



Ag@School

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1790

4 million Americans
90% lived on farms

1850

23 million Americans
64% lived on farms

1950

151 million Americans
12.2% lived on farms

2010

315.5 million Americans
1.8% live on farms

2024

340.1 million Americans,
less than 2% live on farms

Agriculture in a Changing World Revolution: A "sudden or complete change"

1820 - 1870 Industrial Revolution in the US

A change from hand and home production to machine and factory production



1837 John Deere invents self-cleaning plow

1920 - 1950 Mechanical Revolution in agriculture

Change from machinery being pulled by horses and mules to using tractors, combines, and other specialized equipment



Massey Harris 25 Tractor
1931 - 1938

1945 - 1960 Chemical Revolution in agriculture

Use of man-made fertilizers and chemical pesticides targeting specific weeds and insects



1965 - 1975 Green Revolution

Dramatic increases in production of wheat and rice in developing countries due to use of genetically improved seeds



Wheat Plant

1975 - Electronic Revolution

Using computer technology in agriculture

1980s - Biotechnology Revolution

Using biology and cellular technology to develop new products.

1982 - Produced human insulin from bacteria



Some crops are GMOs (genetically modified organisms) where a precise gene has been altered to improve the plant in a specific way

1990s - Electronic Revolution continues

Use of computer technology and global positioning satellites (GPS) to guide equipment
1996 - GPS plus GIS Revolution - Farmers use satellite technology (Global Positioning System) to track and plan their farming practices with Geographic Information Systems



GPS Lightbar
Guidance System

2000s - Now - High Speed information highway revolution

The internet gathers and communicates information at lightning speed, wi-fi can operate systems remotely, and human labor is replaced with machines, including sensors, 3D cameras, lasers, drones, robotics, etc.



Today's Children... Tomorrow's Leaders

tech•nol•o•gy (tek nol'ə jē), n. using scientific knowledge to find a better way of doing something.



AGRICULTURE IN A CHANGING & GROWING WORLD

People continually find better ways of doing things. When people apply what they have learned about science; that's technology!

No industry has made better use of technology than agriculture. Improvements to agriculture have changed America from an **agrarian** to an **urban** society. Less than 2% of our people now work the land. This allows everyone else to live in cities and work in other careers. This means more doctors, more teachers, and more scientists.

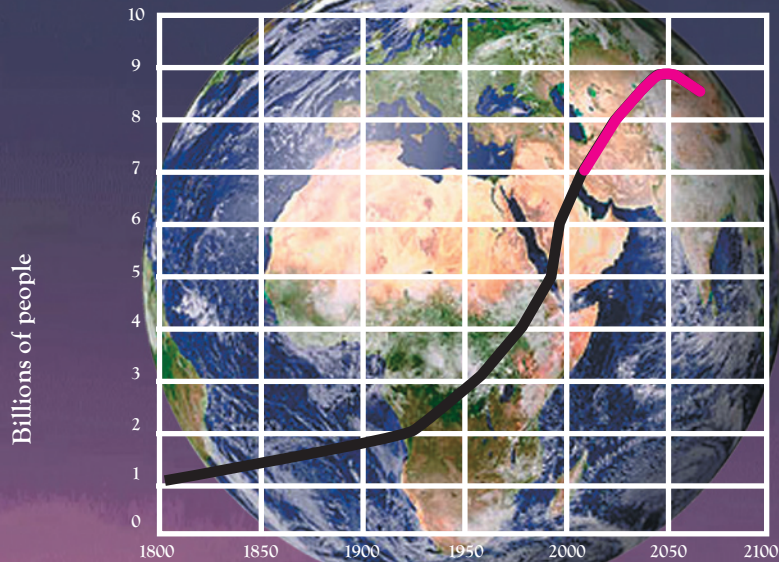
Even though less than 2% of the US lives on farms, 17% of our total workforce is employed in agriculture. Growers produce the raw products and others turn them into things we eat and use.

Historically, the early 20th century mechanical revolution put tractors, combines, and other specialized machinery in use rather than horses and mules.

Then in the mid-20th century, agriculture experienced a revolution in chemical and genetic knowledge that allowed **high-yield agriculture**. In the late 20th century, agriculture benefited from the electronic revolution, using computers and satellites.

Prior to 1900, nearly all increases in food production came about because more land was brought into production. Now in the 21st century almost all increases must come from higher yields and be based on science and technology.

CAN AGRICULTURE CONTINUE TO FEED THE WORLD?



YES! BY USING TECHNOLOGY!

Our world population will grow to more than 9 billion people by 2050! The world's farmers & ranchers will have to grow 60% more food than what is now produced.

Name the BIG FOUR!

There are about 380,000 kinds of plants. About 100 are regularly grown and eaten as human food. Amazingly, over half of the world's food comes from only four plants. Three are grains, and one is a tuber vegetable.



First grown by ancient tribes in the mountains of South America, this food is actually an underground storage unit. The roots collect more water and food than the growing plant can use at one time. The plant stores the excess food in oval shapes, called **tubers**. This crop produces more pounds of protein per acre than corn, rice or wheat. Idaho leads US production but **Washington grows more pounds per acre.**



One-seventh of all the farmland in the world is used to grow this grain - far more land than for any other food crop. It is a staple food for 35% of the world's people and is used to make breads, cookies and noodles. North Dakota, Kansas, Montana, Washington, and Idaho are the leading production states in the U.S.



Christopher Columbus found this grain growing in North America in 1492. American Indians helped the Pilgrims survive by teaching them how to plant and cultivate it. Today, it is our country's number one agricultural crop. Iowa, Illinois, Nebraska, Minnesota and Indiana lead US production.



It's a staple food for half the world's people. Native to Asia, it has been grown and eaten there for thousands of years. It grows in warm areas and plants must be under water for most of the growing season. In the US, it is grown mostly in Arkansas, California, Louisiana, Mississippi, Missouri, and Texas.

How does local milk get from the farm to you?
Follow the steps below!

The FARM-TO-SCHOOL Cycle of Milk

BACK TO BASICS



One Day's Production for a High-Producing Dairy Cow =



4.8 pounds of butter

or 8.7 gallons of ice cream



or 10.5 pounds of cheese

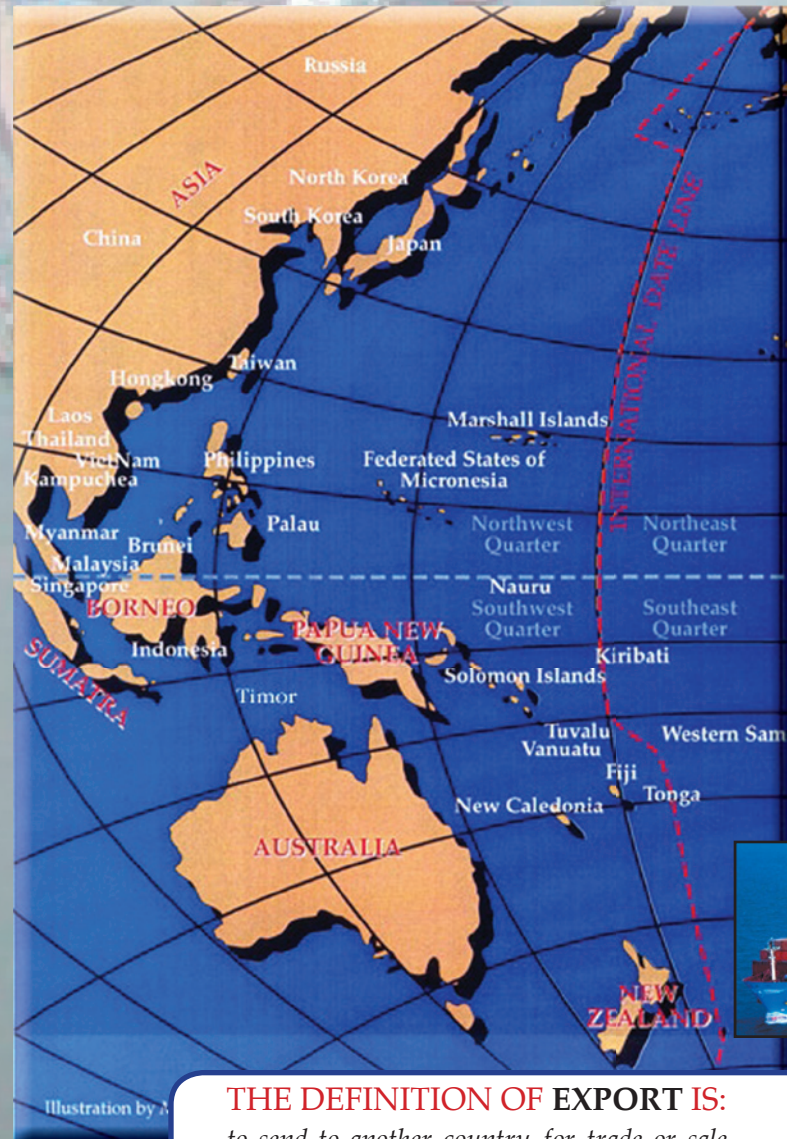
How is Washington Trade Bo

Washington's location on the **Pacific Rim** allows for advantageous international trade. C
Hong Kong, and Vietnam were Washington's top exporters in 2023. By ship, Washington p
In 2023, Washington-grown or processed food and agriculture exports totaled \$7.5 billion
largest exporters of food and agriculture products in the US.

1. What is the Pacific Rim?
2. Can you name five countries on the Pacific Rim
3. On the map put an 'X' on the State of Washington
4. Use a globe to trace the polar air route from Washington to Europe

How do we increase exports?

Trade is not always a simple process. Countries can impose tariffs (taxes on imported products). If consumers want to buy the imported products they must pay a higher price to cover the cost of the tariff. Tariffs and other trade barriers can be used to protect producers within a country from foreign competition. Tariffs can lead to trade wars as exporting countries retaliate with their own tariffs on imported goods. One method of increasing trade is to make trade agreements between countries. Free Trade Agreements (FTAs) have proven to be one of the best ways to open up foreign markets to U.S. exports. We currently have 14 agreements with 20 countries around the world.



THE DEFINITION OF EXPORT IS:
to send to another country for trade or sale

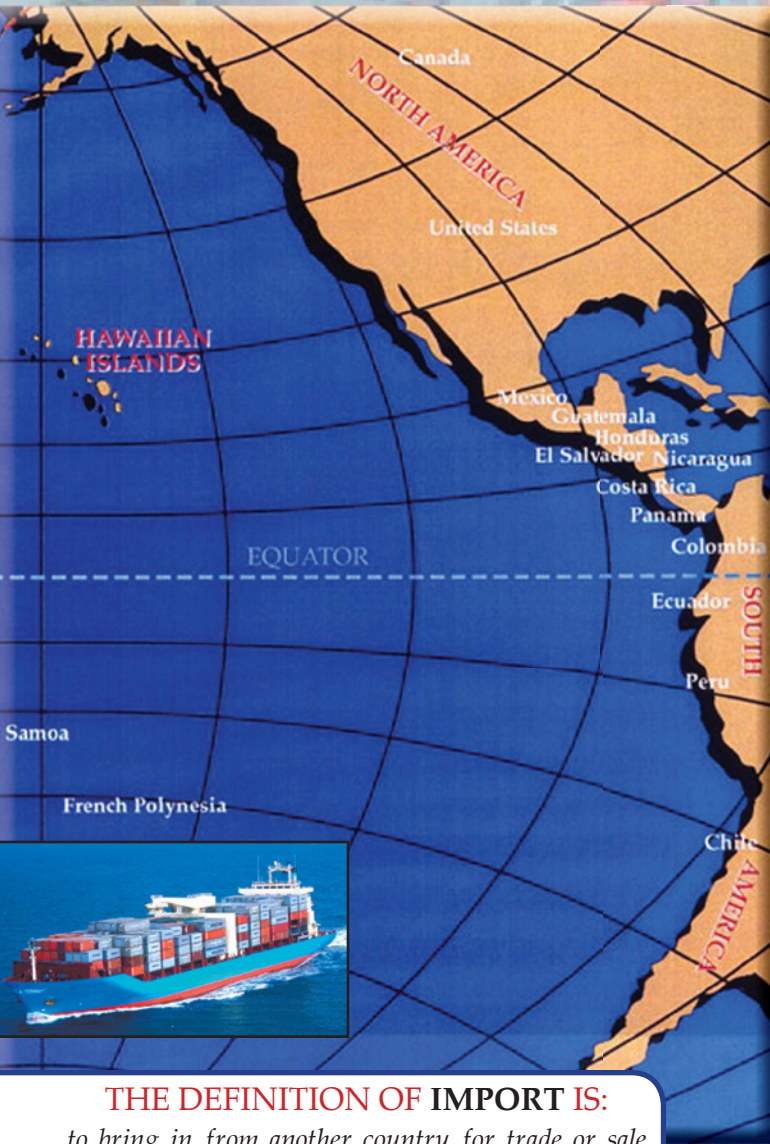
SUPPLY AND DEMAND

Prices are determined by two groups of people: Producers and consumers. Producers make or create something to sell and consumers buy or use that product. The amount of something offered for sale is called **supply**. The amount that people are willing to buy is called **demand**. The price you pay in the store usually depends on which of those is the highest at a given time. If demand is high, prices usually go up. If supply is high, prices usually go down.



Boasted By The Pacific Rim ?

. Canada, Japan, China, Mexico, South Korea, Philippines, Taiwan, Indonesia,
n ports are about two days closer than California ports to the Asian Markets.
ion (WSDA 2023). Washington consistently ranks in the top five



Trade – A Heritage In Washington

Our tradition as a trade state began back in the early nineteenth century with the fur trading activities of Hudson’s Bay Company and the Canadian North West Company. Seattle became a major seaport during the Klondike gold rush by selling provisions to miners and transporting prospectors to the Alaskan gold fields. In 1916, William Boeing started building wooden airplanes in a small red barn. Today Boeing Company is the country’s largest exporter. Global demand for the things we produce helped to build our state and drives our economy today. More than 40% of all Washington jobs are linked to trade. Washington Products that are especially reliant on global trade include wheat (up to 90% of the crop is exported each year), potatoes (up to 70% are exported in the form of French fries), and tree fruit (approximately 30% of apples and 25% of cherries are exported each year).

THE DEFINITION OF IMPORT IS:

to bring in from another country for trade or sale

See if you can fill in the following sentences and discuss scenarios.

1. A heavy frost freezes Florida’s orange crop before harvest. Supplies of oranges for juice drop. The price of orange juice will _____.
2. More farmers around the world are now growing wheat to export. Supply is greater than demand. The price of wheat will likely _____.
3. Hurricanes damaged oil drilling rigs in the Gulf of Mexico. There is less oil on the market. The price of gas will _____. Discuss how this affects what you pay for things in the supermarket?

Has Technology Improved Production Agriculture?

Precision farming: allows small areas of land within a field to be managed separately so that the best possible crop yield will be reached using the exact amount of seed, fertilizer, and chemical for each small area. This farming method requires several technologies like **GPS** (global positioning system). GPS uses a network of satellites orbiting the earth to transmit exact locations to computers on the ground. GPS can automatically guide huge farm machines to stay along a track hundreds of meters long with only a few centimeters of difference.

Geographic Information Systems (**GIS**) is used to collect specific data about various locations within a farmer's field. Data is gathered from multiple soil samples, yield monitors from harvest, even aerial photographs. GIS plus GPS can reduce the number of passes needed to cover a field and save seed, chemicals, fertilizer, fuel, and time. Skips and overlaps are eliminated and work can be done even at night or in dust or fog.



Drones: or unmanned aerial system (UAS), use high tech cameras to assess the status of crops and fields. Drones give the aerial view and precise information back to the grower that can identify crop health and assess crop damage. Information gathered can assist with irrigation management and utilizing sensory data can determine specific harvest times.

Technology Has Improved Machines: Fruit can be sorted by cameras and computers. After apples are washed, polished, and waxed they are dropped into cups on a moving belt where a camera takes four pictures that creates a three dimensional computer view. The color and diameter are determined and scars and blemishes detected. The apple is evaluated for weight, color, defects, and shape. The computer signals each belt cup to drop its apple at the correct packing box, perhaps hundreds of feet down the line. The machine made by Aweta is fast; each camera can evaluate 10 apples per second.



Controlled Atmosphere (CA) Storage: Eating crisp, juicy Washington apples year-round is possible due to controlled atmosphere storage that involves careful control of temperature, oxygen, carbon dioxide and humidity in sealed rooms. As apples ripen, they naturally take in oxygen and give off carbon dioxide. If we reduce the oxygen, we will slow ripening. Oxygen levels in the sealed rooms are reduced, from the approximate 21% in the air we breathe to 1 or 2%, usually by adding nitrogen gas. Temperatures are kept at a constant 32 to 36 degrees Fahrenheit. Humidity is maintained at 95% and carbon dioxide levels are also controlled. Exact conditions in the rooms are set according to the apple variety. Computers help keep conditions constant. Washington has the largest capacity of CA storage of any growing region in the world.

More efficient irrigation: The modern center pivot irrigation system has come a long way from just flooding fields with water. The system uses a long water pipe that is mounted on motorized wheels and has one end connected to the water line at the center of the field. When operating, the irrigation system swings in a circle, sprinkling water as it rotates. These systems are computer controlled using GIS (Geographic Information System) and can even be operated from the farmer's cell phone. Irrigation is the reason our farmers lead the nation in the yield/acre of corn and potatoes.



From Field to Table: Food Preservation

Food starts to spoil the moment it is harvested. **Enzymes** (complex proteins produced by living cells that cause specific biochemical reactions) cause the food to start to break down and microorganisms, molds, and insects can take over. The Food and Agricultural Organization of the United Nations (FAO) has estimated that about 25% of all worldwide food production is lost after harvesting to insects, bacteria and spoilage. Over the centuries, man has used many methods to preserve food. When we talk about food preservation, we describe the methods to slow or stop the deterioration of food. Think of what living things need to survive--food, water, warmth, and air. We limit these necessities to preserve food.



Drying--Removing water from foods was an early method of preservation. The sun and wind were used to dry foods. A fire can be used to supply heat and then the food also gets a smoky flavor.

Refrigeration --If we take away heat, we can slow down deterioration. Man used cellars, caves, cool streams, and blocks of ice before we had electricity to power appliances. Freezing slows deterioration almost to a standstill.



Curing--Curing is also based on drawing the water out of cells---usually accomplished with salt. In the 1800s it was discovered that salts containing nitrites (salt peter) caused cured meats to be red in color instead of the usual unappetizing gray.



Canning--Foods are placed in jars or cans and heated to temperatures that destroy microorganisms and inactivate enzymes. After heating, the cooling creates a vacuum seal that keeps air away from the canned food.

Pickling--This process preserves foods in vinegar (or other acid). Microorganisms cannot grow in such an acid environment.



Sugar and Honey--Fruits packed in honey, or jams and jellies that are made with high concentrations of sugar also inhibit microbial growth, although certain molds can grow over time.

Freeze Drying--A modern food preservation method is freeze drying, where food is preserved by rapid freezing and drying in a vacuum chamber. Ancient Incas in Peru (where potatoes originated) would preserve potatoes as chuñu. To prepare chuñu, the Incas would leave some of their harvested potatoes outside for several days. In the cold, dry mountain air, the potatoes gradually became freeze-dried. The Incas helped the process along by walking on the potatoes to squeeze out extra moisture. This also served to flatten the potatoes so that they took up less space when stored. Chuñu could be stored for up to ten years.



FOOD ON THE OREGON TRAIL



Once the wagon train started on the trail west, there were not many places to stock up on staples and fresh produce. Non-perishable food was most of the menu. Without refrigeration, travelers had to rely on salted meats, pickled vegetables, dried fruit, bread, and coffee.

The least liked food was hard tack or "pilot bread". It was a mixture of flour and water, baked for a long time at low temperature. It was indeed very hard, but it would not spoil if kept dry. When it rained on the trip, as it often did, hard tack dipped in coffee might have been the only thing on the menu.

Next to bread, bacon was the food eaten most often. At this

time, "bacon" was most of the meat from a hog, including hams and shoulders, and was sliced as needed. One pioneer women, Helen Carpenter, complained, "But then one does like a change and about the only change we have from bread and bacon is to bacon and bread." Bread dipped into bacon grease was called "hot flour bread".

Imagine walking day after day in a cloud of dust and grit, eating pretty much the same food over and over. The trip to Oregon took about five months to cover the 2040 miles. Food supplies stored in water-tight containers took up a good deal of space in the covered wagon. A typical food list for each adult would include: 150# of flour, 30# of hard tack, 10# rice, 30# sugar, 2# baking soda, 10# salt, 75# bacon, 10# coffee, 2# tea, 15# dried beans, 15# dried fruit, 20# of corn meal, and a small keg of vinegar and a barrel for water. Canned foods were expensive and food preservation was questionable, so few items could be safely kept for the four to six month trip. The prairie schooner wagon could haul about 2500#! A family of four would require over 1000# just in food!

Washington Innovations



Combine Automatic leveling device:

The combine shown here is harvesting wheat, but it is also used in Washington to harvest corn, barley, canola, mustard, garbanzo beans and many other crops. It harvests a 30-40 foot wide cut and when fully loaded with grain weighs over 25 tons. For harvesting the hillsides of the Palouse an automatic leveling device was patented in 1946 by mechanical engineer R.A. Hanson from Spokane, Washington.

Raspberry Harvester:

This Korvan (now Oxbow) 9000 raspberry harvester, invented and built in Lynden, Washington, harvests ripe berries by gently shaking the bushes. Because of the high cost of picking by hand, most raspberries in Washington are now harvested mechanically. The self-propelled harvester travels about 1 mile per hour during the harvest process.



Robotics:

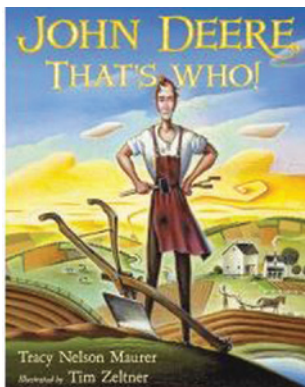
Robots are becoming increasingly popular to meet the demands of labor intensive procedures. Robots have many applications in agriculture and are designed for a specific task that might range from fruit picking and sorting, weeding, planting, and even driverless tractors/sprayers and robotic milkers. Engineers and scientists at Washington State University Tri-Cities and the WSU Center for Precision and

Automatic Agricultural Systems (CPAAS) are creating a practically adoptable robot that will pick apples as efficiently as people. The robot features an arm and "hand" in which eight motors operate in congruence with a vision system to delicately grasp and twist the fruit off the tree as a human does.

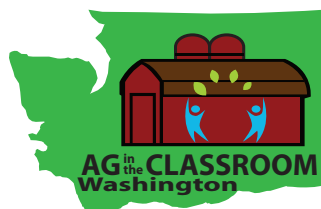


LIBRARY CORNER

Back in the 1830s, who was a young blacksmith from Vermont, about to make his mark on American history? John Deere, that's who! Who moved to Illinois, where farmers were struggling to plow through the thick, rich soil they called gumbo? Who tinkered



and tweaked and tested until he invented a steel plow that sliced into the prairie easy as you please? Long before the first tractor, who changed farming forever? John Deere, that's who!



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KIDS CORNER



My name is Nia Sackmann and I live in Warden which is Grant county. I'm 11 years old in the 6th grade. Besides going to

school, I play basketball, show steers, and help out on my family's farm. Last year one of my steers was named Babycakes. He was Red Angus and ended up weighing about 1300 lbs at the fair! I show at two fairs each summer as part of the Moses Lake Grange #1151. My family has cows, chickens, and my older sister has goats. When I help work cows on the farm, I run gates, run the scale, and give shots and ear notches. My favorite thing about growing up on a farm is learning how to take care of animals.