

Backcountry Lightning Avoidance

Lightning is a serious hazard that can result in injury or death. Avoidance is our best defense, and we must avoid all lightning strike incidents. Leaders must appropriately plan activities to high risk areas, develop the awareness to identify approaching storms, use the flash-bang method to estimate storm distance and speed, know how to reach safer terrain when storms do occur, and choose appropriate campsites to avoid nighttime emergencies.

John Gookin, NOLS curriculum director, reminds us, “It cannot be emphasized enough, that being outdoors exposes people to random lightning hazard, no matter what actions are taken. No place outside is safe when thunderstorms are in the area.” and that backcountry lightning guidelines should not be confused with the more effective safety of vehicles and buildings in the frontcountry.

Backcountry response - there are four actions that can reduce your risk. These behaviors are in order and each one is roughly twice as important as the next one:

- 1. time visits to high risk areas with knowledge of expected and observed weather patterns**
- 2. find safer terrain if you hear thunder**
- 3. avoid trees and long conductors once lightning gets close**
- 4. get in the lightning position if lightning is striking nearby.**

1) Time visits to high risk areas:

Timing activities to coincide with safe weather requires knowledge of typical and recent local weather patterns. There is no such thing as a surprise storm. You need to set turnaround times that will get you off exposed terrain before storms hit. Constantly observe the changing weather and discuss its status with your group. Be willing to change your plan, rather than summiting a peak or crossing open ground during a thunderstorm. Begin your response plan as soon as you hear thunder. In a flat quiet windless location you can hear thunder for about ten miles. In windy conditions you might be able to hear the thunder for about five miles or less. In hard rain you may only hear thunder out to one mile. Be alert and respond to minimize exposure

2) Finding safer terrain if you hear thunder:

The Flash-Bang ranging system is used to measure the distance and speed of an approaching storm. Due to differences in *speed of light* vs. *speed of sound*, there is a five second delay of sound for each mile that light travels to your eyes. Count the seconds between an obvious lightning flash and its bang, and divide by five to determine distance in miles. Do not stake your life on the reliability of this ranging system, as mistakes are easy to make with multiple strikes and the stresses of group management.

What is safer terrain? In the backcountry, terrain choice can decrease your chances of being struck. Lightning tends to hit high points and the terrain around it. Avoid peaks, ridges, and significantly higher ground. Avoid tall objects such as large trees, sailing masts, or flag poles, which often attract strikes. If you need to move through a forest, seek out evenly spaced forest of similarly sized trees, rather than solitary trees. If able to descend a mountain, choose the side

that is further from the storm. All boaters should move to shore and get off the water if able. Reassess your plans and move to safer terrain as soon as you hear thunder, not when the storm is upon you. Here are some specific details to consider, and check out the image on the final page:

Buildings and Vehicles, if available, will always be your safest options.

Tents may sometimes increase the likelihood of lightning strikes if they are higher than nearby objects. Tent poles conduct ground current and may generate upward leaders. Carefully select tent sites that are unlikely to be exposed in a storm, even if conditions are calm. When tented in "safer terrain" you can use the lightning position inside the tent to reduce ground current effects. But if your tent is exposed on a ridge, in a broad open area, near a tall tree, or some other risky location, you should get out of the tent and move to safer terrain before the storm reaches.

Gently rolling hills the lower flat areas are rarely safer than the higher flat areas because the gentle or rolling terrain rarely attracts leaders. Strikes are random in this terrain. Look for a ravine or other significant depression to reduce risk.

Wide open ground offers high exposure during an electrical storm. Avoid trees and bushes that rise above the others, since the highest objects around tend to generate streamers. Look for an obvious ravine or depression before the storm hits. When the storm is over you, spread out your group at 50' intervals to reduce multiple injuries and assume the lightning position.

Naturally wet ground, isn't any more dangerous than dry ground. Wet ground actually dissipates ground current faster. However, standing in water should be differentiated from wet ground, and standing in water is very dangerous during a thunderstorm.

Water - Boaters and swimmers should monitor weather forecasts before their trips to avoid thunderstorms. While on the water, watch the skies diligently for threatening thunderstorms and get off the water before the storm arrives. If you wait until you hear thunder, you may be too late. When you get to shore, move away from the water and look for protective terrain to wait out the storm. Be cautious of trees at the water's edge, which may be the tallest objects around the body of water.

The bottom line is that boaters and swimmers must be alert, get off the water before a storm arrives, and find safer terrain and be cautious of tall trees at the edge of the water.

3) Avoid Tall Trees and Long Conductors.

Tall trees are especially adept at generating streamers that attract strikes. If you need to move through a forest, seek out evenly spaced forest of similarly sized trees, rather than solitary trees. The "Cone of protection" from trees and cliffs is a myth and has no place in lightning safety education anymore. People that try to use trees as a cone of protection inadvertently place themselves near some of the most common strike injury mechanisms which are ground current and side flash.

Long electrical conductors — particularly ones that are on or near the surface of the Earth (Metal fences, power lines, phone lines, railway tracks, handrails, measuring tapes, bridges, climbing

ropes) can carry significant lightning current even if these objects are at some distance from the lightning ground strike point. During a thunderstorm, wet, extended ropes should be regarded as equivalent in risk and danger to metal wires.

4) Get in lightning position



Fig. 8: **the lightning position** is for waiting out storms in stationary situations when it is impractical to move to a safer location.

- 1) **Put your feet together** to *significantly* reduce the effects of ground current which causes about half of lightning fatalities.
- 2) **Crouch** to *slightly* reduce the effects of side flash and upward leaders which together cause ~40% of lightning fatalities.
- 3) **Don't touch** long conductors to avoid contact voltage which causes ~20% of lightning fatalities.

Use lightning position to lower your height and take shelter from a storm that has overtaken you, making it impossible to move to a safer location. It may do more harm than good if you stop your efforts to reach safer terrain, instead stopping to take this position. In lightning position, keeping your feet together definitely reduces step voltage. If you are stuck in a tent on a dark rainy night, balling up is much better than being prone. Many people sit Indian style because it is more comfortable. The lightning position reduces the chances of lightning injuring you as badly as if you had your feet further apart, but is no substitute for getting to safer terrain or a structure if it is immediately available. But in wide-open country, or gentle rolling terrain, there are no simple terrain advantages, so use this position to reduce exposure (slightly). When instructing a group into the lightning position, disperse your group, spacing them several body lengths apart (~20') to reduce the chances of multiple injuries, and so survivors can do first aid on lightning victims.

Emergency Response

- **Scene Safety:** Avoid further injury to survivors, rescuers, and the patient. You may have to wait for the storm to pass to treat some patients if they are in extremely hazardous locations.
- **Basic Life Support:** Rescuers should be prepared to provide prolonged CPR or rescue breathing.
- **Triage:** Unlike normal triage protocols in multi-casualty situations, attend first to those who are in cardiac or respiratory arrest without obvious lethal injury.
- **Assessment:** All patients require a complete body survey and careful evaluation for head, spinal, long bone, or cardiac injuries. Peripheral pulses, and sensory and motor status, should be assessed. Check the skin for small hidden burns.
- **Monitor** closely for cardiovascular, respiratory and neurological collapse.
- **Evacuate** any patient obviously injured by lightning, and be alert for lingering physical or neurological issues from exposure to lightning

Resource: Gookin, John. Backcountry Lightning Risk Management. *International Lightning Meteorology Conference, 2010.*



Backcountry Lightning Risk Management

No place outdoors is safe from lightning when thunderstorms are in the area.

Lightning is an *objective hazard*. Your behavior can reduce the *risk* of that hazard harming you.

This diagram is specific to a continental (dry) climate.

This diagram is part of the paper "Backcountry Lightning Risk Management" (Gookin, 2010); use of this diagram without the paper's context may increase the risk of lightning injury.

Terrain lightning safety factors

- 0 1 **Extreme risk:** avoid these areas if there are any signs of thunderstorms
- 2 **High risk:** Be gone from these areas before a storm hits.
- 3 **Least objectionable alternatives,** but still much riskier than inside of modern buildings
- 10 Getting inside an enclosed metal topped vehicle can avoid many lightning hazards.
- 10 Inside a modern building is very safe if you take a few simple precautions.



Higher strike densities are...

- 1) On or near high terrain like peaks and ridges (often reversed in the Appalachians)
- 2) On or near tall objects like relatively taller trees
- 3) On the windward sides of mountains, where the storms come from
- 4) On wide open water and in trees at the edge of open water

