

ARCTIC & GLACIAL TERRAIN & ENCOUNTERS



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SNI-013

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I grew up and lived all my life in the midwest and am used to snow and ice in winter. I've never ridden a snowmobile, and I've never driven an off road vehicle in the snow. I went skiing once in Missouri and I know it's a lot of work if you're not used to it. I can't imagine skiing down a real mountain slope. I've gone ice fishing with my youngest son when he was little in the lake in the middle of the town where I live in Southwest Michigan, near Kalamazoo. I've gone ice skating and sledding and am not afraid to drive in snowy conditions. I've driven in near white out conditions at a snail's pace for over a hundred miles. I know there are many who have little or no experience with cold or snow. I've seen a semi truck lose control on the interstate and cross the median and tip over and slide on my side of the road towards me. I've seen idiots fly past only to pass them later as either the cause of an accident, or the sole vehicle slid off in the ditch. I've had ears, nose, cheeks, fingers, and toes very cold with a burning and stinging sensation as my skin warmed. I once had hypothermia and never thought I'd be warm again. After my first winter living in Michigan I lost my acclimatization to the heat and humidity of Missouri summers, but I can go out in a t-shirt in 40 degree F and not feel like I'm freezing. I hope this little document helps give those unfamiliar with cold and snow a picture of what it's like.

If you want more on the effects of heat loss, my [Deserts and Desert Terrain](#) has more information to consider.

Information on ice thickness from Minnesota DNR, Farmer's Almanac, and The Engineering Toolbox websites.

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Arctic & Glacial Terrain is similar to areas where winter is bitterly cold and snow and ice persist for weeks or months. High mountains will have snow cover longer than lower elevations, some shaded peaks may only have a few weeks in the summer without any snow on the ground. Peaks that hold glaciers, of course, will have ice and snow year round. Late season and early season sudden snowstorms in the mountains will be common. Trade across mountains will slow and then cease when the mountain passes become choked with snow.

In the spring, warmer climates will have the spring runoff that feeds the waterways at lower elevations. There may be seasonal flooding depending on the volume of the snow pack and the speed and intensity of warmer Spring temperatures.

Hazards:

Slipping on ice. Can result in sprains or broken bones. A sprained foot, ankle, knee, or hip will slow movement. Continuing to walk on a sprained appendage will cause the sprain and swelling to worsen to the point that movement is impossibly painful. A saving throw or constitution check to withstand the pain for a moment might allow one to tough out walking on a severely aggravated sprain, but it won't be fast or graceful.

The use of crutches will allow some movement to one with a sprained or broken portion of the leg. This prevents the use of shields and weapons while attempting to move. Injuries to hands, wrists, arms, elbows, shoulders, etc. will either prevent the use of crutches or make their use very slow. Sprains and broken bones to arms will not prevent walking, but will prevent the use of both a shield and a weapon or two handed weapons. Injuries to the dominant hand/arm will result in a penalty for to hit rolls.

Slipping on ice can be as simple as falling down, or as complex as sliding down a slope, or slipping over a precipice. Both the slide down a slope or a fall over a precipice will result in additional injury. Sliding any distance on ice can result in bruising, cuts, and scrapes. Falling can result in multiple sprains, broken bones, internal bleeding, head injuries, and/or death.

Snow Blindness – This is essentially a sunburn on the cornea (outer portion of the eye) caused by overexposure to UV light. Symptoms are eye pain, headache, sensitivity to light, blurred vision, or temporary loss of vision. Water and white sand can also cause this. 48 hours out of sunlight is required to recover. Extended exposure can lead to permanent effects on vision, including blindness. Special eye wear is required to minimize the effects of the bright sun on the white snow & ice allow for safe travel on clear days. Sunglasses or snow goggles, wooden eye coverings with one or more horizontal slits to minimize the light reaching the eyes and improve visual acuity.

Hypothermia – When core body temperature falls below a certain point the effects are felt, such as lethargy. Thus the mantra not to fall asleep when not inside a warm shelter.

Frostbite – The freezing of body parts. The body limits blood flow in the extremities to maintain core temperature. Redness, numbness, and pain are the symptoms of minor frostbite. Severe frostbite is when fingers and toes turn black due to lack of blood flow due to freezing. Digits not amputated and properly treated will lead to gangrene and death.

One must keep dry. Both sweat and melting snows leads to one becoming wet. Moisture conducts the heat away from the body very efficiently resulting in one becoming cold. When traveling multiple days a way to get out of the wind and allow clothing to dry is key to staying warm.

Fissures – Cracks in glacial ice can be covered by snow or very thin ice, or may be found unexpectedly in the dark or thick fog.

Snow Bridges – These can be drifts of snow across gaps in glacial or mountainous terrain and give the false impression of covering solid ice or solid ground. New snow on thin ice is a similar danger.

Thin Ice – Ice which is unable to support more than a given weight. See below for examples of minimum ice thickness to support given loads.

Sudden snowstorms/blizzards – Without the ability to predict or control the weather, one is subject to this unpredictable force of nature.

Windstorms – Strong winds can knock people down, blow away tents or other shelters, cause damage from flying debris, etc.

Thundersnow (Thunderstorm during a snowstorm.) - This is rare, but there can be lightning during a snowstorm. In some instances, a sudden drop in temperature can change a rainstorm into a snowstorm.

Ships getting trapped in ice – Ships traveling at the highest latitudes will need to take care, once trapped, the ship may be driven along with the ice's seasonal migration with the currents, or be crushed or damaged and sink.

Ice Sheets - Over seas & oceans raise the possibility of being on a portion that breaks away. If large enough, travelers may not realize they are now adrift.

Calved glaciers result in Icebergs - Literally ice mountains, that are the bane of ships.

Avalanches – Snow pack, ice, boulders, trees, etc. come crashing down when the weight of the snow pack is so heavy that even a loud sound will cause it to break loose and come crashing down the mountain. Those trapped by an avalanche may survive the initial crush of snow and debris, only to die of suffocation, hypothermia, or thirst. Those in the direct path of an avalanche have almost no chance to survive without some means of rapid movement or flight. Those near the edges may be able to reach safety and avoid the mass of snow and debris, or only be partially trapped or only lightly buried and be able to self rescue. The greatest risk to these individuals is the loss of gear required to survive. Backpacks, belts, and other items will be knocked free and can be merely out of sight or buried under untold tons of snow & debris.

Cold Related Precipitation:

- Sleet – Slushy rain. Too warm to be snow and too cold to be rain.
- Hail – More common with thunderstorms in warmer weather. Varies in size from small grains to grapefruit sized. Most common tends to be like small pebbles and can shred crops and leave dents in cars. Larger hail can cause bodily injury and more serious property damage.
- Freezing rain – Rain that freezes quickly once it lands. This leads to tree limbs becoming coated with ice causing them to hang very low. It looks pretty, but you will hear the distant crack as tree limb break and fall. Roads and sidewalks become extremely slick. Undisturbed snow can develop a thin crust that children can walk on for short distances.
- Dry, powdery snow – This is light and easily swept aside by a broom. Falls off a shovel when shoveling it. Very difficult to make a snowball. One must take off their gloves and use the warmth of their hands to form it.
- Wet, heavy snow – This can fall from the sky or occur when a warm day causes existing snow to melt. This is the kind that is great for making snowballs and snow people. Six or more inches of the stuff can cause a cheap snow shovel to bend or break, if you try to lift or push too much at once. Very difficult to drive on.
- Slush – The mix of snow and ice in low spots, like potholes, low spots, and ditches. Common place for one to step in and get their shoes or boots soaked. The resulting wet socks can be hard to remove.

Special Gear:

Technology in a modern or science fiction setting, or magic items in a fantasy setting will play a part in special gear. There may be no other effect than it prevents frostbite or hypothermia. Maybe it gives +1 vs. cold attacks.

- Snow Shoes
- Skis – Cross Country or Downhill
- Ice cleats – For traction on ice
- Sleds - Dogs or others
- Sleighs – Horses or others
- Ice Boats or Ships – Boats or small Ships converted, or purpose built, to go over ice on runners.
- Special shoes or covers for horses to gain traction on ice.
- Ice Axe
- Ice Saw
- Eye wear to minimize snow blindness.
- Ice Picks on cord draped around the neck/over the shoulders to enable self rescue from falling through the ice.
- Roof rake to clear snow to avoid collapse or roofs are built with steep peaks like A frames.

Gear:

Regular gear is gear that travelers may bring with them if they are planning ahead and don't have access to the ideas or technology of ice and snow specific gear.

- Rope
- Spikes
- Grapnels/Grappling Hooks
- Ladders – Rope, Wood, Rope & Wood, Pole with cross members
- Winch, pulleys, tackle

Layers:

It is important to dress in layers to easily remove layers to prevent sweating or add them to prevent chilling.

- Warm undergarments
- Outer garments
- Coats
- Cloaks
- Leggings
- Footwear

Mounts:

Horses are limited in the depth of snow they can travel. Bearing a rider or other load has an effect. Horses will tire much sooner, thus having a much narrower range than when the ground is clear and dry. This will lead to the use of alternate mounts in a fantasy genre or vehicles in a modern or science fiction genre that can either walk on snow, or more easily push through it. Ice will require special shoes to allow mounts to gain traction.

Trade:

- High mountains with glaciers may provide ice to the surrounding region.
- Ice can be harvested from ponds, lakes, and rivers.
- Ice can be preserved by an ice house where the ice is layered between earth, straw, sawdust, or other material to help minimize melting of the ice. Often the walls of these structures are thick sod with thick sod roofs.
- Ice and its melt water could be trade worthy on the far side of the mountains in the rain shadow of mountains where arid & desert terrain is more likely.
- Rare commodities may only exist in cold regions or only at certain times of year.
 - These can be animal, vegetable, or mineral items.
 - Animals could be live specimens for mounts or breeding stock for herds, or the meat or other part, such as fur.
 - Rare ice crystals or other fantastic creation of the GM could relate to cold, snow, and ice.

Encounters:

- Visibility will be hampered by bright sunlight on white snow & ice, haze, fog, snow, or blizzards.
- It is entirely possible for two groups to pass each other in a howling blizzard and never know of the existence of the other.
- Howling winds can also mask the approach of predators or enemies.
- Cold based creatures attracted or enraged by body heat.
- Lost travelers suffering from snow blindness or other malady of the cold.
- Miserable heat or fire based creature(s) seeking a cure for a rare illness or curse.
- Entrance to the world in/under the ice hidden by a thin crust of ice over a fissure. Those rushing ahead risk falling into oblivion. Careful travelers can find a means of descent whether an ice path, ladder, rope, or ice slide.
- Group of raiders, traders, or scouts on ice boats, dog sleds, sleighs, skis, etc.

Ice Thickness:

Ice must have a minimum thickness to support any weight. The color of ice is an indication of its thickness. White ice, or “snow ice” is half the strength of clear ice. Clear ice may be referred to as solid, blue, black and found on ponds and lakes. River ice has 85% the strength of clear ice. *Modern ice safety recommendations are to check ice thickness every 150 feet. Cars, pickups, and trucks should be parked 50 feet apart and moved every two hours to prevent sinking. One is advised to drill a hole next to your vehicle and if the water overflows the top of the hole, that section of ice is sinking.*

Thickness values for clear ice to be safe for different conditions are:

- 3 inches for a single person on foot
- 4 inches for a group in single file/ice fishing or other activities on foot
- 5-7 inches snow mobile or ATV
- 7.5 inches Passenger Car (2 ton gross)
- 8 inches Light Truck (2.5 ton gross)
- 10 inches Medium Truck (3.5 ton gross)
- 12 inches Heavy Truck (8 ton gross)
- 15 inches 10 tons
- 20 inches 25 tons
- 30 inches 70 tons
- 36 inches 110 tons

Note that ice strength is influenced by many factors

- age - newer black ice is stronger than old milky
- distance to shore - ice close to shore is weaker than ice farther out
- river outlets and inlets - ice close to outlets and inlets is weaker
- obstructions like rocks, trees and plants
- water currents
- cover of snow

Travel:

Travel on foot or mounted is difficult. The cold causes the body to work harder keeping warm and pushing through even shallow snow is akin to walking on sand. It takes effort and the ability to travel is limited to the physical ability of the individual or their mounts or other beasts of burden to maintain a certain pace. The amount of food needed to maintain peak functioning is increased and those not acclimated to the conditions will tire sooner.

Modern travel, such as with cars and trucks on snowy and icy roads is frightening to those who have never done it. The key things to remember are to drive slow and that you avoid using your breaks. Stopping is done by decelerating, i.e. taking your foot off the gas and gently pumping the breaks once you near the point you wish to stop. Using the breaks as you would when the road is dry results in sliding or spinning out of control. If you go too fast for the conditions of the road, you will start to fishtail and have trouble staying in your lane. This is similar to hydroplaning on a road covered with a thin sheet of water. Starting when on ice or snow is similar, slowly apply gas to avoid spinning. This is identical to getting out of mud. Carrying sand to use for traction, or a board to get past the slick spot is common. Four wheel drive vehicles are no help in slick conditions. The same method to move applies no matter how many wheels have power.

The type of snow also matters. White powdery snow is easier to drive on than wet heavy snow. Even powdery snow gets packed onto a road by repeated traffic and becomes ice. Snow plows are often on dump trucks that hold sand or salt with spreaders on the back to cover the road as the truck passes. Salt and other chemicals can't be used if it is too cold.

The deepest snow I've driven in before plows got to it was about a foot on the short stretch of my road to the main road two doors down. In a mi-sized sedan, it was very difficult, especially the mound of snow left by the plows from the main road. Snow of up to 6" would be the deepest I'd want to drive any distance on a road. I've never driven onto a frozen lake. I've walked across the lake in the center of town. I've gotten wet feet at the edge where the ice is thinnest.

In the upper peninsula of Michigan, they have huge snow equipment and kids don't get snow days. I was up there for my day job once the last week of November that included the first few days of December. They had a couple of feet of snow overnight, and when I left the hotel to go to the client site, I was amazed at how well cleared the roads were. I grew up in areas where we get enough snow to warrant snow plows, but they never do as thorough or timely of a job.

Permafrost:

Any ground, including rock and soil that remains at or below the freezing point of water for two or more years. It occurs at the highest latitudes and can occur at high mountain elevations. Subsea permafrost exists at the higher elevations. This ground is very hard to dig and ice may be present. The depth to which it is frozen can be hundreds or thousands of feet, nearly a mile.

Frost heave can form domes of earth pushed up a few inches or feet called palsas, or pingos which are up to 230 feet high and 2,000 feet in diameter. If these structures can thaw and collapse, the resulting pools of water have the same names. In spring and summer, the upper layers can thaw resulting in pools of water collecting in low areas.

Geothermal Vents:

Volcanoes, geysers, and hot springs can form little oases in the cold that allow for more densely populated areas. Whether the population is animal or intelligent.

Active volcanoes that release lava or hot gasses can cause sudden melting of snow and ice leading to flooding. A volcano near an ice dam that has formed a large lake from the surrounding glacier's melt water could unleash a devastating flood that affects an area of hundreds of miles depending on the elevation of the land near the dam. If a mountain range is nearby, it will block any low lying areas beyond, unless there is a mountain pass that allows the water through.

Vegetation: Trees will be evergreen type trees. As one moves further north or south, the deciduous trees will grow sparser and evergreen more prevalent, until only evergreen are seen. Eventually, the growing season is too short to support trees and only vast expanses of open grasslands, tundra, are seen.

Animals: Will tend to either thick hair or thick fat or both. Coloration will tend to white fur or brown fur where there are rocky areas allowing the animals to blend in for land animals. Sea animals will vary. Fish won't need to see gaps in ice to surface for air, while whales and seals will stay near openings so they can breathe. Predators like polar bears will stake out these openings looking for a meal. Cold blooded animals won't last long unless there is a magical nature to them.