergency situation, the winter backcountry leader may enlist the help of other group members to gather wood. It will take more wood than anticipated to sustain a fire throughout a night and it is much more challenging to collect wood when it is dark, hence enlisting the assistance of participants as soon as it is evident a night out is likely.

The winter backcountry leader can light fires with natural material or with the use of assisted fire-lighting materials to assist and expedite the process. Although it is good to practice natural techniques, using materials to expedite the process will ensure a fire is started as efficiently as possible in an emergency situation.

Natural Fire Lighting:

- Fire bundles using the small twigs at the ends of branches
- Using pitch from trees as a fire starting aid

Assisted Fire Lighting:

- Commercial fire starter sticks
- Vaseline soaked cotton
- Pieces of bicycle tire tubes
- Wax soaked pieces of cardboard or wood chips

Group Management in Emergency Situations

Winter backcountry leaders need to be cognizant of all group members in the event of an accident. While the patient may require immediate attention, uninjured members of the party often also require care and monitoring. If possible and practical, providing uninjured group members with tasks that assist in the management of the emergency situation may help occupy them. Common tasks group members could complete in an emergency include:

- Assisting with first aid and documenting patient history and vitals.
- Creating a shelter or fire
- Meeting organized rescue at the trailhead (if on a day trip)
- Inventorying the group's collective resources (gear, supplies and individual skills/training)
- Safety oversight (people can do unexpected and unpredictable things when adrenaline is flowing – safety of the responders remains the first priority)
- Technical oversight - i.e. building anchors, fixed lines, hauling/lowering systems, etc.
- Constructing a flat landing pad for a helicopter
- Monitoring patients with non-life threatening injuries

The leader may also wish to delegate the technical aspects of establishing and maintaining external communications links with rescue agencies. Normally, the leader would personally handle the content of external communications but circumstances may suggest also delegating this under supervision. If delegated, the leader may consider writing specific notes so important information remains consistent in the communication process.

If conditions allow, it is desirable that the leader remain hands-off, stand back, maintain oversight of the entire scene, plan ahead, allocate tasks and resources, and supervise. This may be in the case of having group members with skills (training) in advanced first aid, shelter construction, technical skills, etc. An effective leader is sensible, seeks advice, delegates wisely and, most importantly, takes charge and makes decisions.

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Notes:

Notes:

Credits

DRAWINGS AND TECHNICAL DIAGRAMS

Sylvain Darnoux: Pages 40, 165
Blandine Reynard: Pages 39, 41, 160, 161
Alice Soissong: Pages 45, 77
Clément Vial: Page 127
Shasta Steadman: Pages 16, 45, 58, 90, 93, 116, 118, 119, 120, 121, 125, 126, 130, 133, 135, 148, 150, 151, 153, 154, 155
Avalanche Canada: Pages 16, 17, 18, 19, 46, 47
Petzl: map images Pages 87, 88, 89

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The purpose of this field handbook is to support The Alpine Club of Canada's winter backcountry leader (avalanche) training program, as well as to act as an ongoing resource for winter backcountry leaders. It is designed to highlight techniques and applications commonly used by winter backcountry leaders to assist in the delivery of a successful winter backcountry outing.

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