Map and Compass

Putting
Conservation
to Work

Recreation Aid No. 2

Outdoor experiences can become safer and more interesting if you know how to use a map and compass. This information can help you become more familiar with the map and compass.

USING THE MAP

A map is a scaled representation of the earth's surface. It is a useful tool in planning a trip or locating our position on the ground.

General

Before leaving on a trip outline your route of travel on a map. Study the map so it becomes as familiar as the back of your hand. You should develop a sense or feeling of belonging to the area.

In addition to studying the map, talk to people familiar with the area, find out if the roads or trails are open, or signed. Talk to land managers, gas station operators, old timers, etc.

There are many different types of maps and you should choose the type to fit your trip.

1. Highway Map - shows route to general area.

2. Planimetric Map - shows general streams, ridge tops, trails, roads, etc. This map most generally used by recreationists.

3. Topographic Map - shows differences in elevation by contour lines (lines connecting all points of same elevation together). Used by hikers and backpackers. Available from U.S. Geological Survey or book and mountaineering stores.

Land Surveys

To understand our maps in the Western United States, you must know something of land surveys.

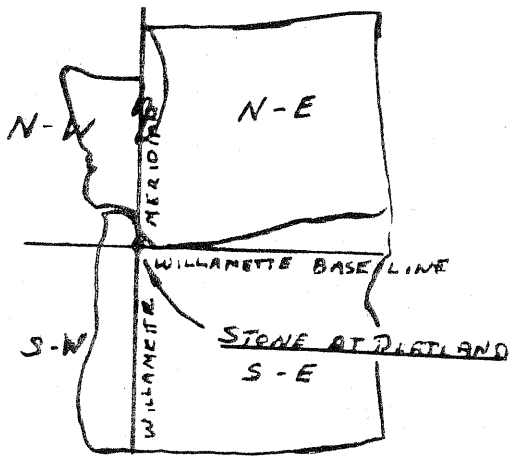
These surveys consist of a series of parallel lines forming a grid across part of the country, and started in the Northwest during the 1800's. This grid has been established on the ground and the lines and cross points (section and township corners) are marked on the ground.

United States Department of Agriculture | Forest Service | Pacific Northwest Region | Portland Oregon April 1965

Basic Elements for Land Surveys in Oregon and Washington

A starting point was needed in Oregon and Washington so a point called the Willamette Stone was positioned near Portland, Oregon.

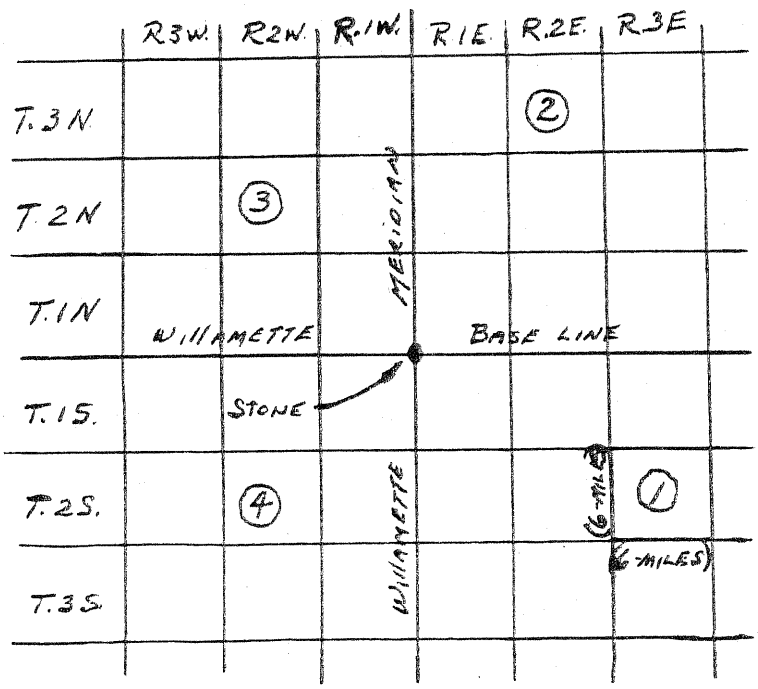
An east-west line was established from this stone and was called the Willamette Base Line. The north-south line was called the Willamette Meridian. These two lines are the axis of the grid covering the States of Oregon and Washington. Similar starting points and grids are found in other states.



General System for Numbering Township

In order to further subdivide this area, lines were run at six-mile intervals parallel to the meridian and range lines. The lines running east and west were called township lines and were numbered consecutively, north and south of the base line, e.g., Township 1 North (T. 1N) was first row above base line and Township 1 South (T. 1S) was first row below the base line.

The lines running north and south were called range lines and were numbered consecutively east and west of the base lines, e.g., Range 1 East is first row east of the meridian line and Range 1 West is first row to the west of the meridian line.



The legal description of the township with the (1) in it is (1) T. 2S. R. 3E W.M. (Willamette Meridian).

What is description of:

(2)

(3)

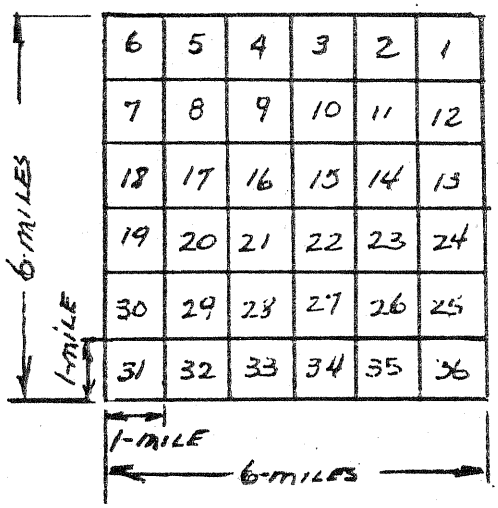
(4)

Numbering Sections in a Township

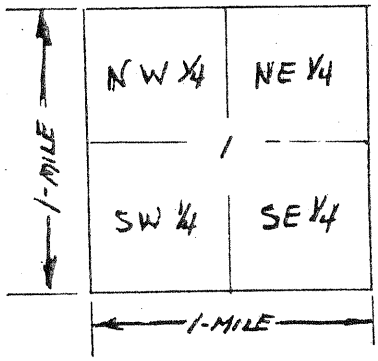
To further divide this grided land area, each square or township (6 miles on each side) was divided into 36 sections each 1 mile square. Each section contains 640 acres.

Sections are further subdivided as needed for location. One-fourth of a section is 160 acres.

Township



Section Divided into Quarters



Legal Land Description

Each piece of land has a legal description and can be referred to in order to locate your position or land ownership on the map.

The section and township survey lines on the map have been established on the ground by blazing or marking trees. Trees with carvings in them face the section corners and act as a reference point for location of the section corners. This work was done by surveyors many years ago.

Legend and Scale

Each map has a scale that tells the distance relationship of that map to the ground. (Some maps have scales of 1" - 1 mile, ½" - 1 mile, etc.) The legend is very important to help you define the characteristics of the map. Legend shows roads, trails, streams, lookouts, mountain tops, some elevations, etc. (See map.)

By using the legal description, the legend and the map scale, the map becomes a ready reference to identify points of interest on the ground.

USING THE COMPASS

A compass is a device for determining direction on the earth's surface by means of a magnetic needle, swinging on a free pivot and pointing to the magnetic north.

General

Direction in the out-of-doors cannot always be determined by the orientation of a map or the position of the sun in the sky. This is when a compass becomes valuable.

Using the compass can be easy if you practice with the following instructions.

Parts of the Silva Compass

There are different kinds of compasses, but we will discuss only the silva compass. The compass housing is divided into 360 equal parts numbered clockwise in consecutive order. Each equal part is called an azimuth or a degree. There are three main parts:

1. Compass needle - the red end points to magnetic north and the white end points south.

2. Compass housing, in this instance, is an aluminum dial with an azimuth circle marked on the outside. The space between each line marked on the housing represents two degrees. There are four principal parts to a compass - North (0^{o} and 360^{o} azimuth), East (90^{o} azimuth), South (180^{o} azimuth), and West 270^{o} azimuth). An orienting arrow also appears on the inside of the bottom of the housing.

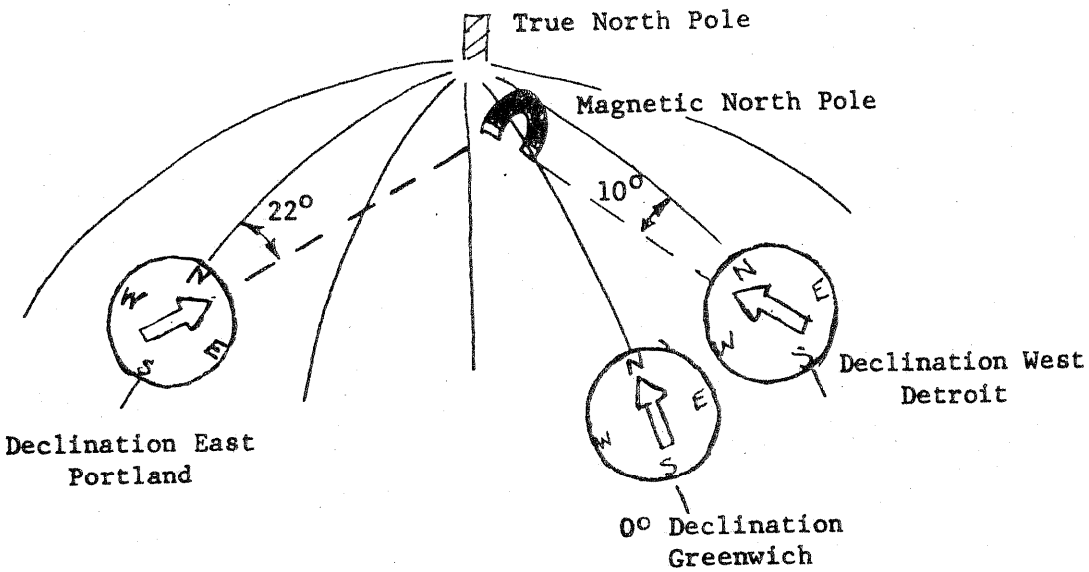
3. The base plate is used to indicate the line of travel as shown by the "direction of travel arrow" on the plate. The base can also be used to scale distances on a map.

Declination

The compass needle points to magnetic north. Maps and land surveys are made on the basis of true north. This is necessary because magnetic north is some fourteen hundred miles distant from true north. Since all maps are made on a true north bearing and the compass needle points to magnetic north, an adjustment must be made on the compass to compensate. This difference is known as the angle of declination.

1. Angle of Declination

   In different parts of the country the angle of declination varies. This is one reason why manufacturers do not build this correction right into the compass. Declination in Oregon and Washington is about -22.



Compass Declination

Since we are west of the declination zero line, our compass needle will point east of true north as is shown in the above illustration. This is called easterly declination. We would always add our easterly declination to a magnetic compass bearing to get a true bearing. An average declination for Oregon and Washington is -22°.

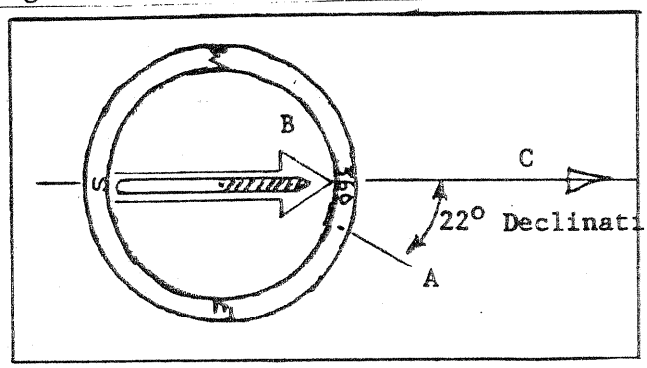
(Note: The following adjustment on your silva compass will simplify future corrections for declinations.)

2. Adjusting the Compass for Magnetic Declination

Set the 360° (or 0°) azimuth on the "direction of travel" arrow, C, as shown in the diagram below.

Opposite the correct declination for this area (-22) scratch a line into the plastic base. This is called the "azimuth line," and is shown by the letter A in the diagram. Ink the scratch line or "azimuth line," with black or red India ink to make it stand out.

Once the proper declination has been set off on the compass, all bearings will then be read from the azimuth line.



A = Etched azimuth line

B = Orienting arrow

C = Direction of travel line

Correction for declination diagram

Orienting the Compass to Magnetic North

The first step in using your compass is to orient it. To orient a compass is to know your location in relation to north. When the free swinging magnetic needle is directly over the bottom orienting arrow in the bottom of the compass housing (make sure both north arrows are pointing the same way), the compassing housing and needle are oriented to magnetic north.

Orienting to True North

The compass can be further oriented to use in traveling a true north direction. Rotate the compass housing until an azimuth of 360° or 0° is opposite the scratch line made earlier on the compass base. (This corrects for the declination or the difference between true and magnetic north.) Hold the compass level, directly in front of you and pointing straight out. Rotate your body until the arrows* are together and pointing in the same direction. The "direction of travel" arrow on the base is now pointing true north and if followed will lead you in that direction.

Following Any Desired Compass Bearing

Set your desired azimuth (on aluminum dial) on the scratched azimuth line.

1. Hold the compass with two hands in front of you and with your arms against your body, the direction arrow of travel (on the base plate) should be pointing away from you. Turn yourself, with the compass held rigid, until the magnetic arrow and the orienteering arrow coincide with each other. Look at the direction of travel arrow and raise your head looking in the same direction. This will be your direction of travel.

2. Line up objects between you and the landmark so you can stay on course. You may have to check your compass bearing along the travel route to make sure you are on the right route.

Taking an Azimuth Sight on an Object in the Field

If you wish to determine the bearing of a landmark with your compass, point the direction of travel arrow at the object. Holding the compass rigid, turn the housing until the arrow in the bottom of the compass is directly under the free floating needle. Read the azimuth at the etched line.

Cautions to be Observed in Using Compass

1. Be sure that the correct declination is set off on the compass. When running lines always follow the line of sight or direction of travel arrow and not the direction of the needle. The compass is a delicate instrument; handle it carefully.

*magnetic needle and orienteering arrow

2. Always follow the line indicated by the compass rather than relying on your judgment as to the direction.

3. Remember the tree, rock or other object sighted on your line of sight. When in doubt, take another compass reading.

4. Keep items containing steel or iron far enough away from the needles to avoid influencing it.

5. Do not attempt to repair the compass except in emergencies.

Keeping on Line of Sight by Backsighting

While following a line of sight or an azimuth you may sometimes lose the landmark (tree or rock) you are following and find it necessary to check your location to determine if you are still on the correct line of sight or azimuth. To do this, you can sight back toward your starting point and then check your compass to see if you are still on the line. This requires sighting a back azimuth which is in the opposite direction from the azimuth.

In turning to sight back along the line, the red-tipped needle will reverse itself and point in the opposite direction from the orienting arrow. You know you are on line if both needles line up in opposite directions. If not, move to one side or the other until alignment is made.

USING THE MAP AND COMPASS

Once you have learned to use the map and the compass separately, you should learn to use them together. Here are a few points you must know:

Orient Map and Compass to North

Set 0^{o} or 360^{o} azimuth on the etched azimuth line on your silva compass. Set compass on the map with the line of travel arrow pointing to the top of the map.

Turn the map and compass until the magnetic needle is centered over the orienteering needle in the housing both pointing to the etched azimuth line. Your map and compass are now oriented to true north.

Determining the Direction from One Point on the Map to Another

If you wish to know the direction of travel from one location on the map to another, first orient your map and compass to north as above. Then, keeping the map stationary, place the edge of the compass on the map so it intercepts the two points of travel. Be sure the direction of travel arrow, which is parallel to the compass edge, points in the direction of the point to which you wish to go. Hold the compass in place and rotate the housing until the orienteering arrow is directly under the needle.

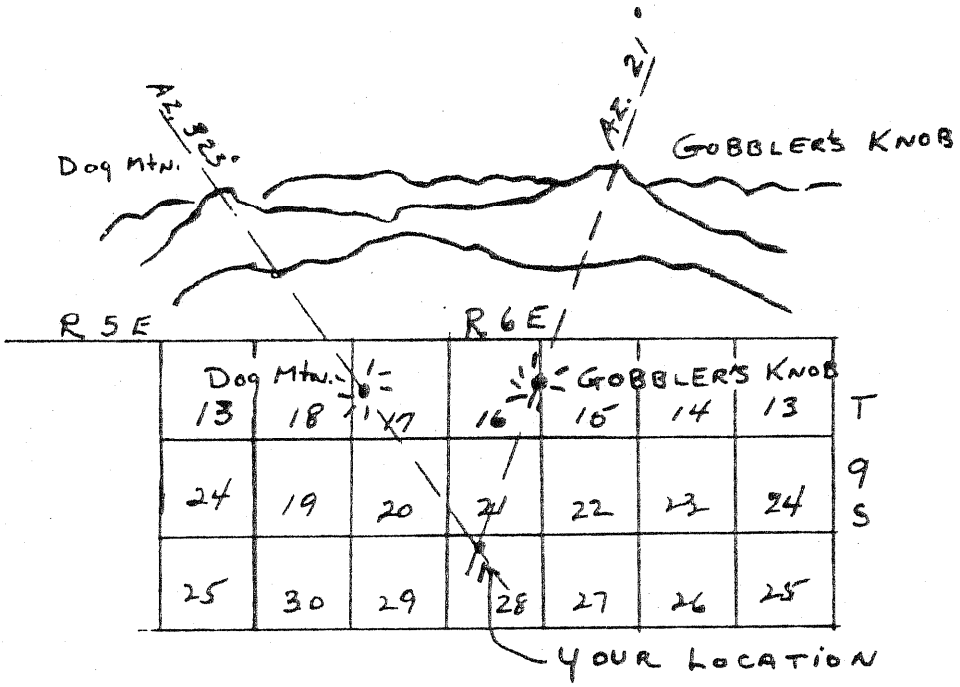
The azimuth bearing is read from the compass housing at the etched azimuth line. To travel this line of sight follow the direction of travel arrow as described in "Following a Compass Bearing" (p.6).

Placing a Compass Bearing on the Map

You may see a mountain in the distance and want to find it on the map. Take an azimuth reading on the landmark (as described on page 7). Orient your map to true north. Keep the map stationary. Rotate the compass housing until the landmark azimuth is opposite the etched azimuth line on the base plate. Place the edge of the compass at the point on the map from where the reading was taken. Rotate the whole compass until the orienteering arrow is immediately below the needle. Make a line on the map along the edge of the compass. It will pass through the point on which the sight was made.

How to Find Your Location from Two Known Landmarks

You are lost but can see two known landmarks which appear on your map. Take azimuth bearings with the compass on each of these landmarks from your location. Using the method just explained above, mark the two azimuth bearings on your map by drawing lines on the map from the known points (along the azimuth you took) toward you. Where the two azimuth lines intersect is your location on the map.



Prepared in cooperation with Oregon State Department of Forestry

PROBLEMS FOR MAP & COMPASS

The following problems go with the large numbers on the attached map:

1. You want to go from Aldrich Butte (1) to Dog Mountain (2).

   a. What is the azimuth?_____

   b. What is the reading you would put on the etched azimuth line on your compass to travel from (1) to (2) in a straight line?_____

   c. Why is the "direction of travel" arrow your desired course?

   _____

2. What is the azimuth from Larch Mountain (3) to Nesmith Point (4)?

   _____

3. You are at Green Point Mountain (5) and see a mountain at an azimuth 216° approximately 3½ miles away. What mountain is it?

   _____

4. What is the azimuth from Mt. Defiance (6) to Dog Mountain (2)?

   _____ What is the reading you would put on the etched azimuth line on your compass?_____

   What is the distance _____ miles?

5. You take a compass azimuth from Mt. Defiance to Aldrich Butte and find it to be 270° on the direction of travel arrow. Is any correction necessary to plot this line on the map?

   _____

6. You are at a lake between Mt. Defiance (6) and Green Point Mountain(5). You take an azimuth bearing on Mt. Defiance which reads 78°. You take an azimuth bearing on Green Point Mountain which reads 205°. What lake are you near? _____

7. You are lost on Benson Plateau and want to find what section you are located in. An azimuth taken on Aldrich Butte (1) reads 294° and an azimuth on Dog Mountain (2) reads 52°. What section, township range and meridian are you located in?

   _____

8. What is the name of the campground in Sec. 1, T.1N., R.7E W.M.?

   _____

ANSWERS:

1. a. 72°
   b. 72°
   c. Because compass has been corrected for declination and direction of travel is true bearing.

2. 45°

3. Chinidere Mountain

4. a. 14°
   b. 14°
   c. 4½ miles

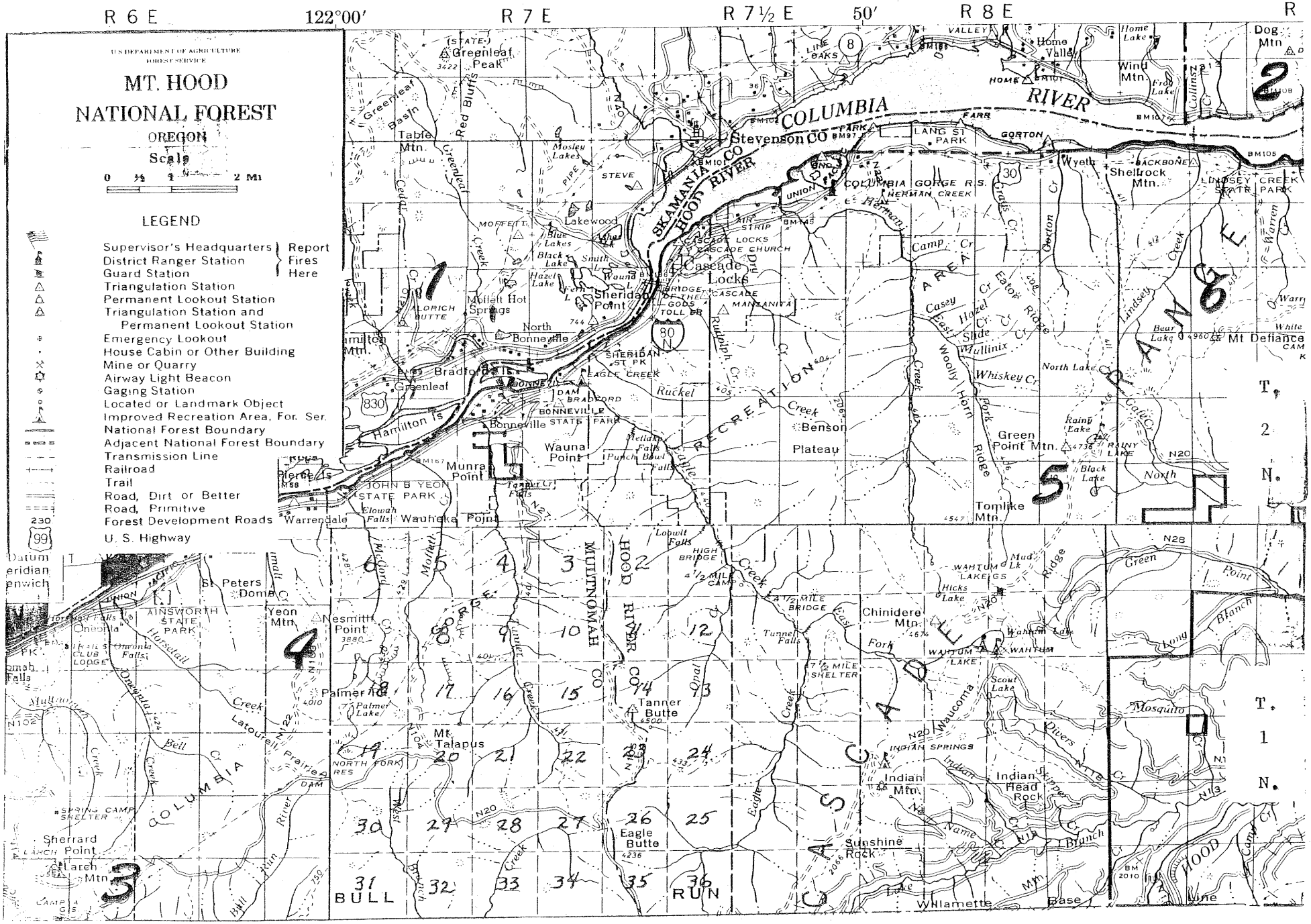
5. No, because you have oriented your map to true north and allowed for magnetic declination.

6. North Lake

7. Sec. 31, T. 2N. R.8E., W.M.

8. 4½ mile Campground

Work Map for Map & Compass Guidelines



Landmarks No. 19 4/1/64

Willamette Stone

By JOE BIANCO
Automotive Editor, The Oregonian

The Willamette Stone State Park — the only state park which comes within the city of Portland — has its historic importance in a stone.

The stone located at the end of a winding trail which begins on NW Skyline Blvd. just west of Mt. Calvary cemetery was the mark from which all of Oregon's lands were sectionized.

The Willamette Stone is a surveyor's monument at the intersection of the Willamette base line and the Willamette meridian. The mark was established June 4, 1851, by John B. Preston, the first surveyor general of Oregon. The original mark, however, was a stake. The stake was replaced July 25, 1885 in a simple ceremony.

Preston selected the site of the Willamette Stone because it was thought that the meridian surveyed north from the stone would pass through the

mouth of the Willamette River. The base line was established in its present location so that it would not cross the Columbia River, thereby producing difficulties in surveying.

The establishment of this stone was the start of the sectionizing of the public domain on the north Pacific coast. The monument is of particular interest to surveyors and abstractors.

The geographic position of the stone is: 45 degrees 31 feet 19.831 inches in latitude and 122 degrees 44 feet 33.551 inches in longitude.

The entrance to the park is designated by a wooden marker, south of NW Skyline Blvd.