Oakland CUSD #5

Ag Mech

April 27-May 1, 2020

Jeff Coon

Week of April 27-May 2, 2020

All of these assignments are on google classroom. You must pick one of the 3 listed and complete by next Monday, May 4th for credit. If you would like to use google docs to complete the work that would be most efficient, just remember to start a new copy with your own work please. Paper copies can be returned to the school.

Class	Choice 1	Choice 2	Choice 3
Ag Science	CDE	Animal Reproduction #2	FFA Journal
Ag Business Mang	Advertising	Borrowing Money	car Insurance
BSAA	Animal Health	Respiration	Domestic Animals
Landscape Design	Managing grasses	Landscape areas	Landscape Power tools
Intro To Ag	CDE	Consumer Trends	Maintaining your SAE
Ag Mech.	Land measurement	coolants	Remote sensing

Mr. Coon Ag Mech. Land measurement option 1 April 27 Name

Checking Your Knowledge:

1. Why does a tract of land need to have a clear title prior to purchase?

2. Why is surveying a necessary career in society?

3. Why would a person consider a river to be a bad starting point for a survey?

4. How does Metes and Bounds differ from the Rectangular Survey System?

5. How do sections relate to townships?

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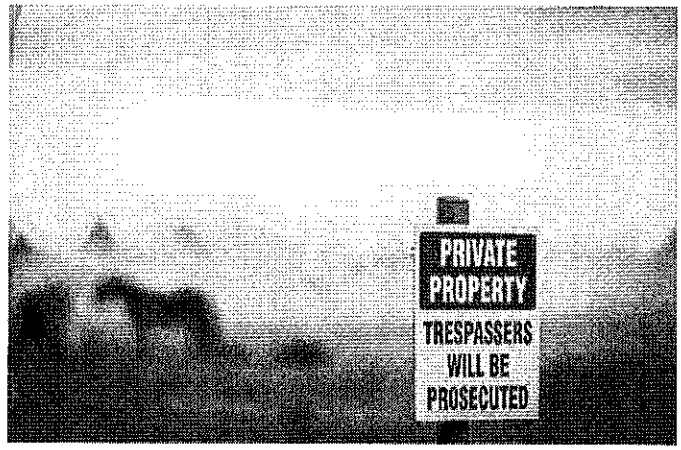
Land Measurement and Legal Descriptions

THROUGHOUT HISTORY, the land ownership has been a dream for many people. Land ownership has been so valued that people have moved away from native lands, fought, and even died for it. With this high value, having a uniform and precise way of designating land areas is important to ensure ownership and prevent land disputes.



Objective:

Explain land measurement and legal descriptions.

Key Terms:

acre
baseline
clear title
principal meridian
section
township
tract

Identification of Property

In the United States, land is owned as private property and may be transferred from one owner to another through payment, inheritance, transfer, or some other means. For a person to take ownership of land, he or she must be able to obtain a clear title to the tract of land.

TITLE

A **clear title** is a situation in which no legal claims exist against property ownership. In the transfer of property, it is essential to have an accurate and detailed description of the real estate.

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Otherwise, lawsuits and arguments could arise. Therefore, surveying the land to describe and locate it physically are critical keys to land ownership.

LOCATION

Surveying land involves locating the tract, identifying boundaries, and recording descriptive data to ensure accurate and legal ownership and transfers. While different surveying systems may be used, all are meant to provide the definite location of a specific tract of land that cannot fit another tract of land. When this is accomplished, the land may be accurately described on titles, abstracts, deeds, tax statements, and other legal documents.

CAREERS IN SURVEYING

Employees for careers associated with surveying and land measurement are in high demand, and there will always be a need for legal verification of property tracts and mapping. Currently, several major areas of employment are related to surveying, and new careers may be added as technology in the field changes. Major career areas with brief descriptions are listed in the following table.

TABLE 1. Common Careers in Surveying

Career Area	Description
Photogrammetrist	Works to make measurements from photographs
Construction surveyor	Works to take measurements of a construction site and advises architects, engineers, and contractors during phases of construction
Forensic surveyor	Works to collect, map, and analyze data used in investigations
Hydrographic surveyor	Measures and maps the location and features of the land under oceans, rivers, and lakes
Geodetic surveyor	Maps the shape and size of the earth to use Global Positioning Systems (GPS) to locate the exact location of an object on the Earth's surface
GIS analyst	Uses software to create, display, and analyze maps prior to construction
Boundary surveyor	Measures, designs, retraces, and maps property lines
Surveying technician	Operates surveying equipment and collects data from the field; may interpret that data in the workplace setting
Topographic surveyor	Uses technology to measure the earth's surface and depict ground features on a map for builders to work from

Source: North Carolina Society of Surveyors Education Foundation
http://www.beasurveyor.com/pick-a-surveying-path

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SYSTEMS OF LAND MEASUREMENT AND LEGAL DESCRIPTIONS

In the United States, two systems of describing land are used: Metes and Bounds and the Rectangular Survey System.

Metes and Bounds

Metes and Bounds is a system used throughout many parts of the world and throughout many parts of the eastern United States. It has three basic items included in a land description: a starting point, courses and distances, and irregular boundaries.

Starting Point

Descriptions in Metes and Bounds begin with a starting point or place of reference. The description continues along lines called courses until the tract of land has been outlined and the starting point is again reached. A starting point may be a natural monument (e.g., a tree, stone, river, or lake) or an artificial monument (e.g., government marker, fence, or highway). The disadvantage to these types of markers is that they may be altered over time, moved, or destroyed.

Courses and Distances

Metes and Bounds uses courses and distances to describe land. The course is the direction in which the tract outline occurs, and the distance is the linear measurement along the outline. Sometimes a course may be described as connecting two monuments. Generally, it is described by the angle of travel in relationship to a point of reference.

Irregular Boundaries

Metes and Bounds incorporates irregular boundaries into land descriptions. Examples of may occur with streets or highways as well as on the borders of lakes and rivers. Typically, a river boundary is described as the center-point between the shores of the river, whereas a lake differs. Properties that adjoin lakes that are not navigable have ownership to the center of the lake. In contrast, navigable lakes have a title to the bed of the lake in trust to the people. Ownership of human-made lake beds depends on the contractual agreements on the property.

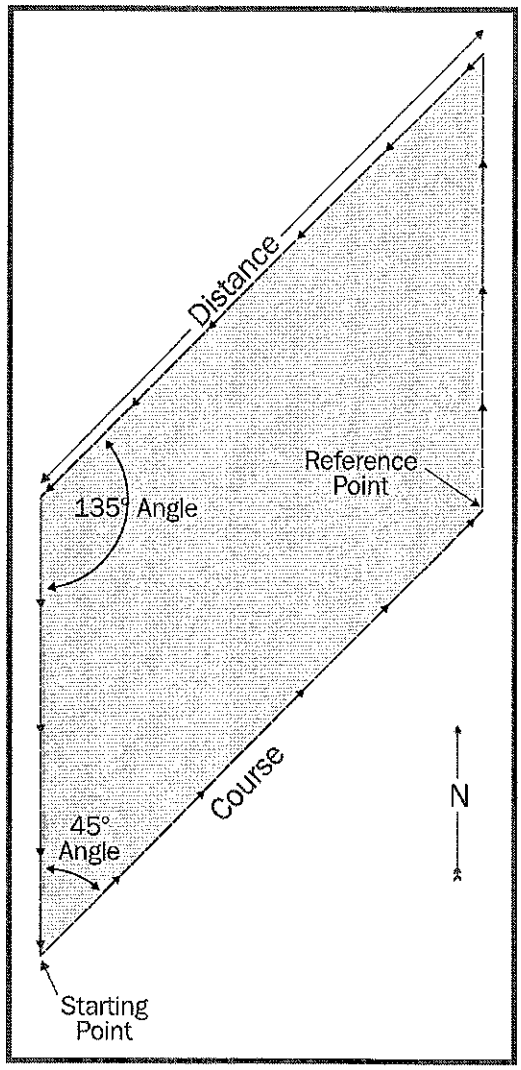

FIGURE 1. This is a land description in Metes and Bounds.

Rectangular Survey System

The second type of survey system used in the United States is the Rectangular Survey System. In 1785, the U.S. Continental Congress declared that a rectangular system be used in surveying public land, with Thomas Jefferson as the organizer. This was the first system of its type, but Canada later adopted it as well. The benefits are to provide for a definite location of land by establishing ground markers and to provide a concise and easily understood legal description for the tract of land. The system relies upon principal meridians, baselines, townships, sections, and tracts to complete descriptions.

Principal Meridian

A **principal meridian** is a line that runs from north to south and is used as a benchmark for surveys. It is used to divide townships from east to west.

Baseline

A **baseline** is a line that runs from east to west and may be referred to as a parallel. Together, principal meridians and baselines form the skeleton of a Rectangular Survey System.

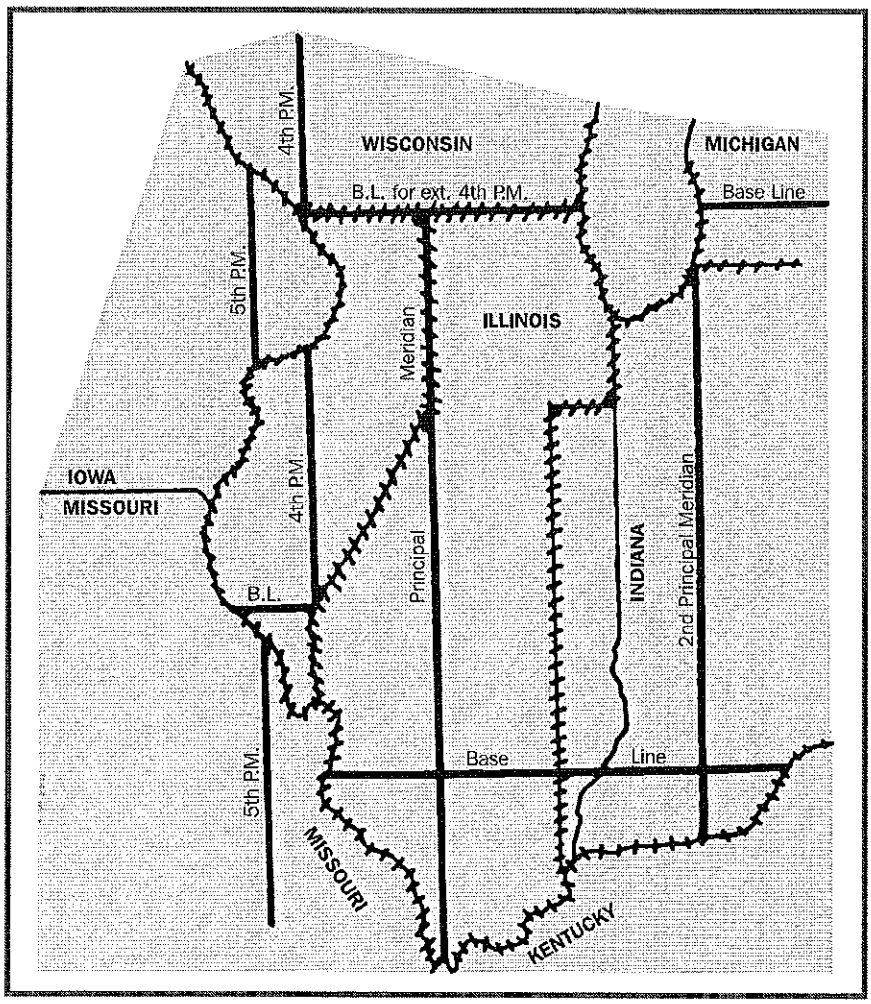

FIGURE 2. This is an example of principal meridians and baselines.

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FURTHER EXPLORATION...

ONLINE CONNECTION: Finding Where You Live

Most of the United States has been mapped using the Rectangular Survey System. If you live in a part of a country that has been surveyed in this manner, you can determine the exact location of your residence. If your family owns a farm, you can explore the location of the property on the U.S. Geological Survey Web site.

Township

A regular **township** is an area of land that is six miles in width and length, totaling 36 square miles in area. A township is described as being ranges east or west of a principal meridian and tiers north or south of a baseline.

Section

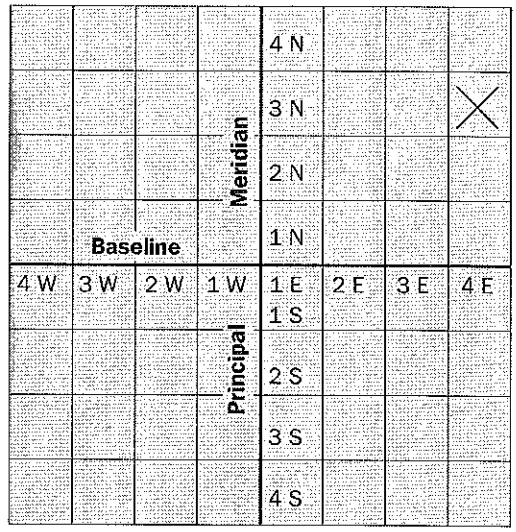
A **section** is a tract of land that is 1 square mile in size and is located within townships. There are 36 sections within a township. In all surveys since 1796, sections are numbered within a township beginning with 1 at the upper right or northeast corner of a township and weaving down the sections to where section 36 is located at the bottom right corner of the township.

Tract

A **tract** is an area of land meant to be owned as property by the same owner. Some tracts are located within a section, whereas other tracts may contain pieces of land from one or more sections.

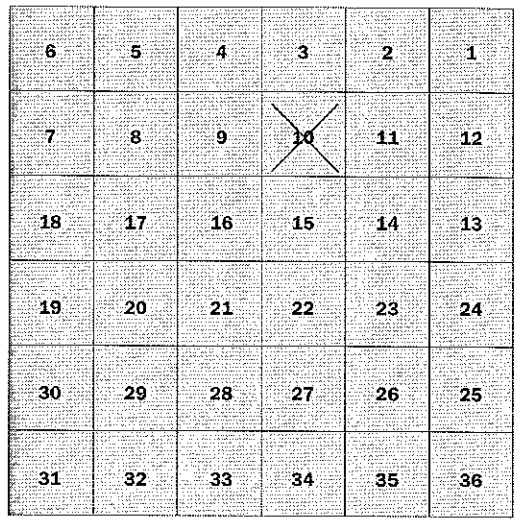
LEGAL LAND DESCRIPTIONS AND LAND AREA CALCULATION

When given a description for a tract of land, a person can calculate the area and determine the tract location. Legal land descriptions are written beginning with the smallest area and progressing to the largest area of the section. The areas are



A township is located with reference to its baseline and principal meridian. Township X is the third township north of the baseline and the fourth township east of the principal meridian.

FIGURE 3. Townships in the Rectangular Survey System.



A regular township contains 36 sections numbered as shown.

FIGURE 4. Sections within a township.

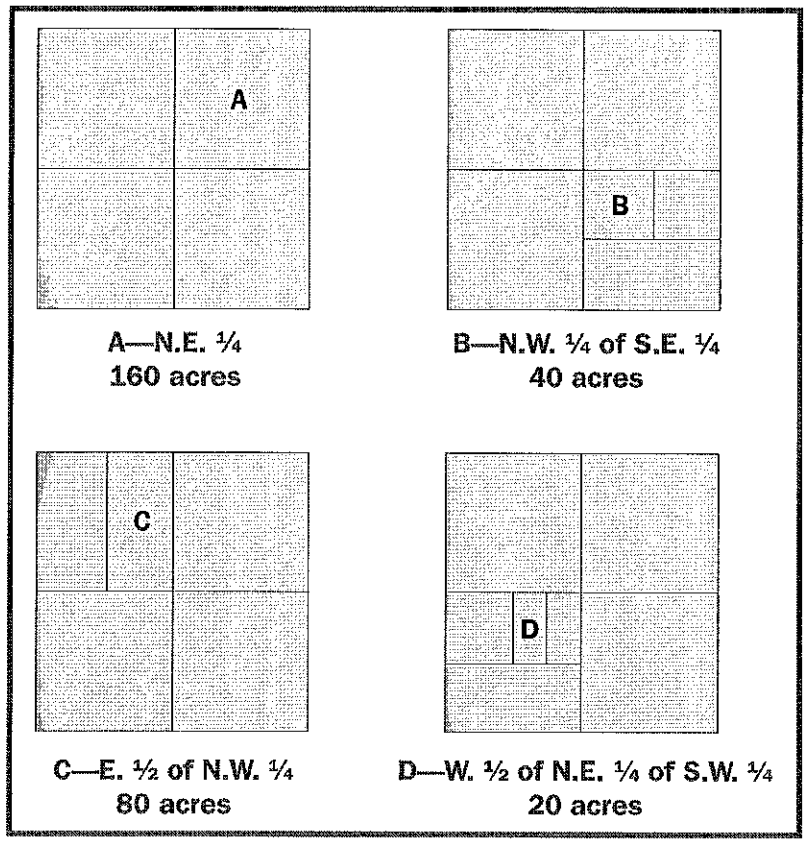


FIGURE 5. Descriptions of four sections of land within a section.

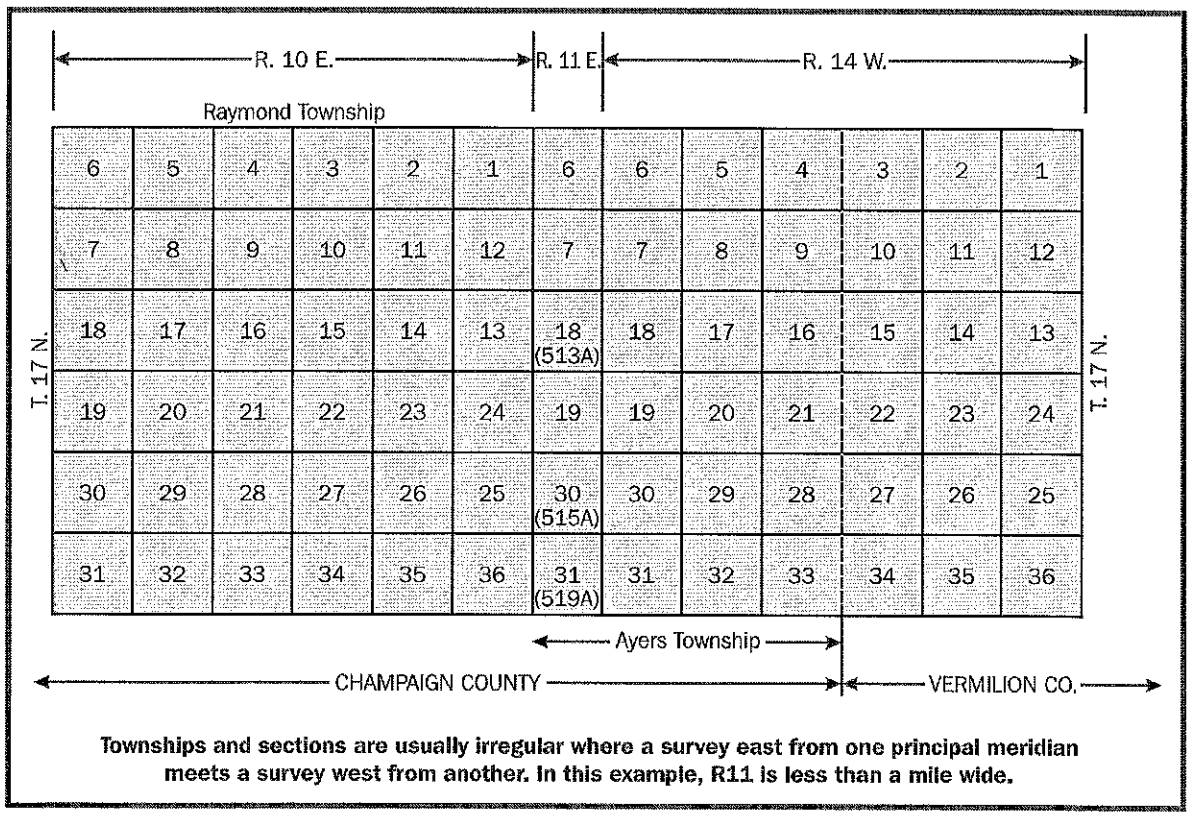


FIGURE 6. Irregular sections within a survey.

described in fractions of a section. For instance, N1/2 NW1/4 of Section 11 is read "The north half of the northwest quarter of Section 11."

Knowing the legal land description of a tract allows a person to calculate the land area in acres. This is important because most land is sold on the value of an acre. An **acre** is an area of land that is 43,560 square feet in size or about the size of a football field. A section of land has 640 acres. To determine the size of a tract of land, the legal land description is reduced by fractions to find the actual acreage.

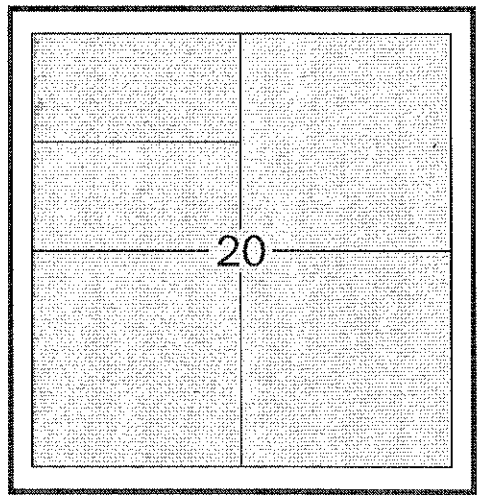


FIGURE 7. The legal land description for the shaded area of the section diagram is N1/2 NW1/4 of Section 11.

Summary:

Accurate land description is vital to the process of land ownership. For this reason, there will always be a need for careers in surveying. As technology increases, the options for people to enter this career field will increase.

Through Metes and Bounds and the Rectangular Survey System, thorough descriptions will ensure order among property owners. While Metes and Bounds focuses on landmarks, distances, and angles, the Rectangular Survey System relies upon principal meridians and baselines as a framework for outlining townships, sections, and land tracts.

Checking Your Knowledge:

1. Why does a tract of land need to have a clear title prior to purchase?
2. Why is surveying a necessary career in society?
3. Why would a person consider a river to be a bad starting point for a survey?
4. How does Metes and Bounds differ from the Rectangular Survey System?
5. How do sections relate to townships?

Expanding Your Knowledge:

Job shadow a surveying technician. Be prepared to ask questions related to employment duties and requirements. Topics of discussion may include salary, education needed, physical demands, benefits, and skills necessary for success.

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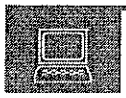
Web Links:



Surveying

http://www.beasurveyor.com/

Legal Land Descriptions

http://biosystems.okstate.edu/home/fharry/1413/800.FactSheets/land.f-9407.pdf

Land Descriptions

http://homestead.org/NeilShelton/Legals/HowToReadLandDescriptions.htm

Mr. Coon Ag Mech. Coolants option 2 April 27 Name

Checking Your Knowledge:

1. What are the various types of liquid coolants used in agriculture?

2. What is antifreeze, and where is it used in the cooling system?

3. What is the proper way to safely handle and store coolants?

4. What are the major cooling system parts?

5. What are the functions of the various parts in the cooling system?

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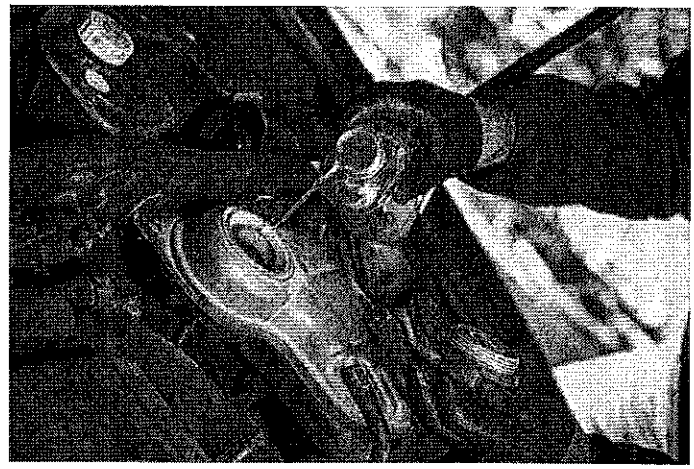
Coolants

IN MOST ENGINES, liquid cooling systems are the most common method used to eliminate the build-up of heat produced by the engine. Engines become extremely hot, and the excess heat needs to be cooled so engine overheating does not occur. If engine overheating does occur, the coolant levels should be checked. This should be monitored closely, especially during the summer months when the air temperatures are also hot.



Objective:

List and describe the many facets and practices when working with or around coolants in engines.

Key Terms:

chemical corrosion	electrolytic corrosion	thermostat
coolant	erosive corrosion	water pump
dry sleeve liquid system	radiator	wet sleeve system

Understanding Coolants

Excess heat must be allowed to escape, or it must be cooled. Heat is removed from the cylinder, bearing, and valve or rotary components by two basic methods. Air can be forced through the engine by baffles, ducts, and blowers. A liquid can be circulated through the engine to carry heat away from engine components to a heat exchanger. The **dry sleeve liquid system** is the process utilized when a sealed jacket separates the engine components from the system. The jacket portion is thick and keeps other engine components away from the coolant. The **wet sleeve system** is a method utilized that directs coolant flow against the engine parts. In other words, the coolant moves through the engine parts instead of being directed away from them as in the dry sleeve system.

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LIQUID COOLING SYSTEM

Several parts of the liquid cooling system are worth mentioning. Each part plays an important role in the engine cooling system.

Radiator

The **radiator** is the area where heat from coolant is released to the atmosphere and provides a reservoir for enough liquid to operate the cooling system efficiently.

Fan

The fan forces cooling air through the radiator core to quickly dissipate the heat being carried by the coolant in the radiator.

Water Pump

The **water pump** is the device that circulates the coolant through the system. Also, the pump draws hot coolant from the engine block and forces it through the radiator for cooling.

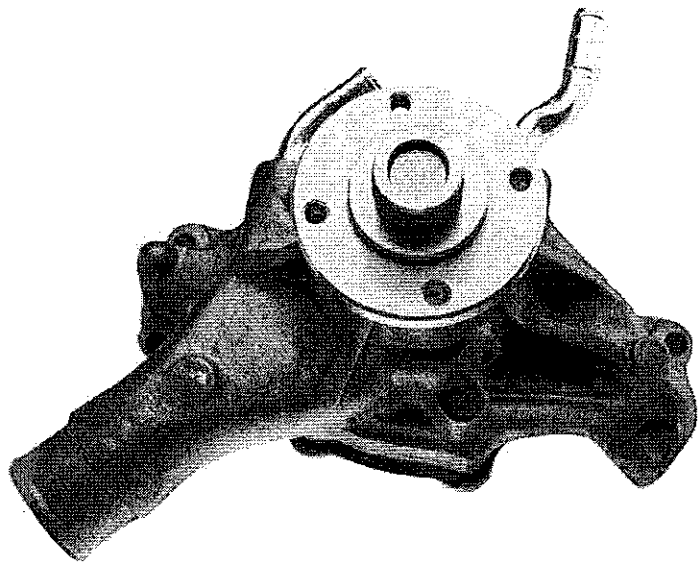

FIGURE 1. The water pump circulates the coolant through the system.

Transfer Holes

Some engines have distribution tubes, but some have transfer holes that direct extra coolant flow to hot areas (e.g., exhaust valve seats).

Fan Belt

The fan belt transmits power from the engine crankshaft to drive the fan and water pump.

Connecting Hoses

Connecting hoses are the flexible connections between the engine and other parts of the cooling system.

Thermostat

The **thermostat** is a heat-operated valve that controls the flow of coolant to the radiator to maintain the correct operating temperature. When the coolant is cold, the thermostat closes to circulate coolant inside the engine for faster warm ups. When the coolant becomes warm, the thermostat opens to circulate coolant through the radiator for normal cooling. The pressure

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cap recommended for the system should be used, and it should be in good condition so efficient temperatures can be maintained.

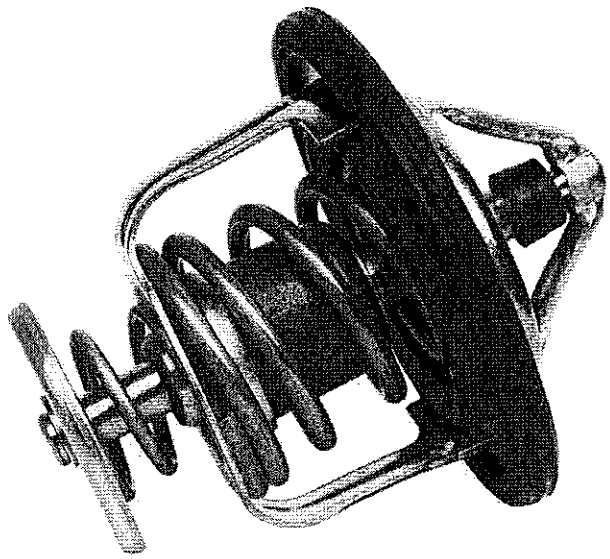

FIGURE 2. The thermostat is a heat-operated valve that controls the flow of coolant to the radiator to maintain the correct operating temperatures.

Coolant

The **coolant** is the liquid that circulates through the cooling system carrying heat from the engine water jacket into the radiator for transfer to the outside air. The coolant then flows back through the engine to absorb more heat. Various types of coolants exist. According to many manufacturers of engine coolants, water is not a good universal solvent, but it is a necessary ingredient in the cooling system. The best coolant mixture can be weakened or made harmful to the engine because of poor water quality. Soft or softened water, ground water, and tap water can contain suspended particles and compounds (e.g., salt, acids, and minerals) that can damage the internal metals of a cooling system and internal engine parts. Water by itself is an unstable heat dissipating substance. Air bubbles in the water formed by heat and engine vibration can cause cavitation, corrosion, and destruction of internal engine parts.

Antifreeze

Some coolants cannot withstand extremely cold temperatures. Therefore, antifreeze is used when freezing temperatures are expected. If the coolant freezes, it will expand and may crack the engine block, the cylinder head, and the radiator. In addition, it may create leaks and weaken the radiator hoses. During operation, freezing can prevent circulation and cause the engine to run hot. Antifreeze solutions must meet certain requirements, such as prevent freezing at the lowest expected temperature; inhibit rust and corrosion of system parts; be chemically stable; prevent electrolytic corrosion; flow readily at all temperatures; conduct heat readily; and resist foaming, cavitation, and corrosion. Different types of antifreeze may be used to keep freezing temperatures from harming the engine.

The ethylene glycol antifreeze is widely used in modern pressurized systems because of its boiling point, which is higher than that of water. The use of propylene glycol gives somewhat less protection against freezing at lower concentrations and somewhat higher protection at higher concentrations than ethylene glycol. The use of glycol ether is higher in price and has an odor similar to that of ether. It has the advantage of mixing with oil if it should leak into the engine crankcase. Interestingly, the type of antifreeze to use is determined by the expected service, local climate, water quality, metal of the engine, additives required, engine design, and manufacturer's recommendation. When antifreeze is added, it will protect for the lowest expected temperatures. Essentially, the usual cooling system mix is 50 percent distilled water and 50 percent antifreeze and other additives. This rate varies with the engine protection level desired.

SAFE HANDLING PROCEDURES

All liquid substances used in agriculture must be safely handled and stored. Working with engine coolants requires special attention. It is always in your best interest to consult the operator's manual for the engine in which the coolant is being used. Follow the guidelines carefully, and always use coolants in the proper manner. Because coolants are considered chemicals, they should have their own Material Safety Data Sheets (MSDS), which will describe procedures to follow if the coolant gets on the skin or is swallowed, inhaled, etc. Always read the MSDS information for any chemical before using it.

Proper Care

You can prevent early mechanical failure through proper care of the area in the engine in which coolants are to be given. In addition, heavy gloves and safety glasses should always be worn when working with coolants. The coolant should not be able to penetrate the skin or be splashed in the eyes because coolants may cause a slight burn or skin irritation.

COOLANT STORAGE

Coolant fluids in bulk should always be stored in steel equipment because it is compatible with other commonly used construction materials. Tanks that have been lined with baked phenolic or epoxyphenolic coatings have been used, as have fiberglass reinforced plastic tanks and stainless steel tanks. Aluminum has been used at low temperatures (approximately 104°F or 40°C maximum), but it is not recommended where the aluminum container is heated. Zinc or galvanized iron is not recommended, and copper or copper alloys may cause product discoloration. Galvanized iron and tin or tinned steel should not be used.

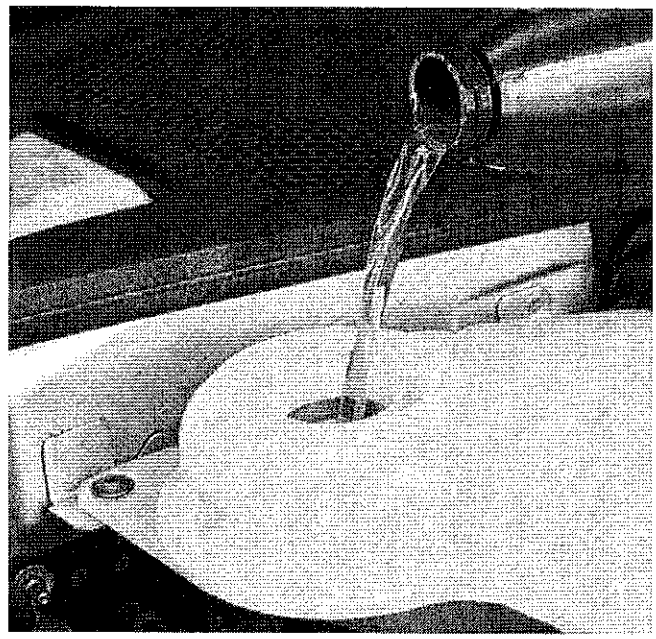

FIGURE 3. All liquid substances used in agriculture must be safely handled and stored.

Atmospheric Air

The atmospheric air influences storage environments when storing coolants. Exposure to air and oxygen-rich environments should be minimized to prevent oxidative degradation that can lead to acid formation. Acidity enhances iron pickup from steel vessels.

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UNDER INVESTIGATION...

LAB CONNECTION: Engine Coolant Colors

According to the publication *Popular Mechanics* (2014), all engine coolants are actually clear. Dyes are added by the coolant manufacturer. Some look like Mountain Dew, and others look like a blue raspberry drink. However, engine coolants cannot be consumed.

Different manufacturers use various dyes in their products based on properties formulated for the engine powering a vehicle. In addition, chemical formulations (e.g., Ethyl-Glycol, Dex-Cool, and G12) come in a variety of colors. While these colors seem pretty, they are chemicals and should be treated as such. Each color coolant is specially formulated to be used in a specific car or truck, for example. The way the coolants are manufactured is worth investigating. Research four different brands of coolants online. Make a chart that shows the manufacturer, the coolant's color, the engine for which the coolant is designed, and the manufacturer's suggested methods for coolant storage.

Small Coolant Container Storage

You should store small coolant containers in a clean and dry building, away from light. For safety reasons, lock the building so children and others may not enter. Ensure the containers are closed tightly. Also, the label on the container must be shown. Follow the guidelines that accompany the coolant and the MSDS.

MAINTENANCE

It is imperative for heat built up in the engine to be able to escape or be cooled. Anything that slows down the movement of heat from the cylinders to the cooling system may cause the engine to overheat, which may lead to damage and expensive repairs. Yet regular maintenance of the cooling system can prevent costly repairs. Read and follow the information regarding coolants in the engine's operating manual. Leaks in the cooling system can mean a loss of valuable antifreeze, which can cause the engine to overheat and become damaged. To prevent leakage of coolant into the crankcase, check the cylinder head joints periodically to ensure the gasket is okay and the cap screws are tightened to specifications.

Three types of corrosion can attack the parts of the cooling system: chemical, electrolytic, and erosive.

- **Chemical corrosion** is a direct chemical reaction between the coolant and the metal parts of the system. Acids in the coolant or various oxidizing agents may cause this to occur.
- **Electrolytic corrosion** is a reaction between two metals joined together—in contact with a solution—that conducts electricity. When selecting antifreeze, be sure that it is not a good conductor. When purchasing the coolant for engines, check the coolant container label to ensure it is not a good conductor. Also, follow the guidelines.

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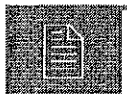
- **Erosive corrosion** is mechanical abrasion from particles (e.g., rust, scale, and sand) as they circulate rapidly through the system with the coolant. Flush the system before installing antifreeze. Rust and other deposits in the system can shorten inhibitor life.

Summary:



The cooling system in an internal combustion engine serves the primary purpose to keep the engine cool and to prevent it from overheating. Engines naturally become hot when in peak operations and need to be cooled so the engine does not overheat and stop working.

Liquid coolants are used mostly in agricultural machines and in modern vehicles to keep engines cooled. Safe storage of coolants is a must and should be stored in an enclosed area. Containers should be labeled properly and kept out of the reach of children and animals.

Servicing the cooling system occurs by keeping an eye out for radiator leaks, hose breaks, water pumps malfunctioning, and broken coolant tanks. These items should be replaced as soon as possible to ensure that the coolant can continue to keep the engine from overheating.

Checking Your Knowledge:

1. What are the various types of liquid coolants used in agriculture?
2. What is antifreeze, and where is it used in the cooling system?
3. What is the proper way to safely handle and store coolants?
4. What are the major cooling system parts?
5. What are the functions of the various parts in the cooling system?

Expanding Your Knowledge:

Take a stroll through an auto parts store (e.g., Napa or O'Reilley's) or some other facility that sells coolants and antifreeze. How many coolant types are on the shelf? What colors are the coolants? Conduct an investigation as to how coolants are made in a factory that manufactures coolants. Prepare a list of the steps in making coolants, and include the chemical properties of each. You may need a science book to help. Why are coolants bright green, pink, yellow, or blue? Investigate these questions, and prepare a poster or a concept map that illustrates the steps in making coolants. In addition, write all of this in your agriculture notes.

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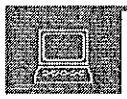
Web Links:



Coolant Technology

http://www.coolantexperts.com/coolant_overview/

Antifreeze

http://www.hemmings.com/hmn/stories/2006/12/01/hmn_feature20.html

Engine Coolant

http://www.kellysgarageagr.ca/service-tips/29-engine-coolant-what-it-does.html

Coolant Storage and Handling

http://www.coolantexperts.com/coolant_storage/coolant_storage_and_handling

Mr. Coon Ag Mech Remote sensing Option 3 April 27 Name

Checking Your Knowledge:

1. Define remote sensing.

2. What are the two basic types of remote sensing?

3. Compare active and passive remote sensing systems.

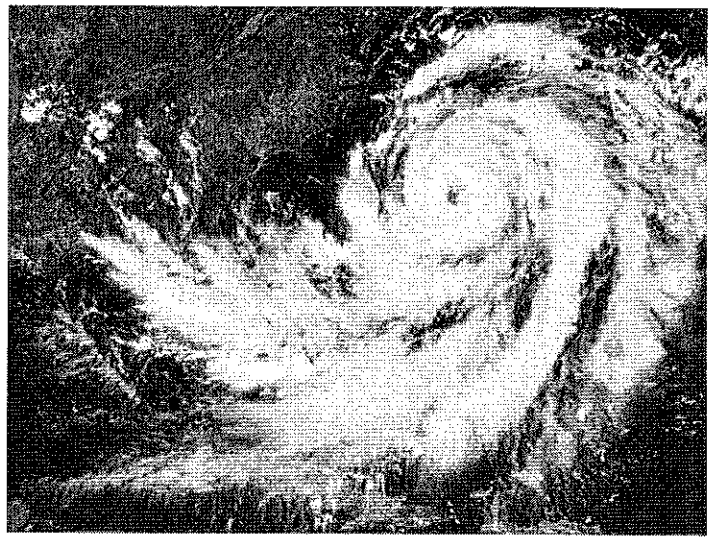
4. How can remote sensing be used in agricultural settings?

5. Describe how resolution and frequency of coverage affect the usefulness of remote-sensing data.

Coon Ag Mech 427 #3

Remote Sensing Technology

WHEN MOST PEOPLE think about satellites orbiting the United States with a variety of sensors and monitors, they think of communications, mapping, or television. Fortunately for farmers, satellite images can be used to determine if crops in the field are suffering from drought, pest problems, and/or nutrient deficiencies. This unit examines remote-sensing technology and how it is used in agriculture.



Objective:

Describe remote-sensing technology and its relation to precision agriculture.

Key Terms:

active system
aerial photography
electromagnetic spectrum
frequency of coverage
Geographic Information System (GIS)
ground-truthing
LANDSAT
passive system
pixels
remote sensing
satellite imaging
spatial resolution
spectral resolution
spectral response
SPOT
vegetative indices

Understanding Remote Sensing

Remote sensing is a group of techniques used to collect information about an object or area without actually being in contact with that area or object. It can be used in precision farming to gather data for management decisions. Remote sensing in agriculture can be accomplished through aerial or satellite imaging, but satellite imagining is more common.

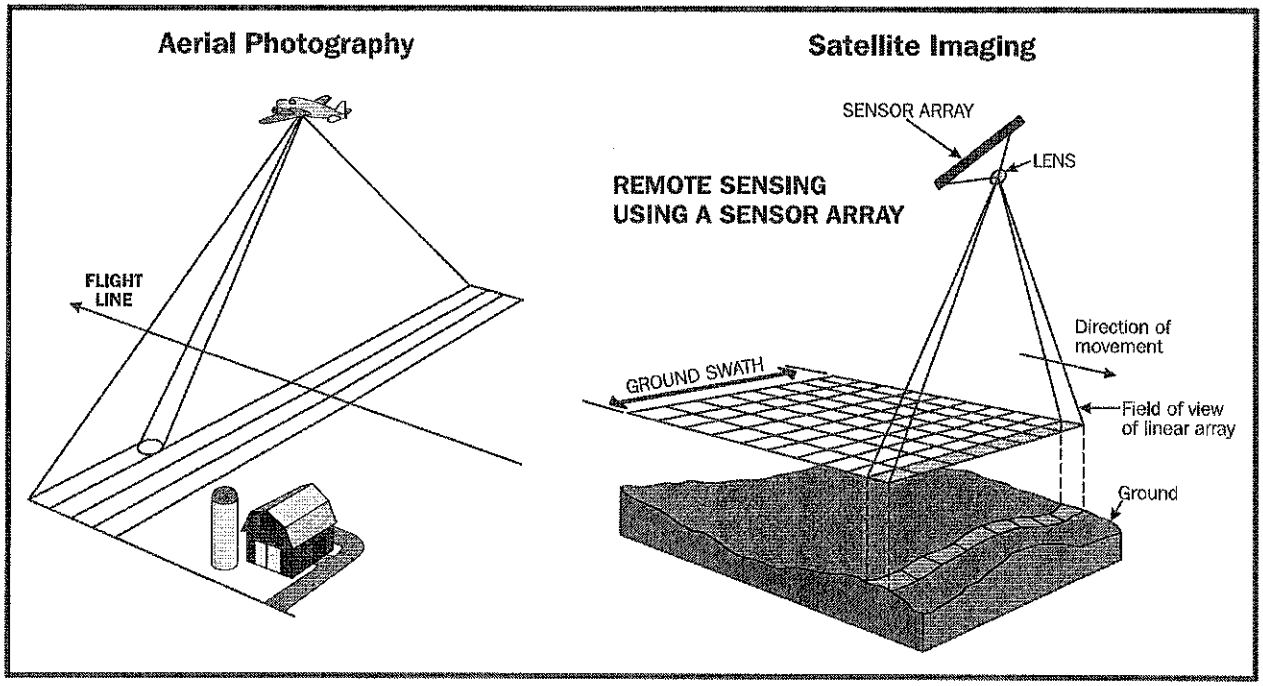


FIGURE 1. Remote sensing techniques.

TYPES OF REMOTE SENSING

Aerial imaging is accomplished through **aerial photography**, which is taking ground images using an airplane and traditional photos or electro-optical sensors. The images create a snapshot of an area or landform. Information can be gleaned from the images based on color differences within each photos. Aerial imagery can be handled by private companies or by individuals.

Satellite imaging is the process of using satellites orbiting Earth to gather information on an area using a variety of sensors. Though the distance is much greater than that of an airplane, satellite imaging can provide detailed information. Remote sensing through satellites typically uses one of two systems: LANDSAT or SPOT.

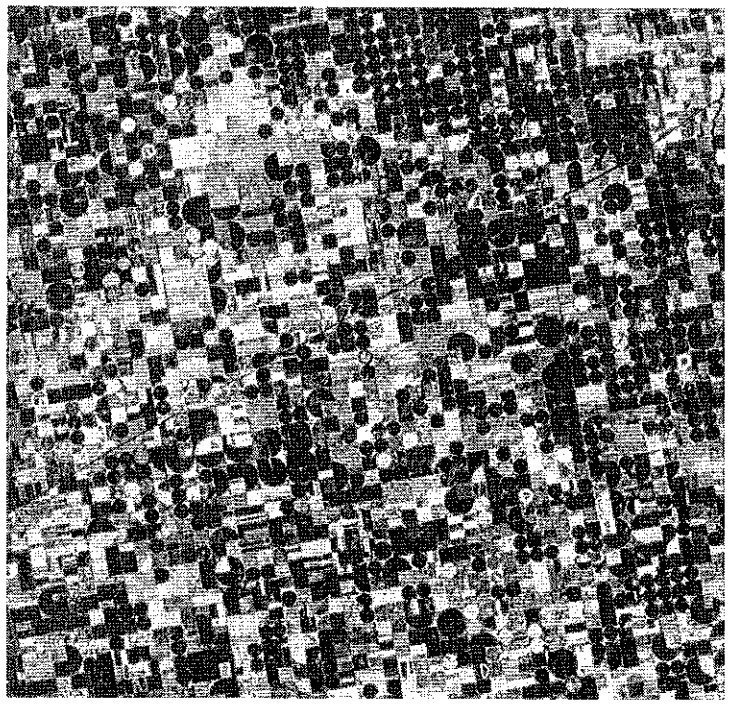


FIGURE 2. Crop circles in Kansas. (Courtesy, NASA)

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Satellite-Sensing Systems

Land Satellite or **LANDSAT** is a group of U.S. governmental satellites used to gather environmental information about Earth's surface.

Systeme Pour l'Observation de la Terre or **SPOT** is a group of French governmental satellites that collects data and information about Earth. Data from these satellites is retrieved by special request.

REMOTE SENSING FOR AGRONOMIC CROPS

Remote sensing performed by satellite gathers information on agronomic crops by utilizing the electromagnetic spectrum. The **electromagnetic spectrum** is all of the possible wavelengths of electromagnetic radiation, from large radio waves to visible light to small gamma rays.

When electromagnetic radiation travels through space and strikes an object, the wavelengths can be reflected, absorbed, or transmitted through the object. Often times, more than one of these reactions occur. In addition, all objects with a temperature above absolute zero emit invisible radiation of their own. The object's **spectral response** is a unique reflection of wavelengths by individual objects.

Remote sensing by satellite uses a variety of sensors to gather information on all of the reflected and emitted radiation to create a differential map that can show differences in an area.

In imaging areas with plants, areas with consistent growth and health would appear the same. In contrast, those areas with poor growth or a lack of vegetation would appear differently.

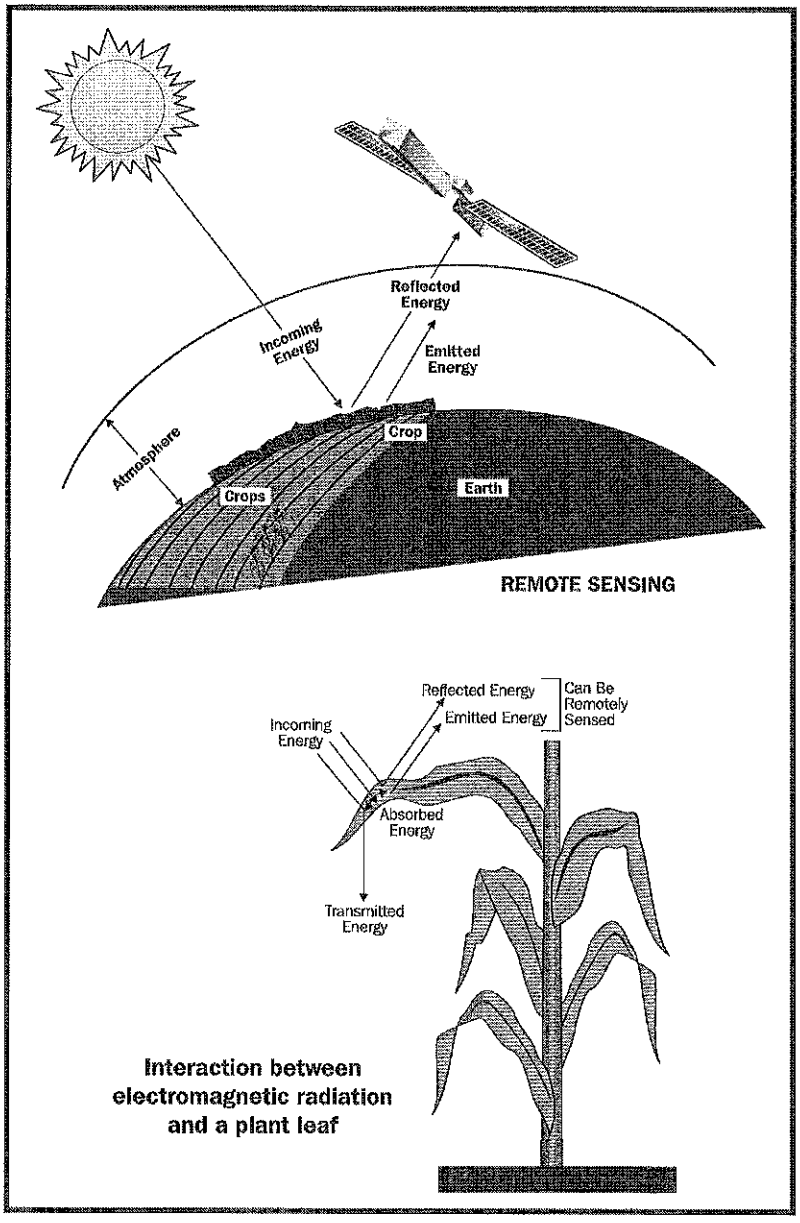

FIGURE 3. Remote sensing and light waves.

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FURTHER EXPLORATION...

ONLINE CONNECTION: Benefits of Remote Sensing

Remote sensing has made an impact on much of our daily lives, sometimes without us even knowing it. From weather to crop disasters, remote sensing provides information that can be used in a variety of ways.

Use the Web site below to investigate how remote sensing can be used. Click on "Agriculture" to explore how the agriculture industry is specifically using remote sensing to provide information to farmers to help them make more informed decisions about their crop plans. Examine other areas of interest to see how the use of remote sensing compares to the uses in agriculture.

http://landsat.gsfc.nasa.gov/?page_id=3510

Active or Passive Systems

Remote sensing can be accomplished through two types of monitoring systems: an active or a passive system. An **active system**, such as radar, is a system that generates its own signal and detects the reflection or absorption of that signal to create the data map. A **passive system** is a system that does not create its own signal and just detects radiation that occurs naturally.

System Resolution

Resolution is an important factor in the usefulness of remote sensing systems. Systems with high resolution may be able to distinguish one plant from the next in a field, while other systems with lower resolution may just distinguish rows of plants from the next. **Frequency of coverage** is how often the system is available to view the area to be remotely sensed. Some methods, such as aerial photography, could be used whenever the customer desires, while satellite imaging may require more time because the satellites must come into position or deal with cloud cover.

Spatial resolution is the size of an object that can be distinguished through remote sensing. **Spectral resolution** is a process that determines how well the sensing system can distinguish between different wavelengths of energy.

Digital Images and Pixels

Once a remote sensing system has gathered data from the electromagnetic radiation emitted from an object or area, it produces a digital image in two- or three-dimensional form. Information is displayed as **pixels**—picture elements. Smaller pixels provide better resolution and a more detailed map. These images could be in black and white, color, or color infrared. In color infrared images, healthy green vegetation appears as a bright red color.

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USING REMOTE SENSING DATA

It is not possible to measure soil moisture content or phosphorus levels in plant leaves using remote sensing. This type of specific numerical data cannot be gathered with this technology. However, using this data with actual ground measurements may enable correlations to be drawn over large areas of land. This may be the largest benefit of remote sensing—the ability to gather large amounts of data quickly with minimal labor input.

Vegetative Indices

For farmers, remote sensing can provide information on crop progress, water stress, leaf damage, and/or general nitrogen levels using remote-sensed maps known as **vegetative indices**. These maps can be used to detect weed and insect pressure in a field by comparing a field image with an identical image taken a set amount of time earlier. Differences in the two images will show changes in the plant growth at different areas of the field.

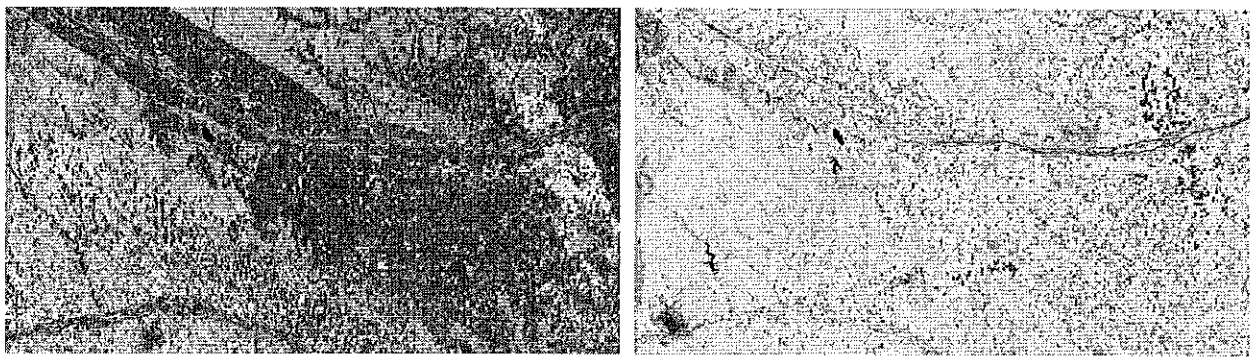

FIGURE 4. This is a remote sensing data comparison of harvest activity in Nebraska. (Courtesy, U.S. Geological Survey)

Data Layers

Remote sensing is used primarily as one data layer in an entire GIS system. A **Geographic Information System** (GIS) is a mapping system that uses a variety of land monitors to create a multi-layered map of information. Yield data, topography, crop scouting reports, crop varieties, and soil fertility maps can be combined with remote sensing data to assist farmers in making predictions and decisions about current and future crops.

Ground-Truthing

Ground-truthing must be completed to verify variability with a remote sensed area and to identify what problems are causing the variation. **Ground-truthing** is the scouting of a remote sensed area to verify the accuracy of the image information.

Summary:

Remote sensing is a group of techniques used to collect information about an object or area without actually being in contact with that object or area. Remote sensing

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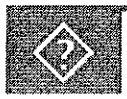
can be accomplished through aerial photography or satellite imaging. Remote sensing gathers information about an area by utilizing light waves within the electromagnetic spectrum. A remote sensing system can be an active system or a passive system. Spatial resolution is the size of the object that can be distinguished through remote sensing. When a remote sensing system gathers data from the electromagnetic radiation emitted from an object or area, it produces a digital image in two- or three-dimensional form.

Vegetative properties (e.g., crop progress, water stress, leaf damage, and/or nitrogen levels) can be determined using remotely sensed maps known as vegetative indices. Remote sensing is used primarily as one data layer in an entire group used in geographic information systems (GIS).

Checking Your Knowledge:



1. Define remote sensing.
2. What are the two basic types of remote sensing?
3. Compare active and passive remote sensing systems.
4. How can remote sensing be used in agricultural settings?
5. Describe how resolution and frequency of coverage affect the usefulness of remote-sensing data.

Expanding Your Knowledge:

Visit Google Maps at https://www.google.com/maps/. Input a map location. Then look at the satellite view of the area you chose. Zoom in on an agriculture field. Compare your area to another area with a completely different agricultural climate.

Web Links:

Remote Sensing in Precision Agriculture
http://www.amesremote.com/

LANDSAT
http://landsat.gsfc.nasa.gov/?page_id=2378

Online Remote-Sensing Guide
http://ww2010.atmos.uiuc.edu/%28Gh%29/guides/rs/home.rxml

Agricultural Career Profiles
http://www.mycaert.com/career-profiles/