OA Guide to Map & Compass - Part 3

part of

The Backpacker's Field Manual

by Rick Curtis

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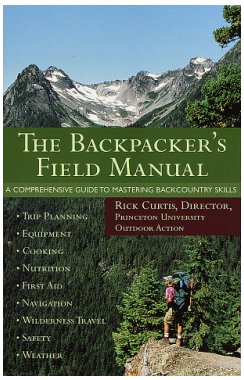

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This material is taken from Chapter 6 - Wilderness Travel from *The Backpackers Field Manual* by Rick Curtis. For more details on this exciting book check out The Backpacker's Field Manual Page.

Using Map & Compass Together

Adjusting Your Compass for the Local Declination:

Another way to deal with declination is to adjust your compass. Some compasses have an outer degree ring that can be unlocked either with a set screw or a latch. This allows you to reset the compass to account for declination. For example, if the declination were 14 degrees East, you could rotate the degree dial to the right so that the magnetic needle was pointing to 14 degrees instead of 360 degrees. Once you do this, you will no longer have to add or subtract for declination because your compass is aligned to true north. Now when the compass needle is inside the orienting needle, the compass bearing that you read off your compass will be in relation to true north instead of magnetic north. If you have a fixed-ring compass, you can mark the declination angle on the compass ring with a piece of tape.

Wilderness Navigation

Navigation in the wilderness means knowing your starting point, your destination, and your route to get there.

Check Your Position Regularly;

Make it a habit of keeping your map and compass handy and refer to them every hour or so to locate your position (more often in low visibility). Keep track of your starting time, rest breaks and lunch stops, and general hiking pace. This will also give you an idea of how far you have traveled and whether your Time Control Plan is accurate (see Planning Your Day, page 00).

Orienting the Map:

It is easiest to read a map if the map is oriented to the surrounding landscape. If you see a valley on your left, then the valley shows on the left on the map. You can do this by eye or with your compass.

- Using Land Features: Lay the map on the ground or hold it horizontally. Rotate the map until recognized features on the ground roughly align with those on the map.
- Using a Compass:
    1. Identify your declination from your map. If your declination is West of true north, subtract the declination from 360 degrees. If your declination is East of true north
    2. Set the compass at the correct declination bearing so that you compensate for declination.
    3. Place your compass on the map so that the edge of the baseplate lies is parallel to the east or west edge of the map with the direction of travel arrow toward the north edge of the map.
    4. Holding the compass on the map, rotate the map with the compass

       until the north end of the magnetic needle points to the **N** on the compass housing (i.e. the red north end of the magnetic needle and the orienting arrow align). This is often referred to as "boxing the needle" since the magnetic needle is inside the "box" formed by the orienting arrow. The map is now oriented with respect to magnetic north. This means that the compass needle direction north is the same as true north on the map. You can also place the compass on the map so that the edge of the baseplate lies along the magnetic north indicator line on the map legend at the bottom and rotate the map as described above. This may give you a more accurate orientation for your map.

Identify Terrain Features:

With the map oriented, look around for prominent features landscape features such as mountains, valleys, lakes, rivers, etc. Make a mental note of the geographical features you will be traveling along and seeing during the day. If you keep the terrain in your mind, you will usually have a general idea of where you are just by looking around.

Tricks of the Trail

Orient Your Map: You can eliminate the need to correct for declination if you use your compass to orient the map each time. As long as the map is oriented with respect to magnetic north, any bearings you take from map to compass or compass to map will be the same. For this reason, it's a good idea to always take the time to orient your map. It will make your life much easier. It also means that each time you use your map, your will need to re-orient it with your compass.

Real Life Scenarios

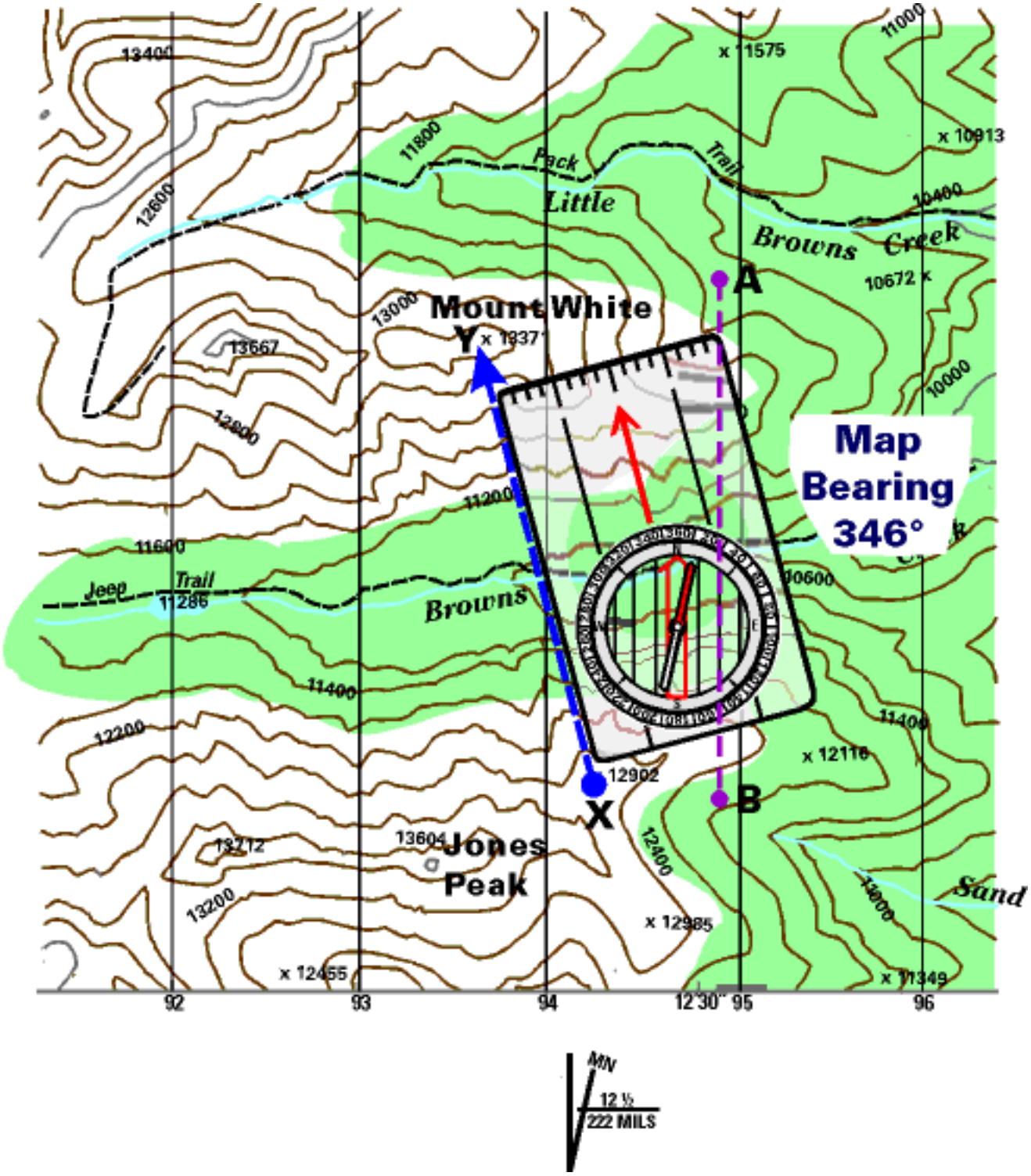
Let's look at some common backcountry scenarios and see how you can use your map and compass to navigate.

Scenario #1 - Lost in the Fog:

Okay, you hike in along the trail and then bushwack off trail to a nearby alpine lake to camp. When you wake up the next morning, you are fogged in. You know where you are on the map, but you can't see to find your way out. What you need to do is take a bearing on your map from your known campsite back to a known point on the trail that you can identify on the map. Then follow your bearing through the fog (or you might decide to wait out the fog if there is difficult terrain to traverse - see Chapter 7: Safety and Emergency Procedures: Dynamics of Accidents page 00). Here's your procedure:

Taking a Bearing from the Map (Map Not Oriented):

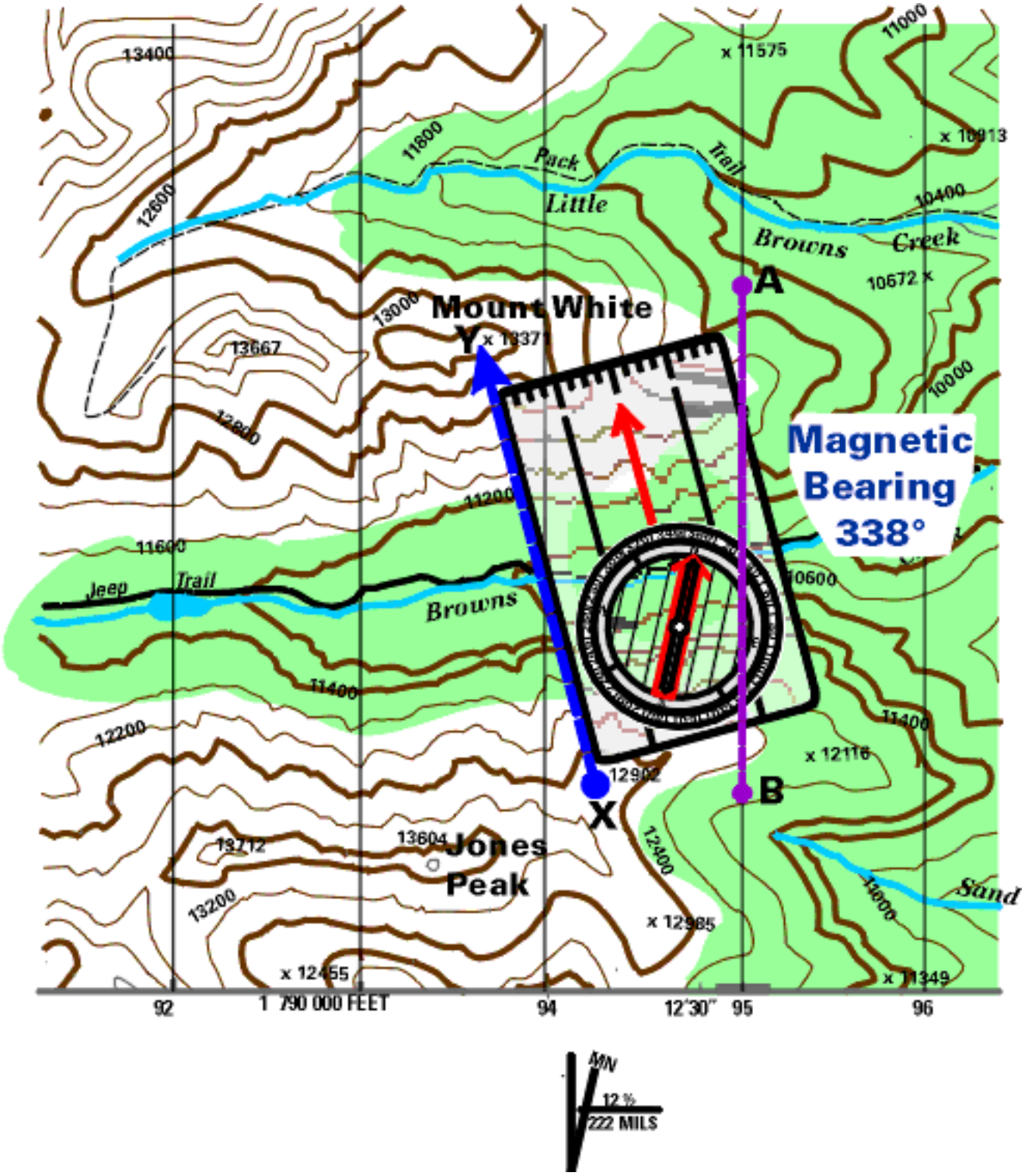
1. Lay the long edge of the compass base plate on the map, making a line from the starting point to the destination (from point X to point Y). Since the base plate is parallel to the direction of travel arrow, the base plate can be used to set the direction to the destination.
2. Holding the base plate steady, rotate the compass housing until the compass orienting lines and orienting arrow are pointing to true north. Here you see the orienting lines and arrow are parallel to the line from A to B as well as to the map gridlines.
3. Read the bearing (in degrees) from the degree dial at the point on the compass base plate marked "Read bearing here." In this case the bearing is 346 degrees.



Taking a Bearing from the Map (Map Oriented to Magnetic North):

1. Orient the map with the compass (see page 00).
2. Lay the long edge of the compass base plate on the map, making a line from the starting point to the destination (from X to Y). Since the base plate is parallel to the direction of travel arrow, the base plate can be used to set the direction to the destination.
3. Holding the baseplate steady, rotate the compass housing until the orienting arrow coincides with the North end of the magnetic needle (known as "boxing the arrow").
4. Read the bearing (in degrees) from the degree dial at the point on the compass base plate marked

"Read bearing here." In this case the bearing is 338 degrees.



Scenario #2 - Heading to the Summit:

You have been hiking along the trail and found a good campsite that is marked on the map. You see a summit ridge above treeline that looks like a great place for photographs, but there's a valley thick with Douglas fir between you and the summit. What you need to do is take a bearing from your current position to the summit and use that to travel through the forest. Here's your procedure:

Taking a Bearing from the Land:

1. Point the compass direction of travel arrow to the destination on the land.
2. Rotate the compass housing until the north orienting arrow of the compass housing lines up with the red magnetic needle. This is referred to as "boxing the needle," since you want the needle to be inside the box defined by the orienting arrow. The north orienting arrow must be pointing in the same direction as the red (north) magnetic needle. Your compass will look like the figure above with the needle boxed.
3. Read the bearing (in degrees) from the degree dial at the point on the compass base plate "Read bearing here."

Walking a Bearing Taken from the Land:

1. After taking the bearing, as described above, hold the compass level and in front of you, so that the direction of travel arrow points to the destination.
2. Rotate your whole body until the magnetic needle lies directly over the orienting arrow. Make sure the north end of the magnetic needle points to N on the compass housing. The direction of travel arrow points to the destination.
3. Site a prominent feature to which your direction of travel arrow points. Walk to that feature. Continue to sight on other features along the bearing and walk to them, until you reach your destination.

Walking a Bearing Taken from the Map:

To walk a bearing taken from the map, you may need to correct for declination if you did not orient the map to magnetic north before you took your bearing. Once you have corrected for declination, follow the same procedure as indicated above for walking a bearing taken from the land.

Techniques for Walking a Bearing:

Sometimes the terrain isn't always so cooperative to let you just follow your bearing in a straight line so there are a number of techniques to use when traveling on a bearing.

- Line of Sight Walk to an obvious landmark—a tree or boulder that is directly on the bearing. Then take another bearing on the next obvious landmark and walk to that. Keep it up until you reach your destination. By going to intermediate landmarks, you minimize the chances of veering off your bearing.

Scenario #3 - Retracing Your Steps to Camp:

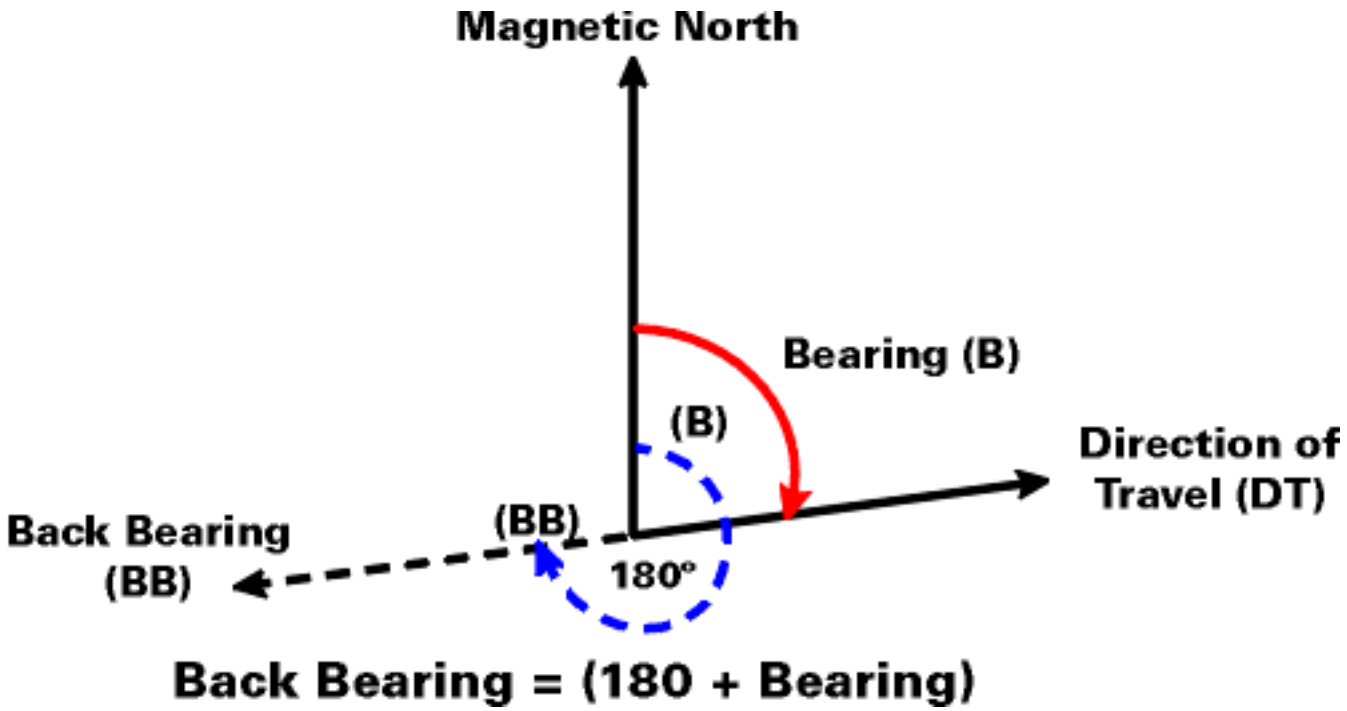
You got to the summit and got some great photos, even one of a baby mountain goat. Now it's time to get back to your campsite. You could just follow your back bearing (see below) back to your location, but there is bound to be some error, when you hit the trail where will you be in relation to your campsite? The best bet is to intentionally aim off. Here's your procedure:

- Back Bearings To check your position while walking a bearing, you can take a back bearing. Before you start to walk on your bearing, turn around take a bearing 180 degrees off of the bearing you are going to walk. For example, if you are going to walk a bearing of 45 degrees, shoot a bearing directly opposite your course of 225 degrees. Locate some landmark along this bearing.

Once you have moved a short distance along your bearing, turn around and shoot a bearing back to that landmark. If you are on course, that bearing will still read 180 degrees off your bearing of travel (in this case 225 degrees). If it doesn't, it means that you are off course. Sailors and sea kayakers use back bearings all the time to check for lateral drift from wind or currents. Back bearings are also useful if you are heading out to someplace and then returning along the same line of travel (see Figure 6.14). There are two basic formulas for calculating a back bearing.

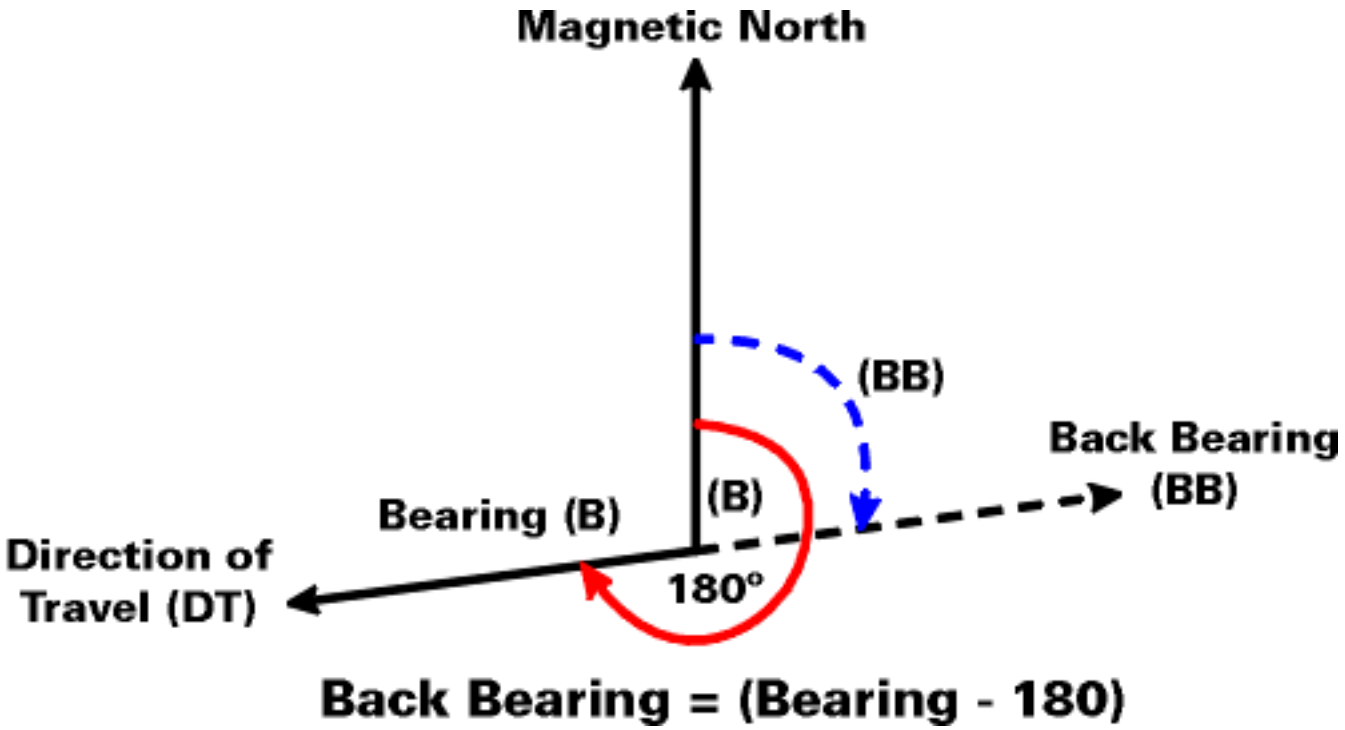
When the Direction of Travel Bearing is Less than 180° (see Figure 6.14):

- Back Bearing = (180° + Direction of Travel Bearing)
- BB = 180° + B
- 225° = 180° + 45°



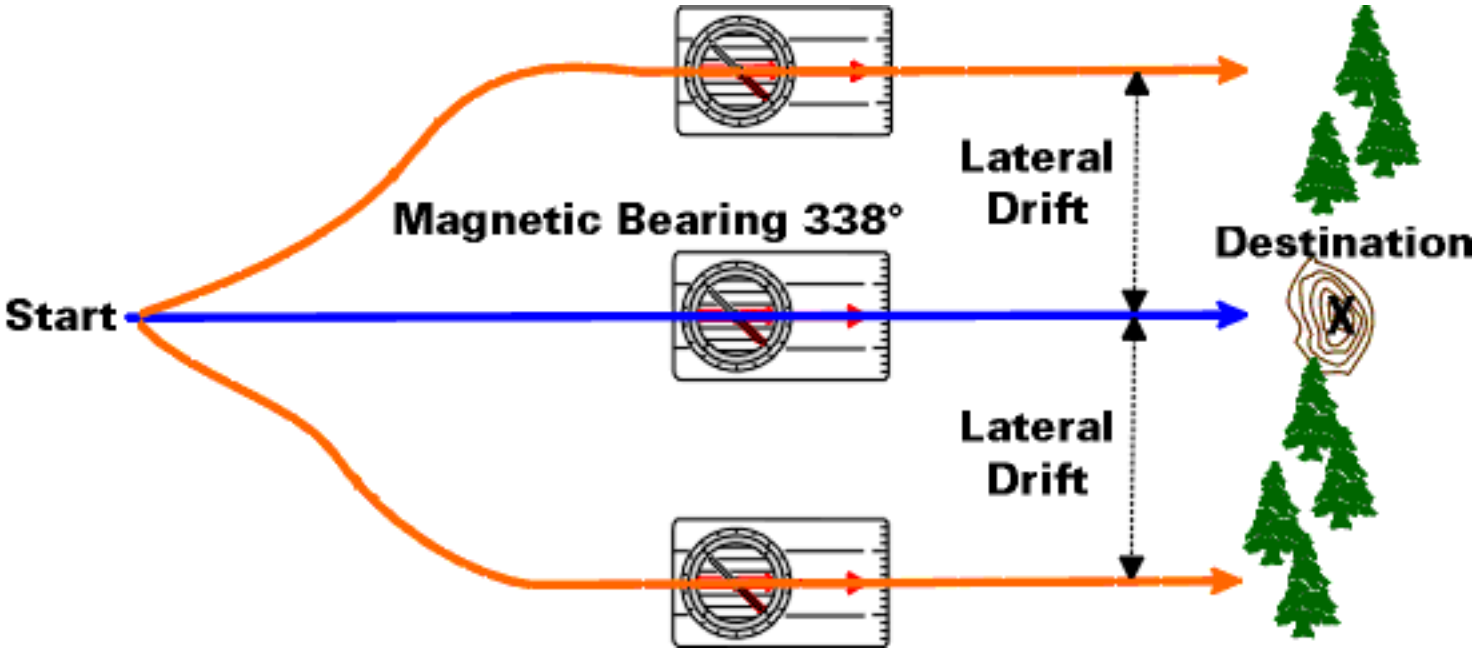
When the Direction of Travel Bearing is Greater than 180 degrees (see Figure 6.14):

- If the Direction of Travel Bearing is more than 180 degrees you use a different formula (otherwise you will have a Back Bearing greater than 360 degrees). If we reverse our example from above, let's say your Bearing is 225 degrees (which is greater than 180 degrees) then your Back Bearing works out to 45 degrees.
- Back Bearing = (Direction of Travel Bearing - 180°)
- BB = B - 180°
- 45° = 225° - 180°

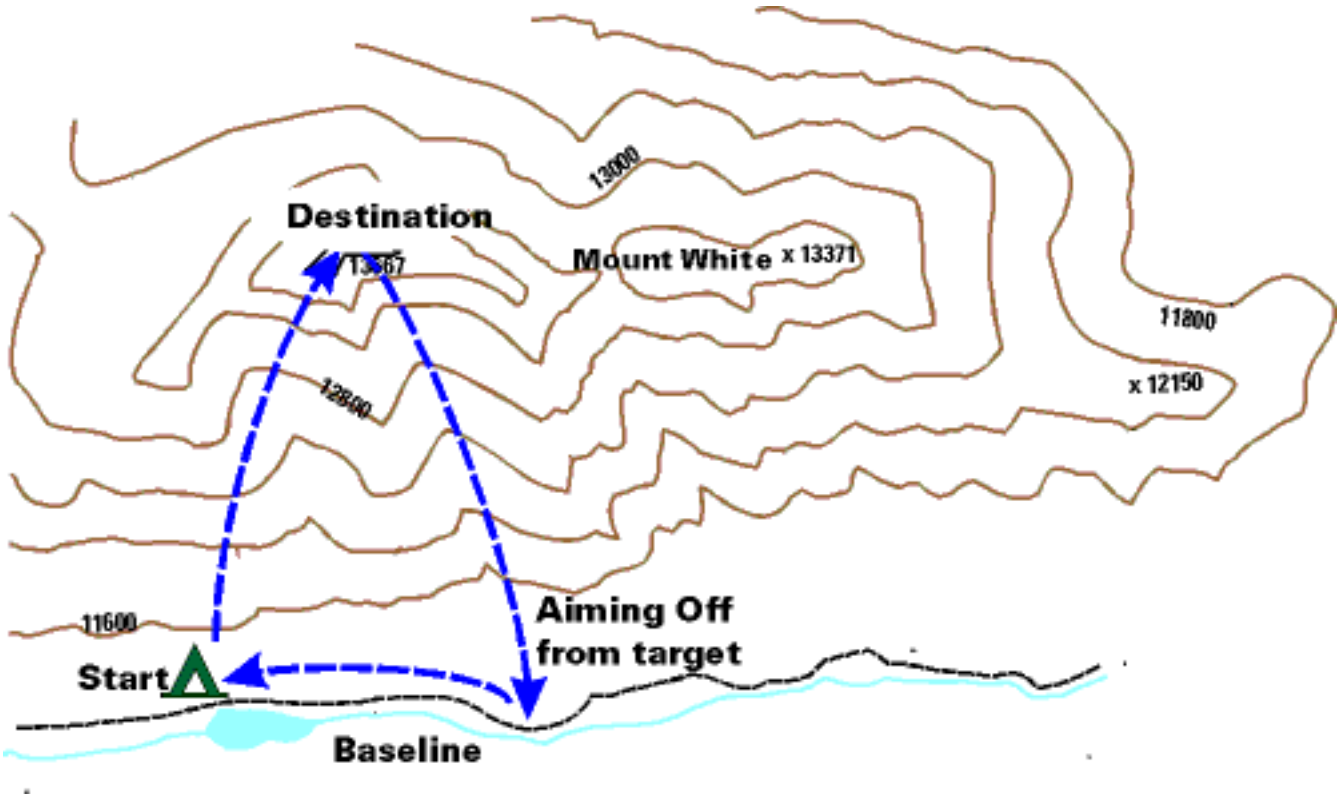


Back Bearing = (Bearing - 180)

- Aiming Off: It is almost impossible to walk a perfect bearing. In most cases your error can be anywhere from 3-5°. This is known as lateral drift (see Figure 6.12) Being off just a few degrees can make a major difference after several miles (see Table 6.1). Therefore, rather than head straight for your target, it is best to deliberately aim to one side of your target (left or right). Then you will know whether to turn right or left and walk to the target.



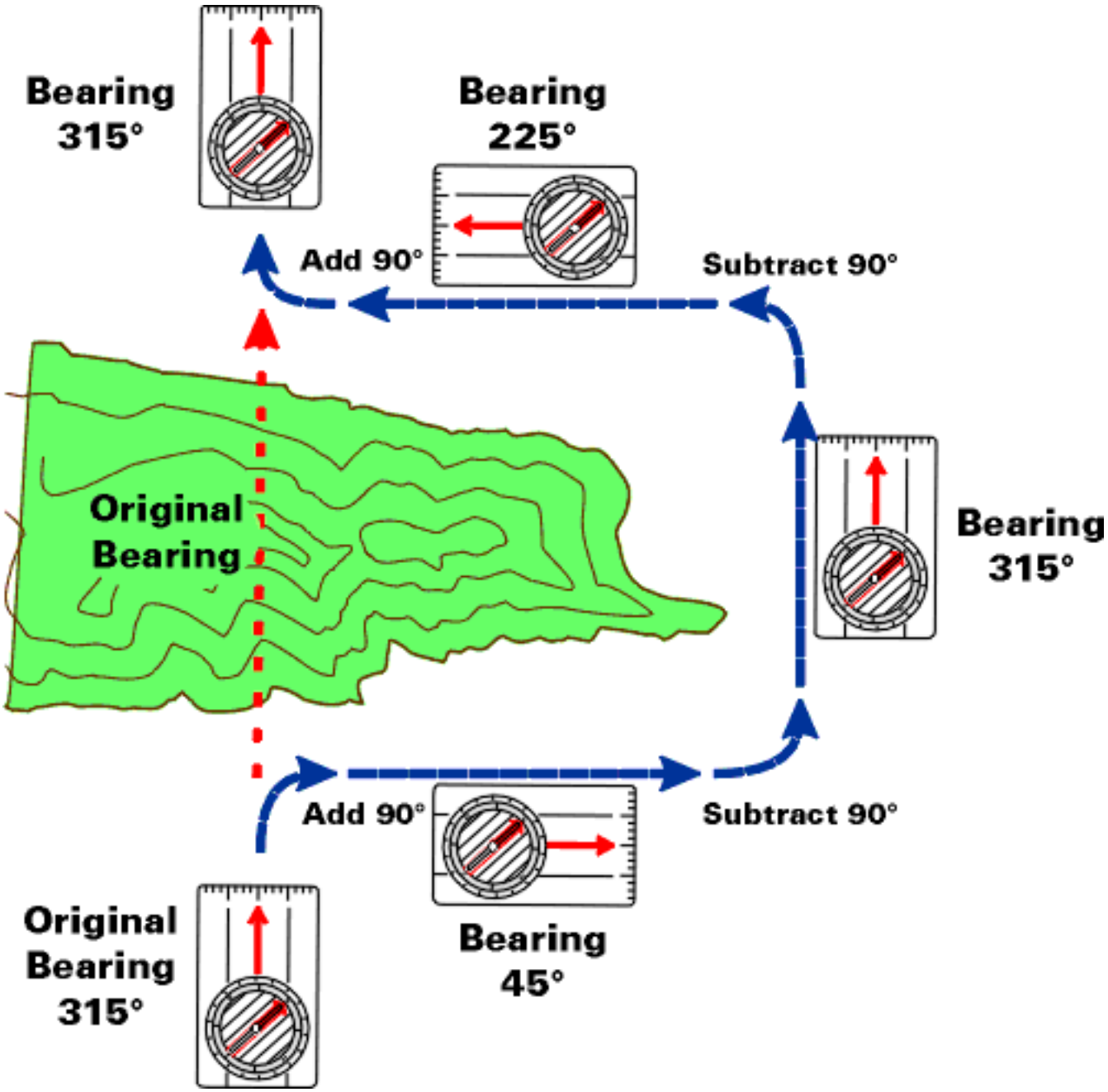
- Baselines: Baselines are helpful because they provide a large target to aim for. A baseline is a reference line that lies across your course. It can be a trail, cliff face, road, stream, or other feature. You can combine a baseline with aiming off to help navigate (in Scenario #3 the trail served as a baseline). Find a baseline near your destination, then aim off of it. When you hit the baseline, you now know which direction to turn to walk along the baseline to reach your destination (see Figure 6.13).



Scenario #4 - There's Something in Your Way:

You're doing this incredible bushwack and you've been diligently following a compass course, sighting from tree to tree. Up ahead there is a clearing, when you enter it you discover a bog. There's no way you can go straight through on your compass course. Now what? Here's your procedure:

- Walking Around Obstacles - When you reach an obstacle, the best method for maintaining your course is to hike a rectangle around the object (see Figure 6.14).
    - Set a new bearing 90 degrees from your original heading and walk that until you have cleared the obstacle along that axis. For example, if you original bearing was 30 degrees, hike a new bearing of 120 degrees. While walking, maintain a count of paces or otherwise track the distance traveled.
    - Go back onto your original bearing, parallel to you original course until you clear the obstacle along that axis.
    - Set a bearing 90 degrees back to your original bearing (in this case 300 degrees) and walk the same number of paces.
    - Now turn back to your original bearing. You will be along your original line of travel.



Scenario #5 - Now You are Really Lost:

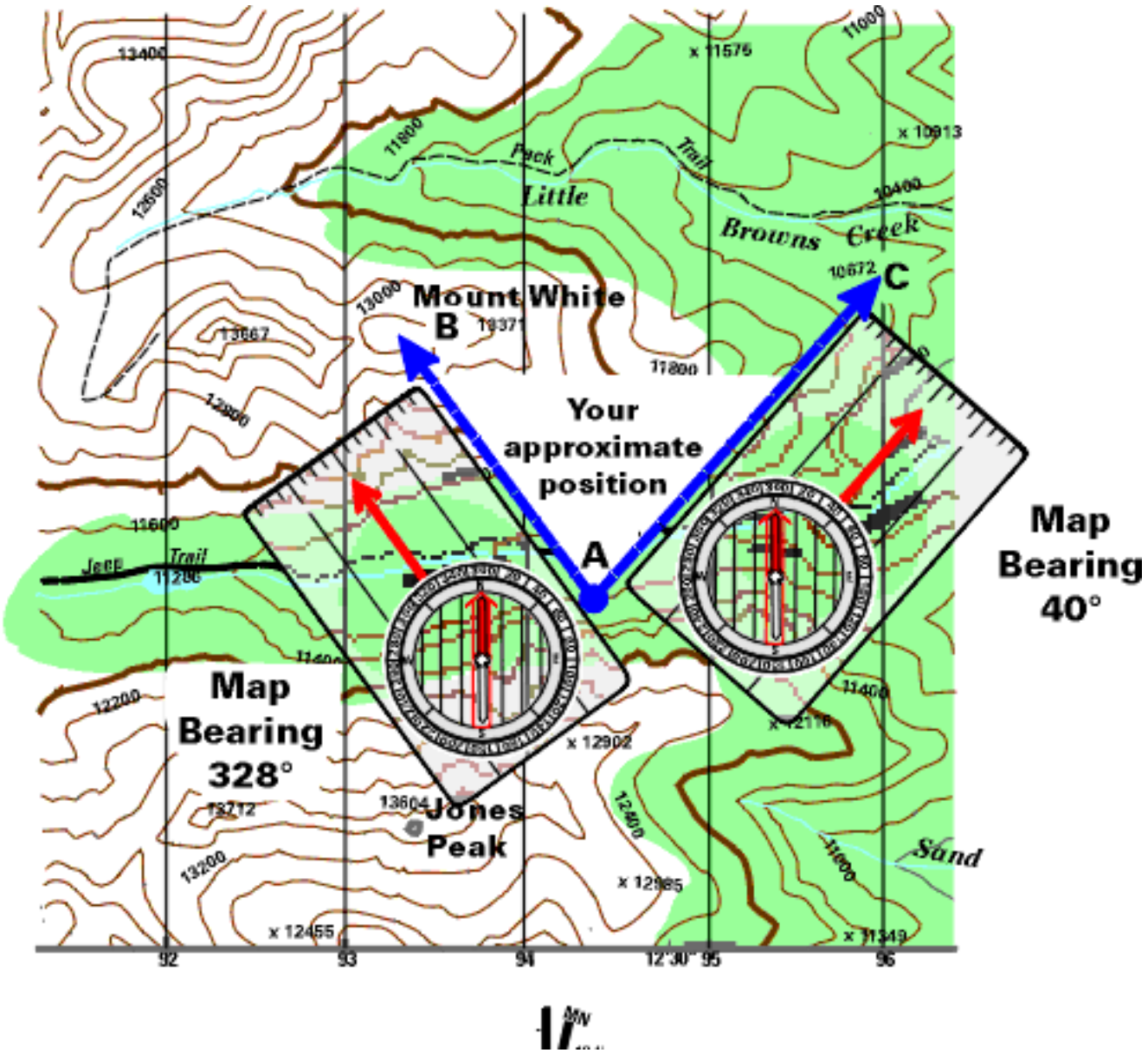
You're hiking off trail through the broad alpine valleys and your having this deep philosophical conversation about the connection of man with nature, so deep that you have lost some of your connection with nature. You look around and you don't know where you are. One alpine valley looks a lot like the last one you came through. Okay, so you're lost. Now what? Here's your procedure:

Triangulation

Triangulation is used to locate your position when two or more prominent landmarks are visible. Even if you are not sure where you are, you can find your approximate position as long as you can identify at least 2 prominent landmarks (mountain, end of a lake, bridge, etc.) both on the land and on your map. (See Figure 6.15).

1. Orient the map.

2. Look around and locate prominent landmarks.
3. Find the landmarks on the map (preferably at least 90 degrees apart).
4. Determine the bearing of one of the landmarks (see Bearings page 00).
5. Place the compass on the map so that one side of the base plate points toward the landmark.
6. Keeping the edge of the base plate on the symbol, turn the entire compass on the map until the orienting arrow and the compass needle point to north on the map.
7. Draw a line on the map along the edge of the base plate, intersecting the prominent landmark symbol. Your position is somewhere along this line.
8. Repeat this procedure for the other prominent landmark. The second landmark should be as close to 90 degrees from the first as possible. Your approximate position is where the two lines intersect.
9. You can repeat this process a third time to show an area bounded by three lines. You are located within this triangle.
10. If you are located on a prominent feature marked on the map such as a ridge, stream, or road, only one calculation from a prominent landmark should be necessary. Your position will be approximately where the drawn line intersects this linear feature.



Other Tools

Altimeters

An altimeter can also be a useful navigation tool. An altimeter measures the local atmospheric pressure of the air just like a barometer. This is usually expressed in inches or millibars of Mercury. The altimeter displays the current altitude on a dial with a needle or with a digital display. Since atmospheric pressure is constantly changing due to weather (see Chapter 7 - Natural History: Weather page 00), you must calibrate the altimeter by first setting it when you are at a known elevation. Say you arrive at the trail head parking lot which the map indicates is at 2,400 feet (730 meters). Set your altimeter for 2,400 feet (730 meters). As you hike the altimeter shows the current altitude as your elevation increase or decreases. In order to maintain accurate readings you should recalibrate your altimeter several times each day. One good trick is to recalibrate or at least look at your altimeter reading before you go to bed. If the altimeter reads higher the next day, then the atmospheric pressure has gone up during the night (typically indicating stable or improving weather). If the altimeter reads lower, then the atmospheric pressure is falling (indicating potential stormy weather).

You can use your altimeter in navigation as another information source to help locate your position. If the altimeter is properly calibrated, you know that you are at a specific altitude. Think of this altitude as corresponding to a particular contour line on your map. This may be enough to give you a very accurate fix on your location. If you are hiking up a trail and it crosses a particular altitude (contour line) at only one point, then you know exactly where you are. In other situations, you know that you are somewhere along a contour line that lies at that altitude (elevation). Other clues may help pin down exactly where along that contour line you are.

Inexpensive altimeters are available for under $50 and are also prone to inaccuracies due to temperature. To minimize temperature problems it is best to let your altimeter adjust to the ambient air temperature before taking a reading. More expensive altimeters that automatically correct for temperature changes can run over $200. A digital watch with an altimeter/barometer is an item that combines two useful tools.

Watches

Wearing a watch in the backcountry is a point of personal wilderness ethics. Many people like to let nature set the pace of the day rather than a watch. I may not **wear** my watch, but I **always** bring one along. There are too many times when I have needed a watch. For example, to get an accurate check on how fast I am hiking to see if my Time Control Plan is correct (see Chapter 1 - trip Planning: Planning Your Day page 00), and especially in first aid and emergency situations where timing vital signs and knowing the exact time that things are occurring may be essential in proper diagnosis and treatment (see Chapter 9 - First Aid & Emergency Care: Patient Assessment page 00). Watches can also be used to determine basic direction (see page 00).

Global Positioning Systems (GPS)

The Global Positioning System is a network of satellites in orbit above the earth. A GPS unit is basically a radio receiver. The satellites transmit to the GPS unit which interpolates the signals into latitude and longitude which are displayed on the unit. Typically signals from three satellites are needed to identify a specific position and a fourth to interpolate altitude. GPS units are accurate to within a few hundred feet of your actual location. Although they can be used to very accurately determine your location and establish compass courses, **don't rely on a GPS unit in place of solid knowledge of map and compass.** Battery failure, damage to the GPS unit, or even leaving it behind at a rest stop could leave you lost if you don't have good map and compass skills. GPS units are particularly useful in locations where there a few landmarks to identify your location (for example long canoeing trips in northern Canada). GPS units are available as hand held units easily transportable in the backcountry.

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