TECH: Space Age Technology Comes to Earth (GPS) (Ag)

Summary

Students will explore eight Career and Technical areas and make connections with business, family and consumers, and technology.

Time Frame

2 class periods of 45 minutes each

Group Size

Large Groups

Life Skills

Thinking & Reasoning

Materials

- Computer Lab or Computer & Projector for Presentation
- Computer Speakers or Headphones
- Computer Internet Access or Agricultural Technologies and Edutainment Software (available from Utah AITC)
- 5 - GPS Receivers *(optional)*
- Geocaching Bags *(optional)*

Background for Teachers

Technology has changed all facets of our lives and had a dramatic effect on agriculture. Agriculture has been around for over 10,000 years. Several agricultural revolutions have occurred that today enable U.S. farmers to feed themselves and 129 other people here or around the world.

From simple stick scratching to make a furrow in the ground to planting a few seeds with a complicated combine with several different sensors, the applications of technology in agriculture are almost too numerous to count! Two hundred years ago, 98 percent of the population worked on farms. Today in the United States, technology and other scientific discoveries have left less than 2 percent of our population working on the farm to produce the raw food and fibers that we use every day. Advancements in plant and animal science, food storage techniques and machines, fertilizers and crop protection chemicals, numerous computer applications and modern machines have transformed American agriculture into the most productive food and fiber producing system the world has ever known, and kept the price of food the lowest of any nation.

Farmers rely on science and technology to produce and market their products. Creaky-bone predictions of rain may still be felt by older farmers, but farmers of the 21st Century will utilize precision farming techniques. Precision farming includes the use of the Global Positioning Systems (GPS), precise soil maps, yield monitors, and computer sensor applications.

Today's high-tech farmer needs to know as much about computers and satellites as he or she does about agronomy and phases of the moon. Modern precision farming allows farmers to work more efficiently, while obtaining increased yields from their crops. heoretically, precision farming means using information technologies such as GPS and geographic information system (GIS) software to gather, store, view, and analyze vast amounts of data—which can then be converted into usable

knowledge to make better farm management decisions for crop production.

Practically, precision farming means that farmers can visualize, identify and control crop patterns from a central computerized location. The goal is to improve profitability and reduce risk. For example, an increased number of tractors are linked to GPS, so their position can be tracked from a distant office. Land management information in office computers then tells tractors where to go, stop, turn or activate cutting or fertilizing equipment. Through a tractorbased GPS, a farmhand is told when and where to turn to begin tilling each row of a field. This can greatly reduce overlap, which on a large farm saves hours of work.

The use of GPS in farming has grown beyond the early practice of grid soil sampling and variable rate fertilizer applications to a new, more useful focus on yield monitoring. In precision farming, growers break fields down into regions, or cells, analyzing growth characteristics of each cell and improving crop health and yield by applying precise amounts of seed, fertilizers and pesticides as needed. Many associate precision farming with combine yield monitors, equipped with GPS. Some farmers now use multi-spectral imaging to produce gray scale values that are converted to color images showing poor to good vegetation conditions.

Yield monitors can forecast yield as bushels per acre, total pounds, acres per hour worked and grain moisture content. This is all done while the combine is in use, and can be recorded on a memory card for later analysis. Sensors monitor, calculate and record, in real time, each field's yield as the combine harvests the crop. This eliminates having to wait until the entire harvest is complete before projecting yields and making important decisions on how much to store or sell.

Field scouting uses a portable geographic information system unit that allows farmers to identify and record the location of problems or events that will affect production--including soil differences, insect infestations, fertility deficiencies and weed problems. Remote sensing and satellite and infrared images also can be employed while scouting fields. Satellites that capture infrared images can look at moisture content and quickly assess the health of a crop before visible damage appears. Soil testing, however, still requires farmers to walk across their fields to take samples. Once a farmer has this information, he or she can make accurate applications of water, chemicals, fertilizer or any other management tool to a particular part of the field in a specific amount or during a specific time.

The GPS is also used to map very large farms and ranches that may cover several square miles. Utilizing a handheld GPS unit, a farmer or rancher can locate pumps, irrigation standpipes, wet and dry areas, cattle, and the location of fences that need mending, etc. The usefulness in locating and mapping with GPS in agriculture is only limited by one's imagination.

Intended Learning Outcomes

Examine and describe how agriculture and natural resources impact our quality of life.

> Students will explore and identify emerging technologies and careers in agriculture (e.g. biotechnology, cloning, GIS/GPS applications such as precision agriculture and livestock identification, bioenergy—fuels, and other manufacturing processes—environmental monitoring, nutrition, new technologies for food safety and security).

Instructional Procedures

Preparation

Review with students the segment about precision agriculture and global positioning they watched previously in the video/DVD Connecting to agriculture. How does this technology help farmers and

ranchers? How does the technology affect the price of food and clothing? Does GIS/GPS help the environment? Try out the following GPS/GIS activity with your students.

Activity Procedures: Range Rambler GIS, Software Simulation
Access the "Range Rambler" computer program either online (streaming from the web) at https://utah.agclassroom.org/files/uploads/games/gis/base_content.html or by purchasing the media from the same site and installing the program on your lab computers. Utah teachers will receive a password for free access. Request this password 24 hours prior to accessing the site. Demonstrate how to use the "Range Rambler" program by completing one field task, preferably using an LCD projector. Speakers are also required. If only one computer is available for the activity, invite a student to complete each new task and then complete the worksheet, as outlined below, as a class. If you have a computer lab, proceed with the following activity

Provide each student or group of 2-3 students with a computer that allows access to the "Range Rambler" program (web or CD). There are five tasks each student or group of students needs to complete. (The tasks are the same for each group, however, the locations are randomly assigned, so each time students access the activity they will get different locations for each task.) The time it takes to complete the tasks is also calculated. Knowing how to use the Field Book will increase the student's ability to complete a task in a shorter amount of time. For example, knowing the color of a plant species you are looking for is very beneficial as you look at the map to find the location for completing tasks. Before students begin the tasks, demonstrate how the Field Book is used and how it will save them time. The Field Book is organized like a notebook a range scientist or rancher might keep and includes the legend for the map in the upper right corner of the screen. Students will need to complete the Field Book on the screen, i.e. the blue is water and students can type the word "water" by the side of the blue block.

Provide each student or group with the ***Range Rambler Worksheet*** . They should complete their Field Book on the computer first and then on their worksheet, before they begin the five tasks. At the beginning of each task, students record their beginning time and ending time. They should find that each task takes less and less time as they advance through each task and learn to use the Field Book.

The following instructions are read aloud to students when they launch the program:
"You are a range scientist. You have been given a list of field tasks to complete in order to evaluate the quality of a potential grazing area. You must use GPS technology and your knowledge of ecosystems and range plants to locate each task site. Press CHECK LOCATION button when you think you're on a site. The satellite map at the top right shows your position and coordinates. Your Field Book contains information about local vegetation, as well as a place for you to keep your notes. Use the arrow keys on your keyboard to move around. Hold down the spacebar to move faster."
When students complete the activity, review the questions asked in the **Preparation** section. Have their answers changed? Where else could GPS and GIS be used?

Optional
If you have GPS receivers, teach students how they work and how to use them. Next do a "geocaching" activity or scavenger hunt where students use the GPS receivers to find caches (or items in Ziploc® bags) and complete the agricultural tasks found inside. These tasks will familiarize them with various agricultural careers.

Additional Activities, What's Next?

Geocache Ag Bags:

You are a farmer and want to know the current price for potatoes. Go to the USDA Market News page at www.ams.usda.gov/foodserv and find out the price for a 100 lb. sack (1-cwt).
Sound waves are used to determine the amount of back fat on a hog. Find out how this technology works and how much this unit will cost. Hint: Search "Lean-Meater" on the web.
You are a vegetable farmer. Go to a commodities market and find out the price for lettuce. (www.ams.usda.gov/foodserv)

4. **Corn Starch Plastic Formula**

1- pint or quart Ziploc® bag
1-T of water
1-T of corn starch
2 drops of corn oil
2 drops of food coloring

There is a bumper crop of corn this year and the government has asked you to experiment with corn starch to make plastic. If you are successful, there will be a larger market and higher price for this year's crop. You have come up with a formula that creates a plastic-like substance. Test your formula. Place the ingredients into the Ziploc® bag and mix well. Seal the bag most of the way; leave 1 inch open for the escape of steam. Keep the mixture agitated until you place it into a microwave. Cook on high for 25 seconds. When you remove the mixture, wave the bag around in the air until it is cool enough to handle. You may take the plastic out of the bag and form it however you like or, you may want to leave it flat so it will dry quickly and you can see how brittle it gets. How might this "corn plastic" be used? If you have time, leave the "plastic" flat/thin and allow it to dry. How has the "dried" substance changed?
Aquaculture or fish production is on the increase because consumers are seeing the benefits of fish protein and are demanding more fish at grocery stores. Your trout are not growing well. Research the temperature requirements for trout at http://aquanic.org/. What is their preferred temperature?
Forestry is one of the "5-Fs of Agriculture." Which universities in your state offers a Bachelor's Degree in forestry? What is the web address for that university? Find one other university in the United States that offers a degree in forestry. Note its website.
Soil less vegetable farming is called hydroponics. Visit a hydroponics website www.hydroponics.com/gardens/mixmatch.html, and list the types of hydroponic systems.
To explain a disease problem you are having with your wheat, you need to know the parts of the plant. Read the following and then identify the parts of the wheat plant (See the attachment):
The top of the wheat plant, is called the head. The head contains the seeds or kernels and the hairy part is called the beard. The stem supports the head and in ancient times was used to weave baskets and other household items. Today the stem is used primarily as bedding for animals, as organic matter for the soil, and sometimes as a building material (strawboard or straw bales for walls). The leaves are where the food is made for the plant to grow. The roots anchor the plant, absorb water and minerals, and store the food the plant has made through photosynthesis as sugar.

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