

LAND MEASUREMENT

Overview

Land measurement and the maps that are produced through land measurement are important parts of forest management and decision making. Maps give us a visual representation of the composition of the forest, its size or acreage and the spatial orientation of features represented by the map. This information is gathered by using a compass and some form of linear measure.



Background

Because measuring every tree in a forest is impractical, foresters commonly measure a sample of trees and then expand the values to represent the entire area of interest. For this reason, foresters must be able to accurately measure the total land area from which the sample measurements are taken.

The basic building blocks for land surveying or measurement are distance and direction. Distance in forestry is measured in a unit called a chain, which is 66 feet. Although this may seem like an odd unit of measure, distances measured in chains convert easily to acres. One acre is 43,560 square feet. An area that is one chain by one chain equals 0.1 acre, and 10 square chains equal one acre. Therefore, areas expressed in square chains can easily be converted to acres by dividing by 10. One mile is equal to 80 chains. Thus, a 1 square mile tract of land (80 chains on each side) contains 6400 square chains or 640 acres.

Chains are usually measured by pacing or stepping off the one-chain distance by counting every other step. This form of measuring distance is simple and quite accurate when practiced. Another tool for measuring distance in forestry is a hip chain, which dispenses a string through a metering device that measures in feet or chains.

A forester determines direction by using a compass. A compass has three main parts: a base plate, dial and needle. The base plate holds everything together and indicates the direction of travel. The dial is used to measure how many degrees the target is from north. The needle on a compass is magnetic and, in the northern hemisphere, points in the direction where magnetic lines of horizontal force come together, which is called magnetic north. True north, however, is located geographi-

cally. The difference between magnetic north and true north is called magnetic declination. This difference varies over time as the magnetic fields fluctuate and depending on where you are geographically.

A compass can be used in several different ways. One is to traverse a compass course and determine the azimuth of each leg of the traverse by sighting the compass at the target and turning the dial until the arrow etched in the base plate lines up with the needle. Degree measurements are then read from the proper place on the dial. A second use is to follow a set of azimuth readings to an end point. Once the azimuth reading is set on the compass, direction can be determined by turning your body until the needle and etched arrow align. Then simply follow the direction of the travel arrow on the base plate for the specified distance.

To ensure accurate compass readings, novices must be cautious to see that (1) the compass is perfectly level, (2) the sights are properly aligned, (3) the needle swings freely before settling and (4) all readings are taken from the north end of needle. Hand compass shots should not normally exceed 5 chains.

Information collected from land surveys is recorded in the form of a map. It is important to know that most maps use true north readings, but the compass indicates magnetic north. This is not a problem if you are going to use field readings to produce your own map, but it is critical if you are going to work from maps already prepared. Some compasses can be adjusted to compensate for the declination, while others cannot. In any event, if you wish to make the adjustment, you will need a chart that shows the declination for the particular area in which you are working.

All maps should have a north arrow, a legend or key, a title and a scale.

Subjects

Math, science

Concepts

The Earth's atmosphere, water, soil, climate and geology vary from region to region, creating a wide diversity of biological communities. Humans use tools and technologies to adapt and alter these environments and resources to meet their physical, social and cultural needs. The technologies vary from simple hand tools to large-scale, complex systems. A compass and pacing are two simple tools that forest managers use to integrate information into a map for quick and easy use. Maps are used in all aspects of resource and environmental management.

Objectives

Students will: (1) learn to measure distance by pacing; (2) learn the basic concepts of how and why a compass works; (3) use these two skills to measure the distance between two points and to determine the direction traveled between the two points; (4) learn about the relationship of direction and distance and how they are used to create a map; (5) learn what information is needed on a map to make it usable.

Materials Needed

At least two instructors

A 2- to 3-acre open area with few physical features such as signs, fences or trees.

1 compass per student

1 clip board for every 2 to 3 students

1 pencil for every 2 to 3 students

10 X 10 graph paper with a map of the traverse on it for each student

Stakes and flagging to mark points on the compass course

Topographical and other maps

Large demonstration compass

Time Required

1 hour 45 minutes preparation time

1 hour to teach class

Vocabulary

- *Chain*: A distance of 66 feet.
- *Compass*: A device used to determine direction by means of a magnetic needle that turns freely on a pivot and points to magnetic north.
- *Legend*: An explanation of the symbols on a map.
- *Magnetic Declination*: The difference in angle between magnetic north and true north.
- *Magnetic North*: The northerly direction in the Earth's magnetic field.
- *North Arrow*: A symbol on a map that indicates the true north direction.
- *Pacing*: A method of measuring distance by counting the number of steps it takes to travel from one point to the next.
- *Scale*: A divided line on a map indicating a unit of measure used to represent a larger unit of measure, as in 1 inch equals 1 mile.

Doing the Activity

Prior to class, measure a 66-foot distance and mark each end. Set up a compass course with 4 or 5 legs ranging from 1 to 4 chains in length. Mark each point with flagging. Prepare a map of the area to a scale that will make the map easy to read. Include a title, scale, north arrow, legend and any land marks that will make the map a good example of what a forester might do in the woods. The map should be produced on 10 X 10 graph paper and copied so that the small squares are visible.

1. Ask the students to tell you what a compass is and what it is used for. Next ask whether they know how to use a compass.

2. Review why and how a forester uses a compass.

3. Show the students the demonstration compass and go over the parts of the compass and what each part does. Ask the students how or why the compass works and what the compass does. Explain that the Earth is surrounded by magnetic fields and that where the fields come together at the north pole is where the compass needle points. Make sure that they know that this is magnetic north, not true north. Discuss the difference between the two and explain magnetic declination. Discuss how this changes depending on your loca-

tion and when the readings are taken.

4. Ask the students what is done with surveying data after it is collected, i.e. where it is recorded. Discuss the four items that every map must have for it to be useful: north arrow, key, title and scale. Show the students several different types of maps and explain what they are used for.

5. Use the one-chain course to help students determine their number of paces per chain. Emphasize that 1 chain is 66 feet.

6. Devote the rest of the class to running the compass course. Split the class up into groups of 2 to 3 students. Give each student a compass, and one person from each group a clipboard with a copy of the map and a pencil. Have each instructor take part of the class and review what the students are to do and how to use the compass. Then have them start the course one group at a time, with one student holding the compass and the other student or students in the group pacing behind the compass. Continue until all groups are on the course. You may start groups at different points on the compass course to expedite the activity. Once all the groups are on the course, walk out and talk with individual groups to see if they have any questions or problems. Help them find the points, and make sure that all students in the group learn to use the compass.

Helpful Hints

- Keep the introductory part of the class as short as possible because the students will need most of the class time to do the compass course.
- Tell students that there will be a competition on the last day of the camp in which they will locate an unknown point using a compass and pacing.
- Don't spend too much time talking. Keep the class moving.

