Subject: GPS (& how its applications with Agriculture) **Date:** June 10, 2010
Lesson Title: Where exactly are we? **Grade Level:** Upper Elementary/Middle School
Time period: 60-90 minutes

Lesson Objectives:

1. Define and draw latitude and longitude lines on a "globe."
2. Discuss GPS and define key terms and applications of using GPS.
3. Practice using GPS receivers.
4. Examine the GPS applications for agriculture and implications for production agriculture.

Materials, audio-visual aids:	**Handouts**
Balloons Markers Blow up globe GPS receivers Power point Presentation & equipment ***Optional**:* *Bring in a guest speaker with GPS equipment and have them show youth how one can create GPS maps.*	1. GPS Vocabulary Sheet 2. GPS Satellite diagram 3. GPS receiver instruction cards 4. Real life application collage 5. ISU Crops Curricula, Be'an All You Can Be, Unit 3, (Chapter 7) pgs. 53-55

Solving the Problem

1. Interest Approach Balloon Activity: Two volunteers or with partners… •Have one youth draw an X, anywhere on the balloon. The other person should have eyes closed & describe where the X is on the balloon to the other. Have the youth who is guessing, draw an X when confident they know the location of X. Open eyes and see where the 'X' is at.	1.1 Complete the balloon activity with a partner.
•Discussion questions….	1.2 Ask the following questions: **A & B:** How close did you come to matching the X? **A:** Was it hard to describe the location to your partner? **B:** Was it hard to understand the location your partner was describing? **A & B:** How could we make it easier to plot our location on the balloon?
2. **Problem statement** – Where exactly are we?	2.1 How can we more easily find a location?
3. **Objective 1**: Define and draw latitude and longitude lines on a "globe."	3.1 To find any exact location on a globe, we use an imaginary grid system called latitude and longitude. To find the locations, several **reference points** are marked.

	3.2 These are points we use as a guide for describing locations. Use the balloon game as an example…how they described where to place the X. 3.3 We are going to make some reference points on our balloon, which is now our globe. 3.4 Mark on the globe: *(Can use ppt slides if desired)* **North Pole:** very northern point on the globe. **South pole:** very southern point on the globe. **Define east, west on the globe.** **Longitude:** imaginary lines that connect the north and south pole. **The LONG way**. **Prime Meridian:** it divides Earth into the Eastern and Western Hemispheres, and is the line from which all other lines of longitude are measured. Located at zero degrees longitude (*East or West*), **longitude at 30, 60, 90, 120, 150, 180 degrees east and west:** We measure longitude by saying each line is east or west of the Prime Meridian**.** **Latitude:** Lines that circle earth from left to right. Like rungs on a ladder. **Equator:** divides the Planet Earth into the Northern and Southern Hemispheres. Located at 0 degrees latitude (*North or South,*) **latitude at 30, 60, 90 degrees north and south:** We measure latitude by saying each line is north or south of the equator. 3.5 Where the lines of Latitude and Longitude come together is the exact location of a place. 3.6 For very exact measurements, latitude and longitude are measured in minutes and seconds. We are going to use degrees to measure today. 3.7 Find the approximate latitude and longitude of: China (North 30 East 30) Australia (South 25, East 135) You might have to do some adding South America (South 0 West 60) Lincoln, Nebraska (North 40 West 95)

4. **Objective 2:** Discuss GPS and define key terms and applications of using GPS.	4.1 When you are going on vacation, how do you know where you are going? Maps. 4.2 Sometimes, a map cannot give us specific enough directions to get where we need to go. 4.3 We use GPS devices. **GPS stands for Global Positioning System**. There are 24 satellites in space that send signals to the GPS receiver; however it only takes 3 to make GPS work. Show GPS device. 4.4 GPS uses the satellites as reference points to calculate positions accurate to a matter of meters. In fact, with some types of GPS you can make measurements to better than a centimeter! 4.5 It's like giving every square meter on the planet a unique address. 4.6 Satellites send the latitude and longitude to the receiver to find exact locations. *4.7 If students can understand and if time, explain the satellites and how GPS determines your position.* **What do the satellites do?** Each satellite is broadcasting the time. But not just any time...atomically accurate time. Your GPS receiver listens to this broadcast. It has an atomically-accurate clock in it, too. By comparing the difference between the time given by the satellite and the time in your GPS receiver, the GPS can calculate the distance between you and the satellite. **How is time turned into distance?** Well, say you are travelling in a car at precisely 60 miles per hour. You travel for 1 hour. How far have you gone? 60 miles! Now, imagine you are riding a radio wave transmitted from a GPS satellite. Radio waves travel at the speed of light, 186,000 miles per second. If it takes you .06 seconds to get from the satellite to the GPS, how far have you gone? 11600 miles. The GPS receiver in the hand of the human on the surface of the earth is 11600 miles from the satellite.

	4.8 GPS is used for several reasons. **Location** - determining a basic position **Navigation** - getting from one location to another **Tracking** - monitoring the movement of people and things **Mapping** - creating maps of the world **Timing** - bringing precise timing to the world 4.9 What are real life examples of how GPS can be used?
5. **Objective 3**: Examine the GPS applications for agriculture and implications for production agriculture.	5.1 Use ISU, Unit 3, ch. 7 handout for discussion point. 5.2 Is GPS used in agricultural production? 5.3 What are some examples that GPS is used in agriculture? 5.4 What is precision agriculture? (sometimes called site-specific farming, allows a farmer to identify variability within a field and manage that variability to increase crop production & profits) 5.5 Precision ag is possible through merging of computers, gps, gis (geographic information systems), variable rate controllers (or VRT), in-field & remote sensing, & telecommunications 5.6 What are the benefits of precision ag? Are there any drawbacks? 5.7 What do you think is the future of precision agriculture?
6. **Objective 4**: Practice using GPS receivers.	6.0 Explain how to use the GPS receivers, using the cards and a diagram. 6.1 Give groups of 2 students a GPS receiver. Go outside and turn them on to find the satellite. 6.2 In groups of 2, have each youth mark a coordinate & throw a ball in that spot (all youth have same type of balls), while the other partner is closing their eyes. Then have the partner try to find the right coordinate and ball that his/her partner marked. Switch. 6.3 *Optional*: If possible, while small youth are doing above activity, have a GPS professional/farmer show youth an actual agricultural application with GPS either in a tractor, 4-wheeler, etc.

7. **Objective 5**: Examine the GPS applications for agriculture and implications for production agriculture.	7. Go through ISU Crops Curricula, Be'an All You Can Be, Unit 3, (Chapter 7) pgs. 53-55 and have youth discuss other ways that technology has changed agriculture. 7.1 Youth can create a collage, poster or presentation showing the different applications GPS or technology has on agriculture describing the pros and cons.

Summary (Closure) – Conclusion to the Problem: Where exactly are we?

1. What is longitude/latitude? (Review findings from balloon activity.)
2. What is GPS?
3. What are some of the GPS applications?
4. What is precision agriculture and how is it used?
5. What did you do with the GPS receivers and how would that be helpful in everyday life applications?
6. What are careers related to GPS or other emerging technologies?

Performance Assessment:

1. Youth can define and draw latitude and longitude lines on the balloon/globe and understand what those lines indicate.
2. Youth can define and discuss key GPS terms and agricultural applications that use GPS.
3. Youth are able to use GPS receivers.
4. Examine the GPS applications for agriculture and implications for production agriculture.