New Jersey School of Conservation
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Orienteering

This field activity lesson introduces students to the fundamental skills of orienteering. Students will use a compass and lead the group through the wilderness of Stokes State Forest.

OBJECTIVES:

1. Students will learn the parts of a compass.
2. Students will learn how to set a compass to any bearing.
3. Students will learn how to identify an appropriate landmark.
4. Students will develop an appreciation for using a compass accurately .
5. Students will have the opportunity to lead the group in the forest.
6. When not leading, students will have the opportunity to review the work of their peers.

MATERIALS NEEDED:

- Compass Box containing:
- 20 compasses
- Demonstration Compass
- Orienteering Fact Sheet
- 20 round “Home base” markers
- Map of the School of Conservation and surrounding area
- Simple Paper Maps
- Intermediate Orienteering Information Sheet
- Novice Orienteering Information Sheet

PROCEDURES:

Before the session, the instructor should check to make certain all equipment items are available and in working condition. All compasses should have strings long enough to be worn around the neck. Compasses should not have large (bigger than 1/4") air bubbles in the housing.

1. Review different uses of compasses: piloting ships and planes, military, sports including hiking, bird watching, fishing, etc.

2. Describe how the Chinese first detected the presence of an invisible magnetic field.

3. Use the large demonstration compass to review the parts of the compass

   (see graphic) :
   a) **Base Plate** - rectangular bottom.
   b) **Housing** - circular raised portion of the compass.
   c) **Magnetic Needle** - one half red, one half white inside of housing; **red end always points north** when the compass is held still and level. However, iron, steel or electrical devices (cameras) can affect the needle.
   d) **Direction of Travel Arrow** - etched on base where it says "read bearing here". Should always be pointing in the **same** direction as your '**nose and your toes'**.
   e) **Orienting Arrow** - has "sergeant " stripes and is the arrow you align with the magnetic needle after setting a bearing. (Put **RED to BED**)

4. While seated, have all students practice accurately setting a bearing on their compass many times.

5. After all students can set a compass, have the class now face the direction their compass is set several times.

6. Before heading into the woods distribute the home base markers in the field and provide bearings that will cause the students to walk a triangle or square using their compasses. First have students mark their "home base" (starting point). To walk squares start with any bearing at all, find a landmark, walk "X" number of steps toward that landmark, stop. Add 90° and repeat, using equal distances for each side. After 4 sides students should have returned to their "home base". For triangles use 120° and three sides. To keep sides equal in length, have students walk heel to toe, using the length of their shoe as a standard unit of measure.

7. Now set off on the Intermediate Orienteering course. Realize that each destination marker is a metal can painted red and white. Each can has a unique number and a letter. Nearby each of the markers you should find a “cache”. This is a plastic jar attached to a tree that contains additional information, activities, as well as the bearing or direction to next marker. If you are teaching in the area of Big Timbers, then please refer to the information in the box below for your course bearings and destinations.

The following advanced skills can be found in the jars but should be cautiously presented to students only after they have practiced and understand the skills listed above.

8. A **back bearing** is a method of reviewing the accuracy of your choice of a landmark. From a control locate and advance to your first landmark. Now turn and aim the Direction of Travel Arrow at the original control. The landmark you are now near will be accurate if the white end of the magnetic arrow falls directly above the orienting arrow. If not, reposition yourself until the white end does rest directly above the orienting arrow.

9. **Pacing** is a simple method of keeping track of or estimating distance traveled. To determine you’re pace walk several times along a 50 ft. rope or tape measure. One pace is equal to two steps. If you begin walking with the left foot leading, begin counting every time your right foot hits the ground. After averaging the number of paces it is a simple matter of dividing 50 ft. by the number of paces needed to cover that distance. The resulting number is the length of your pace. If you measure on your map that your destination is 1/4 mile away, with a pace equaling five feet, you now know that in approximately 264 paces you should be very near your goal. Factors that influence the

length of your pace over uneven terrain are hills, thick brush, and other impediments to forward progress.

10. **SETTING A COMPASS FROM A MAP**
    Use the following instructions to determine a bearing between two locations on a map:

    A. Refer to the laminated map supplied by SOC. Unlike most maps, the parallel lines on this map align with magnetic north (not true north).

    B. On the map, identify or draw a line that connects your starting point with your destination point. Place the long edge your compass on this, making sure that the **Direction-of-Travel Arrow** on the compass is pointing from your starting point toward your destination point.

    C. While holding the compass so that its position does not shift, turn the circular **housing** until the **orienting arrow** and **housing lines** are parallel to the magnetic north lines on the map. The number at the "read-bearing-here" mark on the compass is the bearing to follow. When doing this step it is important to remember that the **Orienting Arrow** on the compass should be parallel to the magnetic north arrow on the map.

    D. The compass bearing is now read at the **Direction of Travel Arrow**.

Teaching this technique to all students may be too difficult, however they should realize that bearings are determined from using the compass in conjunction with the map, and that bearings are not usually provided as they are in the SOC orienteering lessons.

Prior to getting the exact bearing it can be very useful to demonstrate the process of getting an **estimated** bearing. This can be done by first identifying a starting location and a destination as described above. For example you are at the Corral and want to go to the intersection of Tinsley Trail and the access road into SOC. Find these sites on the map. Knowing that the top of the map is north and the parallel lines run north and south, it should be obvious that to travel to the trail/road intersection from the Corral you would need to travel west or some bearing that is close to 270 degrees. Repeat this process. Follow the above steps to determine a precise magnetic bearing. This precise bearing should be relatively close to the estimate. If not, your precision process is flawed in some way. Is the Orienting arrow pointing in the same direction as the magnetic north arrow on the map? Is the direction of Travel arrow pointing from your starting point toward your destination?

SUMMARY:

Lead a discussion that reviews the group's work and the fact that the group may have felt lost at times. Reinforce that if you keep the process clearly in mind, you should believe in the accuracy of a compass. Once these and other skills are learned, your compass can take you to the ends of the earth to make discoveries of your own.

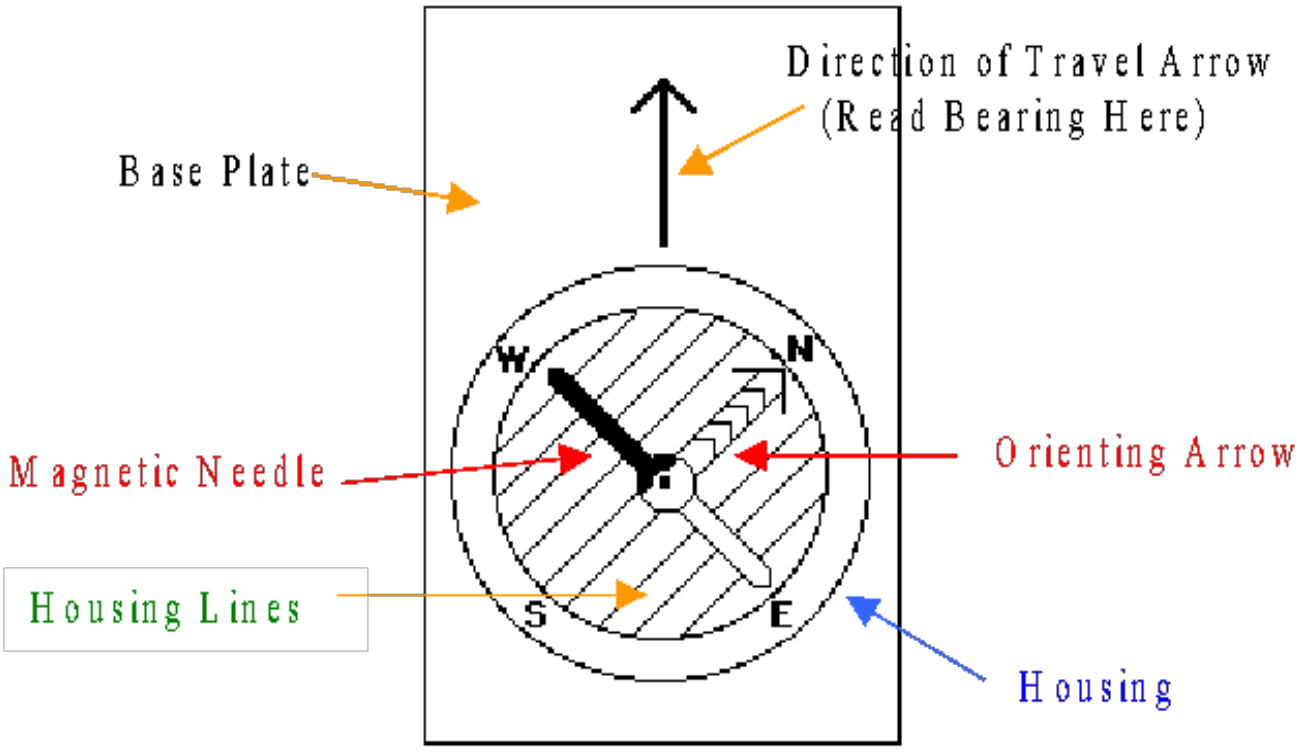
ADDITIONAL/ALTERNATE ACTIVITIES:

- Have the students use the simple paper maps to determine the correct bearings between points.
- Have the students use the laminated map to determine bearings between points within Stokes State Forest.
- Discuss the legend and symbols used on the map.

- Review the scale of the map and measure distance between points using a compass string.

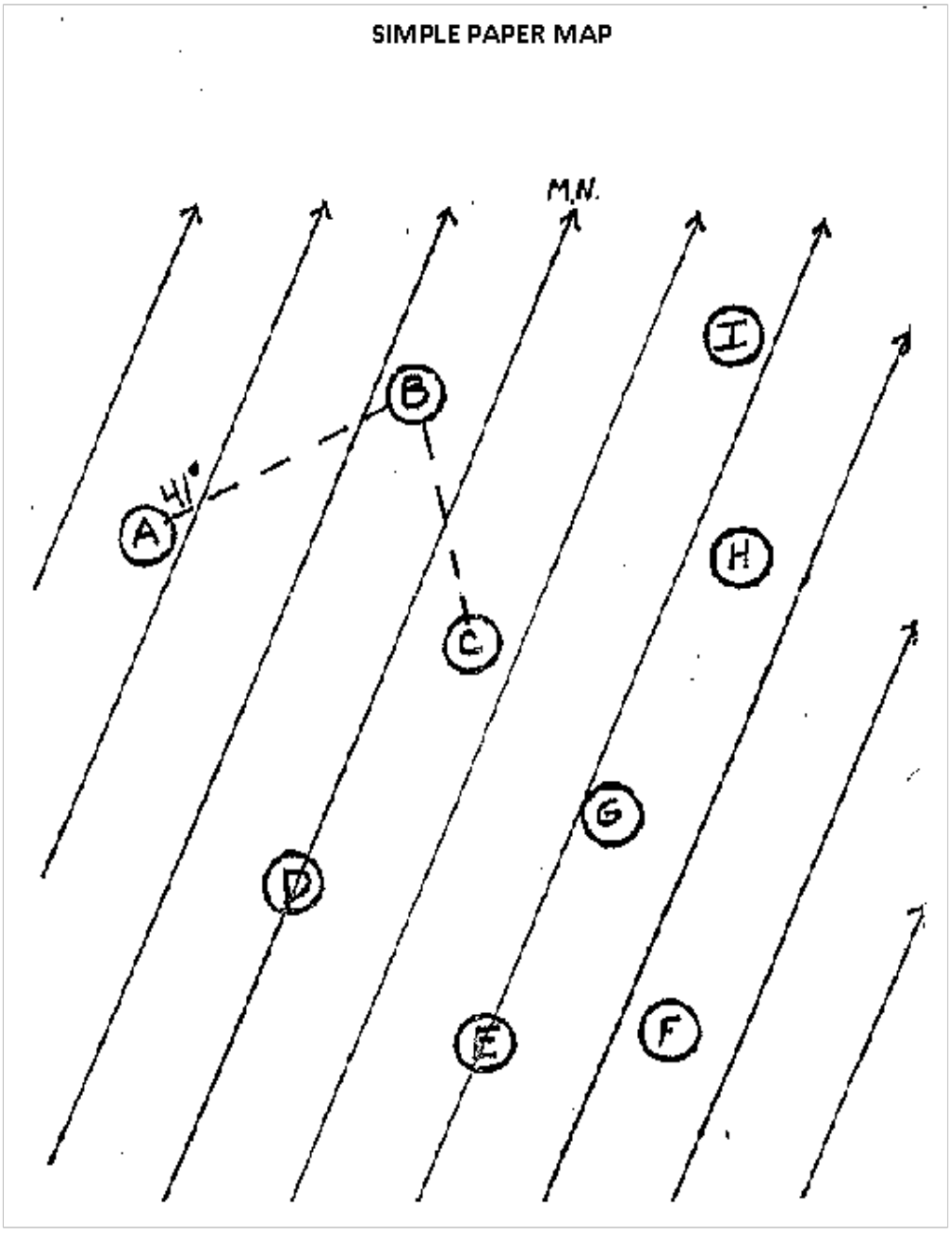
Special Note for Orienteering Instructors meeting at the Infirmary or Big Timbers

If, and only if, you are conducting your class from the Big Timbers/Infirmary Area, you will proceed to Cabin #2 after the initial lesson and reviews. At Cabin #2, set the compass to **214** degrees. Following this bearing for about 1000 feet should lead you across the stream (use stones or bridge) and eventually to the trail intersection of the Tinsley Trail (yellow blazes) and the Spring Brook Cabin Trail. Once you arrive there with the group, turn left onto the Spring Brook Cabin Trail and follow it to the cabin. The cabin's picnic table provides a good location to review the process for determining a bearing from a map as described in #6 above. Follow this process to determine the correct bearing for a hike back to camp from the cabin to the Trading Post circle. The bearing should be **338** degrees for a distance of about .5 miles. Leaving from the outhouse keeps hikers away from most of the wettest areas. Please take care moving through the rocky terrain. Look for a footbridge across the small stream.



M.N = Magnetic North

SIMPLE PAPER MAP



NJ Student Learning Standards

This field lesson touches upon the following NJ Performance Expectations and may also be tailored to focus on any of the following standards

Mathematics

- MP.2 Reason abstractly and quantitatively.
- MP.4 Model with mathematics.

HS-PS3: Energy

- HS-PS3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Comprehensive Health and Physical Education

- 2.2.8.MSC.1 Explain and demonstrate the transition of movement skills from isolated settings (e.g., skill practice) into applied settings (e.g., games, sports, dance, recreational activities).
- 2.2.8.MSC.7 Effectively manage emotions during physical activity (e.g., anger, frustration, excitement) in a safe manner to self and others.
- 2.3.8.PS.1 Assess the degree of risk in a variety of situations, and identify strategies needed to reduce deliberate and non-deliberate injuries to self and others
- 2.2.8.LF.4 Identify and recognize factors that generate positive emotions from participating in movement and physical fitness activities.
- 2.2.8.LF.5 Engages in a variety of physical activities (e.g., aerobic-fitness, strengthen, endurance-fitness activities) using technology and cross-training, and lifetime activities.

Career Readiness, Life Literacies, and Key Skills
Critical Thinking and Problem-solving

- 9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process
- 9.4.5.CT.2: Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

• 9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global

MS-ETS1: Engineering Design

• MS-LS2-1 Analyze Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Scientific and Engineering Practices / NGSS

This field lesson can be tailored to have students directly involved with

- Asking Questions and Defining Problems
- Analyzing and Interpreting Data
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

Social and Emotional Learning

All of our field lessons integrate the concepts of self-awareness, self-management, social awareness, responsible decision-making, and relationship skills found in the New Jersey's Core Social and Emotional Learning (SEL) Competencies.

Additional Information For Orienteering

ORIENTEERING RATIONALE

The School of Conservation teaches basic orienteering skills to students because we believe this is an essential outdoor skill. We also believe learning this skill develops confidence in students which leads to an increased comfort level while in natural areas. In the end if students are more comfortable while visiting natural areas, then they are more likely to thoroughly enjoy themselves during their visits. Increasing a person's enjoyment and interaction with the natural world should foster an improved environmental ethic.

BACKGROUND INFORMATION

We use and depend on map and compass skills nearly every day. When we travel (whether by automobile, bike, foot, etc.) from one place to another we choose which route we would like to use based on our priorities of aesthetics, time constraints, traffic conditions and many other factors. When providing directions to others, our brain automatically begins making mental maps that we rely on to describe the proposed route. Landmarks are often given to provide visual feedback for those following our directions. We also frequently rely on the four cardinal directions of North, South, East and West when giving directions.

Compasses work because there is a natural magnetic field surrounding the Earth that is caused by the liquid metal near the center of our planet. One end of the magnetic field is near the North Pole and the other end is near the South Pole. The Chinese are credited with this discovery nearly 4500 years ago. Historians believe this magnetic field was first detected when someone placed a sliver of lodestone (type of magnetized rock) on a raft made of bark or wood and then set it in a pond. Under these circumstances the raft was able to turn until the lodestone was aligned with the magnetic field. Once aligned, the raft would cease to spin. The discoverer then tested the theory by traveling to different areas at various times of day to determine if this phenomenon was constant. Since the magnetic field is a constant phenomenon, angles from this constant, measured in degrees, can be determined. In short, the compass is a fancy protractor with a sensitized needle that provides all users with a common starting position or reference point. It wasn't until approximately 1100 AD that a written description of a magnetic compass was first documented in China. The literature from Europe documents the use of a compass at about 1200 AD.

The early pioneer, scout, trapper, and wilderness explorer relied heavily on the skill of landmark navigation. This is the oldest form of navigation. Navigating in this manner required a highly developed sense of observation and memory. It was essential that they could place the natural signs of mountains and rivers, stars and vegetation into a familiar pattern that provided the landmarks needed to travel when both maps and compasses were very primitive.

Later on people learned to use the stars and sun for navigating. In the 1400s marine astrolabes were developed for use on sailing ships. Basically an inclinometer, the marine astrolabe measured the angle of a star to the horizon and could determine the ships position latitude (north/south) only. These astrolabes were the predecessors to a sextant, which could be used vertically as well as horizontally, and therefore could also determine a ship's longitude. Because they don't require any electricity, sextants are still practical back-up tools for ships.

Today we have Global Positioning System (GPS) devices that can very precisely measure the speed of a signal from the device to an orbiting satellite and back. When this is repeated four or more times, a precise location can be identified. There are, however, potential problems with depending exclusively on a GPS. Malfunctions can occur, including loss of battery power,

insufficient signal strength, and user error. Misuse can happen more easily due to the operating differences between manufacturer and model. Since all compasses look and operate very much like any other, it is always a good idea to have a compass with you when navigating away from civilization.

Maps are a universal medium for graphically communicating specific information and the spatial relationship between that information. Road maps help drivers navigate the confusing web of possibilities to reach their destination. Geopolitical maps show the boundaries between nations or states. There are even maps for navigating the mall.

The maps used here are topographic maps, which illustrate in detail the altitude, or height above sea level, of an area, as well as streams, lakes, trails, roads and buildings. The map's markings that indicate altitude are called contour lines. Seeing how close the contour lines are gives the perceptive traveler a sense of the steepness of the mountain or ravine. Extremely close contour lines may indicate a cliff and be too difficult to safely travel across, leaving the hiker to navigate his/her way around the hazard.

Orienteering has evolved into a very popular sport around the world, but particularly in the Scandinavian countries (Denmark, Norway, Finland, and Sweden). Using the combination of a compass and a map the athletes are sent off in timed intervals, then individually choose which route between controls or stations would be quickest. The person who finishes in the least amount of time is the winner. A straight line between two objects, although the shortest distance, may not be the most time efficient. Factors affecting the route chosen include distance, vegetation, waterways, cliffs, and many other types of obstructions. Because people who orienteer are continually evaluating their position and making decisions based on landmarks and terrain while on the run, the sport of Orienteering is sometimes called the '"thinking man's or woman's " sport.

In this day and age of technological advancements, many have altered the manner in which they navigate, changing from map and compasses to satellite guided Global Positioning System (GPS) units. These devices can be stand-alone GPS units for strictly navigation purposes, or any "smart cell phone can function as a GPS unit with the proper software. However, relying solely on technology can be risky, especially if navigation is crucial to survival. Batteries go dead, GPS satellites can malfunction, and cloud cover can significantly interfere with obtaining the satellite signal. Proficiency with map and compass is essential when navigating through natural areas. Any program teaching GPS navigation will reinforce the necessity of learning map and compass skills.

For further information:

1. Drury, Jack and Bonney, Bruce, (1992). *The Backcountry Classroom*: *Lesson Plans for Teaching in the Wilderness*. ICS Books, Merrillville, IN.

2. Kjellstrom, Bjorn. (1976). *Be Expert with Map and Compass*: *The Orienteering Handbook*. Scribner's Sons, NY.

3. Jacobson, Cliff, (1999). Basic Essentials: Map and Compass. The Globe Pequot Press, Guilford, CT.

4. For information about Orienteering events in southern New Jersey and Pennsylvania contact the Delaware Valley Orienteering Club at: www.dvoa.us.orienteering.org/

5. For information about orienteering events in northern New Jersey and Southern New York contact the Hudson Valley Orienteering Club at: www.hvo.us.orienteering.org/