Abstract

The purpose of this project was to create middle school agriculture curriculum for the top three agriculture commodities in Humboldt County. It was designed and created specifically for Humboldt County to educate the upcoming generations about the unique and diverse agriculture industry Humboldt County provides. It is hoped that this easy and ready to use curriculum will get the students interested and involved in the agriculture industry in the future years. It includes a teacher’s aide outline, student handouts, a Power Point, and an activity handout.
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Agriculture is a vital part of everyone’s life whether they realize it or not. A person relies on some agriculture product for their basic needs every day. Most of these people don’t realize how many of the products they use everyday are agriculture commodities or agriculture by-products. As a whole, the California population lacks a great deal of knowledge about the foundation of civilization. Agriculture Education is defined as, “a systematic program of instruction available to students desiring to learn about the science, business, and technology of plant and animal productions and/or about the environmental and natural resources system” (About Agriculture Education, 2012). Education on agriculture needs to start young so the future generations can grow up more knowledgeable about the industry that provides food, shelter, and clothing for them.

As the population grows, so does our dependence on agriculture production. “California’s agricultural abundance includes more than 400 commodities. The state produces nearly half of US-grown fruits, nuts, and vegetables. Across the nation, US consumers regularly purchase several crops produced solely in California” (California Agricultural Production Statistics, 2012). Our state will not be able to continue to produce the quantity of products necessary to supply the country if agriculture continues to be put in the background of our education system. Knowledge about how food is produced and grown is important for making healthy decisions throughout life.

Humboldt County’s top three agriculture commodities are Timber, Nursery, and Dairy. The timber industry is often overlooked as an agriculture commodity. The manufacturing of
lumber in Humboldt County started in 1851 on Humboldt Bay and the first sawmill opened up the same year. As Humboldt County is abundant in forests, which include Douglas fir, cedar, and redwood trees, the industry bloomed. By the year 1881, there were around 400 mills that were cutting some of the world’s largest trees. The city of Eureka and all the surrounding towns and areas were all built off of the timber industry (Humboldt County History, n.d.).

Nursery production in Humboldt County is a “viable niche industry” as the mild climate allows for less stress on the plants. There are two forest-tree nurseries and numerous specialty and small production plant nurseries. However, the main contributor to the industry is Sun Valley Farms located in the Arcata Bottoms (Agricultural Resources and Policies, 2003). The Sun Valley Group was created by a high school agriculture teacher and one student in Oregon. The farm location in Arcata was bought in 1969 and named Sun Valley Bulb Farm and was later renamed to Sun Valley Farm (Past and Present, n.d.). The company has grown immensely along with the Arcata Sun Valley Farm. The major crops produced in the Arcata division are Lilies, Iris, Tulips, French Tulips, Freesia, Hyacinth, and Hydrangea (Tour Arcata Division, 2012).

The development of Humboldt Creamery in 1929 opened the doorway for all the local dairy family. The Humboldt Creamery Association started when 152 dairy families contributed ten cents per cow to open up a cooperative to produce and market their own products (Who We Are, 2012). What makes this county unique in its dairy production is that the farms are pasture based. The climate on the North Coast doesn’t change as the seasons go on and allows the dairymen a different way to manage their animals.

The agriculture industry is striving for a world where all people understand and value the important role of agriculture, food, fiber and natural resources systems have in the United States and the World. Developing our agriculture education is the only way to reach this goal.
Statement of the Problem

Public is getting farther and farther away from agriculture and doesn’t understand their own local agriculture industry. They are uneducated about the basics of their own local agriculture and that causes problems such as new regulations and misconceptions about agriculture. It is important for younger generations to know and understand the impact agriculture has on their lives every day. *The problem is that there is lack of area specific agriculture curriculum that can be taught by non-agriculture teachers.*

The Importance of the Project

Agriculture is the foundation of our country as well as our state. However, a large number of the population doesn’t know or understand the basic agriculture practices in their area. People are more interested when it directly pertains to them. Focusing on area specific agriculture education not only teaches about agriculture, but it allows for a more visual concept that they can apply to their lives. Teaching about local agriculture will also allow for more hands on learning and direct interaction with the agriculturalists. Increasing and developing the way agriculture is presented to the public is what will keep the industry thriving.

Purpose of the Project

The purpose of this project was to create agriculture curriculum with fun hands on learning activities about the timber, nursery and dairy industries in Humboldt for the local 5th and 6th grade students. It is important for our industry to spark interest in the younger generations and teaching them about their local agriculture industry instantly makes the topic more interesting for the students. This also will make it easier for teachers to include agriculture in their curriculum.
Objectives of the Project

The objectives to accomplish the purposes of this project are:

1. Create awareness for the importance of teaching agriculture.

2. Research the top three agriculture commodities in Humboldt County.
   a.) Timber
   b.) Nursery Products
   c.) Dairy

3. Create a curriculum for middle school’s that includes the basics of each commodity’s industry and fun learning activities.

4. Implement the curriculum into the local schools starting with Ferndale Elementary teachers.

Definition of Important Terms


2. Chainsaw- a portable power saw having teeth that are linked to form an endless chain.


4. Cell Wall- Cell walls provide structure to each individual cell.

5. Chokers- a tightly fitted steel cable, also called a steel noose. The cable wraps around the tree and is secured in the bell (lock) and tightens when pulled on. Used to move trees.

6. Colostrum: The first milk a cow produces and a calf drinks. It is a very thick milk and is full of antibodies for the calf.
7. **Cow**: An adult female dairy animal that has had a calf.

8. **Dam**: The mother of an animal

9. **Double headed axe**: A tool with a blade on both sides of the head on a handle used for felling trees or chopping wood/limbs

10. **Dry Cow**: A cow that is within two months of giving birth. Her milk production stops and her udder “dries” up before producing colostrum.

11. **Fresh Cow (Freshening)**: A cow that has just given birth.

12. **Gloves**: A fitted protective covering for the hand with a separate part for each finger and the thumb.

13. **Hard hat**: A hat made of a hard material for protection

14. **Hearing and eye protection**: Objects designed to cover ears or eyes to protect from loud noises or foreign objects.

15. **Heifer**: A young female dairy animal.

16. **Hydroponics**: Hydroponics is a method of growing plants in either water or a nutrient solution without soil.

17. **Lactation**: The stage of a cow’s life where she is producing milk after calving. The lactation length standard is 305 days.

18. **Leaves**: Leaves are where the majority of gas exchange of the plant takes place along with Photosynthesis, which is the process of taking the sun’s light energy and turning it into energy for the plant to use.

19. **Loader**: Front End Loader: a tractor with wheels and a claw like front end attachment used to pick up trees. Heel Boom: a log-loader on tracks which the
end of a log being loaded with bears and is steadied as it is lifted and swung into position.

20. **Logging trucks**- Semi trucks used to haul logs from the woods to the milling plants. They use Wrapper cables and binders to secure the logs to the trucks.

21. **Milking Parlor**: The building the animals are milked. Also holds the storage tanks and other equipment necessary for milking.

22. **Roots**- Roots are what provides the plant support, like an anchor on a ship. They also store excess materials, absorb water and minerals, and even make specific compounds a plant might need.

23. **Seed**- seeds are the beginning of a plant inside of them along with a food storage area for the growing seed.

24. **Sire**: The father of an animal

25. **Soil**- Soil is a dynamic natural body composed of minerals and organic solids, gases, liquids, and living organisms which can serve as a medium for plant growth

26. **Soilless Media**- Medium for plant growth that does Not contain any natural soil.

27. **Stem**- Stems provide support for the plant, storage for nutrients and energy, and a way to move the materials the plant needs to different parts of the plant.

28. **Tape measures**- a tape of cloth, paper, or steel marked off in a linear scale for taking measurements, in this case to cut the trees to length.

29. **Teat**: The part of the udder that releases the milk.

30. **Udder**: The location of milk production
31. **Wedge** – a piece of material, thick and one edge and tapered to a thin edge at the other, used for influencing the direction of the falling tree. (http://www.thefreedictionary.com/wedge

**Summary**

Today’s society lacks basic agriculture knowledge which used to be considered common knowledge only a few generations ago. The public is losing touch with the industry that is the bases of our everyday life. With understanding come more educated decisions. These decisions the public makes on issues, such as regulations, directly influences the agriculture industry. It is important for our industry to spark interest in the younger generations. Teaching them about their local agriculture industry instantly makes the topic more interesting for these students.

This project was to create agriculture curriculum and fun hands on learning activities about the timber, nursery and dairy industries in Humboldt for the local 5th and 6th grade students. Creating an area specific curriculum and using local businesses as examples and references makes the information more applicable to their lives. After the curriculum was made, it was tried and tested at Ferndale Elementary School.
Chapter II

Literature Review

The dairy industry is a major part of agriculture in California. In fact, California is leading the United States in the production of dairy products (CA Dairy, n.d.). Milk is full of nutrients and has scientific evidence that suggests dairy products can boost immunity, lower blood pressure, reduce the risk of diabetes, reduce risk for some cancers and support weight maintenance strategies by increasing satiety (Nutrients in Milk, 2009). Those are in addition to containing calcium, vitamin D and potassium, all of which are considered to be under-consumed by most Americans (Nutrients in Milk, 2009). The dairy industry also provides approximately 443,000 jobs for Californians and about $63 billion in economic activity (Dairy Cares, n.d.). It is important not only for those within the agriculture and dairy industries but also in the United States that the California dairy industry grows and thrives.

Logging in Humboldt County and Timber Production

Logging has been a big part of Humboldt County since 1852 when the first sawmill opened up on Humboldt Bay (Humboldt County History, n.d.). Humboldt County is known for the large amounts of Redwood trees which are very unique because of their giant size. Some are 20 feet or more across in width (Humboldt County History, n.d). by the year 1881 there was around 400 mills operating in Humboldt County which build and supported the county (Humboldt County History, n.d). The timber industry provides more than just wood for houses; they also help Humboldt County and California economically. In California alone, 110,000 jobs and $4.2 billion in payroll costs come from this industry. (Economic Benefit. (n.d.)) Trees are
used for so much more than just lumber. They also produce paper products including books, disposable diapers, cardboard, magazines, egg cartons, coffee filters, and even milk cartons. Some other products trees help produce are carpet, cosmetics, pain, tape, glue, toothbrushes, football helmets, and even shampoo (Gifts From Trees. (n.d.)). Trees also provide a way for carbon to be recycled and used for plant grown and for the release of oxygen into the air (The Carbon Cycle. (n.d.)). Without forests, logging, and active sustainable forest management we lose not only recreation land area, but the source of our planets health and products we use every day.

**Nursery Production in Humboldt County**

Nursery production provide people with the ability to buy and plant flower, trees, ferns, succulents and more for not only making their home beautiful, but to make their community warm, inviting, and enjoyable. The main nursery producer in Humboldt County is Sun Valley Farms, located in the town of Arcata. They have 2 forest-tree nurseries and numerous specialty and small production plant nurseries. The major crops produced in the Arcata division are Lilies, Iris, Tulips, French Tulips, Freesia, Hyacinth, and Hydrangea (Tour Arcata Division, 2012). They are another good employer in Humboldt County as well (Agricultural Resources and Policies, 2003).

Nurseries have many different buildings and equipment to grow and develop their plants. Most nurseries use a green house, but some also do field production. Field production is the main method of producing ornamental trees, shrubs, fruit trees, and perennial flower (Cooperative Extension Service. (n.d.)). The advantages of field production over normal production, such as a green house, are less demanding in terms of maintenance and labor during
the growing period, plants do not require winter protection, and lower start up costs (Cooperative Extension Service. (n.d.)). Not all plants are able to survive a life outside; that is when greenhouses help. Greenhouses are a way to overcome climate problems by using a free energy source, the sun. They allow producers to control the environment their plants are in which allows them to grow any type of plant they want even if they are in the wrong type of climate for that plant (Hanan, J. J. (2000)).

Nursery production often gets overlooked because people see this type of production as a luxury product; for those people who garden, have orchards, or any plants at all. They forget just how much plants impact our environment too. Just like trees, plants take in carbon dioxide for photosynthesis and release oxygen back into the environment (Plant Physiology: Photosynthesis, Respiration, and Transpiration. (n.d.)). Not only are plants important for our atmosphere, but they also help make our lives more beautiful too.

**Dairy in California and Humboldt County**

California is home to approximately 1,750 dairy families. The dairy industry provides around 443,000 jobs for the state and about $63 billion in economic activity for California. The dairies in California also produce about one-fifth of our nation’s milk supply and are the leading state for dairy product production in the United States (Dairy Cares, n.d.). In California, 99% of dairies are family owned and are passed down from generation to generation. These families and dairies are an integral part of each community and care about the quality of their products (Family Farms, n.d.).

Humboldt County is a large dairy production area with dairy farms that have been passed down from generation to generation. In 2006 milk was valued to bring in around $29,727,000
and is the third highest crop produced in this area (Agriculture in Humboldt County, 2007). There is a local creamery, Humboldt Creamery, which produces fluid milk, powdered milk, ice cream, butter, and cheese (Milk and More, n.d.). There is also a local cheese factory, the Loleta Cheese Factory, which produces over 34 varieties of cheese (Our Featured Products, n.d.). Both of these plants contribute to the economic welfare of the county. It is important for the younger generations to know and understand the dairy industry and the impact it has on the county as well as the state of California.

**Public Misconceptions about Logging and Dairying**

Many people believe that foresters just want to cut down all the trees in the forests. They also often say that anybody can come and log an area with no regulations. This project is attempting to change this view in our younger generations. A timber harvest plan has to be filled out, submitted, reviewed, the area surveyed before harvest, and the area surveyed after harvest. The reasons for this plan is regulate commercial and private logging, make sure all the state and federal laws are being complied with and also so our forests last for many years to come (Timber Harvest Planning, (n.d.)). Each plan is valid for three years and the after the timber has been harvested Cal Fire is notified and they check to make sure only the approved amount of timber was cut down. Other agencies, such as the Department of Fish and Wildlife also have to approve the plan. They look for more of the environmental impact logging that area might have such as listed endangered species living in the area, impact to the nearby watersheds, lakes, rivers, streams, and any impact to our forest land recourses. Overall, a lot of time, energy, and concern goes into allowing an area to be logged (DiPerna, R. (n.d.)).
The average person today is very disconnected with the everyday running and happenings on a typical farm because they don’t have to produce the food they eat themselves. They are able to go to a grocery store and pick up everything they need. However, this distance between the farm and the consumer has developed several common misconceptions about dairy farms and products. Everyone is trying to make the dairy industry move away from what they call “factory farming” but in California 99% of California dairy farms are actually family owned operations and not factory farms (Family Farms, n.d.). These farms are passed down from generation to generation and are part of each family’s legacy.

Animal care is a big concern for people and has many misunderstandings about why dairies care for their animals the way they do. The reason for using calf hutches to raise calves instead of keeping the calves with the cow is a common misconception. Dairymen don’t use hutches/pens in order to fit as many animals in one area as possible, to keep the calves from moving, or to get the money from the milk instead of feeding it to the calves. Hutches/pens are used to reduce the chances and the spread of disease-causing organisms, prevent any physical injuries to the calves, and to minimize calf death losses (Quingley, 2001). You can compare this to a hospital nursery. Human babies aren’t all put into one cradle or direct contact, so dairymen do the same for their new born calves. These animals are the farmer’s livelihood so cow and calf comfort and health are their number one priority.

The process of milking is another part of the dairy that is misunderstood. It is often said that milking hurts the cows and that the machines are ‘sucking’ the milk out. Not milking cows would actually hurt them. Leaving the milk in the udder without scheduled releases will cause pain and discomfort. Eventually the cow will naturally start ‘leaking’ which is when milk sporadically squirts out of the teats, usually when the animal is walking and puts pressure on her
udder and is a very uncomfortable situation. Milking machines are worked by a vacuum pump and a pulsator. The vacuum pump controls the air for the pipelines and the individual milking claws. The pulsator is a pump that alternatively admits the vacuum and air in the chamber of the lined teat cup and pipelines. This alternation of air and vacuum creates a massaging feel on the teat and mimics what is done when hand milking (Wattiaux, n.d.).

A few other misconceptions are health related. The worry that the use of antibiotics and rbST will result in residues in milk can be a genuine concern. All milk is tested for traces of antibiotics and rbST before the milk is taken from the dairies store tank and before it is allowed into the bulk tanks at the creameries. If there are traces of antibiotics in the milk, then the milk is dumped and the dairyman will be fined (U.S. Department of Health and Human Services, 2009). Bovine somatotripin (bST) is the hormone all cows naturally produced which affects how the animal’s energy and nutrients are used. The synthetic hormone, rbST, is made from a copy of the natural bST hormone. The FDA tested rbST before it was released for commercial use and there was no difference between the milk from cows not given rbST and those that were. rbST is used as a growth and production enhancer and works with the animals natural hormones (Dairy Food Safety, 2004). Methane is the major environmental factor that puts people off dairy. The misconception is that dairy cows are the largest source of methane that is contributing to global warming. Dairy contributes only 2.3% to the total greenhouse gases in California. In addition, the dairy industry has reduced its carbon footprint by 63% over the past 65 years (Dairy Cares, n.d.). Misconceptions such as the ones above are the main reason why educating the public on basic dairy practices is so crucial.
Health Benefits

Forests aren’t just beneficial for the animals and ecosystems that live in them, they are also beneficial to our health as well. Besides providing an outdoor recreational area for the public to enjoy for activities such as hiking, mountain biking, skiing, snowboarding, camping, and rivers/lakes to swim in, forests in the United States are considered ‘net carbon sinks’. Currently about 50% of all the fossil-fuel emissions are able to be taken up by both of the ocean and land (Miller, J. B. Sources, Sinks, and Seasons. Nature, 451(3), 26). Most of the land that takes up this extra carbon in the atmosphere are our forests.

The plants grown in nurseries also contribute to the intake of carbon dioxide from the atmosphere. They take the carbon dioxide for photosynthesis which converts light energy into usable energy (sugar) and oxygen. The oxygen produced is then released back into the atmosphere (Plant Physiology: Photosynthesis, Respiration, and Transpiration. (n.d.)). An unexpected benefit nursery production provides is an economic impact. The number of paid employees in nursery and greenhouse production is 150, 543 people. This industry also brings in a total of $16,362,000 or more with $647,000,000 in indirect business taxes (Hall, C. R., Hodges, A. W., & Haydu, J. J. The Economic Impact of the Green Industry in the United States. Production & Marketing Reports, 16(2), 345-348).

Dairy products contain many key nutrients including calcium, vitamin D, potassium, and protein. Calcium is a vital nutrient for building bones and teeth and also in maintaining bone mass (Choose My Plate, n.d.). Milk has a huge source of calcium; in fact, one cup of whole milk contains 276 mg of calcium. That is 28% of your daily value needed (Nutrients in Milk, 2009). Osteoporosis is very common in people with low calcium intake. Osteoporosis is a type of disease of the bones where you can lose too much bone, make too little bone, or both. Bones then
become very weak and can break extremely easily even from simplest everyday actions (Learn About Osteoporosis, n.d.). The best way to prevent developing osteoporosis is to make sure you get your daily intake of calcium and vitamin D. It has also been shown that “an anti-obesity effect of dietary calcium and dairy food is now evident from animal studies, observational and population studies, and clinical trials” (Zemel, 2004). Some of vitamin D’s main functions are bone formation, assist in calcium absorption, and growth as is related to bone formation (Jurgens & Bregendahl, 2007). Vitamin D is essential in maximizing calcium absorption and a deficiency in vitamin D can cause decalcification of skeletal and calcification of soft tissues (Jurgens & Bregendahl, 2007, 65). Potassium is needed for the proper functioning’s of the heart, kidneys, muscles, nerves, as well as the digestive system (Potassium, 2010). Protein is the main structure of all the organs and soft structures in a body (Jurgens & Bregendahl, 2007, 65). There are two different types of protein found in milk, whey (20%) and casein (80%) (Milk Products: Source of High-Quality Protein, n.d.). Protein consumption is also essential for amino acid construction and the replacement of other proteins (Nutrition for Everyone, 2012).

Agriculture Programs

There are many programs already in place that educate about agriculture. These programs include but are not limited to FFA, 4-H, Dairy Princess Contest, and Ag in the Classroom. The FFA Organization was founded in 1928 to help prepare the future generations for the changes in agriculture that would be coming (About Us, 2012). The FFA organization provides many opportunities for students in all aspects of agriculture and well as personal development. It teaches about leadership, public speaking, and entrepreneurship. Part of the livestock curriculum includes dairy science. Some dairy related programs the organization provides for students
include dairy judging, dairy product judging, dairy CDE’s, dairy SAE’s, project competitions, and proficiencies (National FFA Programs, 2012). All of these allow for students to learn about the different parts of the dairy industry and for a chance to educate others too. These programs aren’t just focused on dairy, but all parts of the agriculture industry and business world.

The 4-H program’s mission is to empower youth to reach their full potential, to work, and to learn in partnership with caring adults. This program was started in 1902 and was an agriculture after-school club. Today, 4-H is the nation’s largest youth development organizations (History, 2012). The dairy program in the 4-H clubs is unique because each club has a leader who is an expert in the subject and works one on one with each member of their group as needed. There are also proficiencies and leadership opportunities, such as a junior or teen leader for the dairy group for members to strive for. This program also encourages research and ‘ag-vocate’s’ for our industry (Plant and Animal Science, 2012).

The Dairy Princess program is sponsored by the California Milk Advisory Board (CMAB) and is a program for young women to represent the dairy industry while presenting a favorable and wholesome image. This program was started in 1958 by the American Dairy Association and was then transferred to the CMAB in 1969. California is broken up into different districts and each district has a Dairy Princess and two Alternate Dairy Princesses. These girls represent the California dairy industry by doing public appearances including school assemblies, classroom visits, service clubs, radio and TV interviews, industry meetings and local and state fair events (Dairy Princesses, 2012). The Dairy Princess Program is known all across the state and is highly regarded. There are many agriculture programs in addition to the ones above that are available to the public and that have been successful.
Ag in the Classroom is another successful agriculture education program. This program’s goal is to “develop accurate, teacher-tested and scientifically sound classroom materials to enhance the educational experience of K-12 students in any learning environment” among many other goals (About Agriculture in the Classroom, 2012). They provide lessons and fact sheets for teachers to download and hands on activities for kids. This program proves that people are interested in learning about agriculture and there are resources out there for them. Now the challenge is to make sure they know how to find these resources.

**Middle School Curriculum Requirements and Development**

For any education program to be successful a few factors have to be considered. Who the audience is, what the message is, and how to present the material in an understandable way are the main considerations. As there are no standards for agriculture education for middle school students, standards for grades 7-12 can be implemented and altered slightly. The requirements for animal science are as follows (California State Board of Education, 2005):

- **D1.0** Students understand the necessary elements for proper animal housing and animal handling equipment
- **D2.0** Students understand key principles of animal nutrition
- **D3.0** Students understand animal physiology
- **D4.0** Students understand animal reproduction, including the function of reproductive organs
- **D5.0** Students understand animal inheritance and selection principles, including the structure and role of DNA
• D6.0 Students understand the causes and effects of diseases and illnesses in animals
• D7.0 Students understand common rangeland management practices and their impact on a balanced ecosystem
• D8.0 Students understand the challenges associated with animal waste management
• D9.0 Students understand animal welfare concerns and management practices that support animal welfare
• D10.0 Students understand the production of large animals (e.g., cattle, horses, swine, sheep, goats) and small animals (e.g., poultry, cavy, rabbits)
• D11.0 Students understand the production of specialty animals (e.g., fish, marine animals, llamas, tall flightless birds)
• D12.0 Students understand how animal products and by-products are processed and marketed

Following and modifying these standards to meet the level of middle school aged students is a good way to make sure all parts of the message are given and are understood. The point of integrated curriculum isn’t to take up a large amount of the teacher’s time. The information needs to be condensed and precise to decrease delivery time and possible confusion for the person teaching it. To develop curriculum that is appropriate for a specific age group, having a survey of different information levels given to a sample age group is also a good idea if no previous development has been done before.
Summary

Agriculture education is important for the future of the industry. Educating the public about the agriculture industry is vital for the continuing success of the United State. Public knowledge about the agriculture industry in Humboldt County is the only way to make sure it lasts and continues to improve. The many misconceptions about industry practices often give agriculturalists a bad image. The number of trees that are cut when a site is being logged and sustainable logging practices are often misunderstood by the general public. Precautions are taken to prevent any harmful environmental impacts such as on endangered species and watersheds (Timber Harvest Planning, (n.d.)). How animals are cared for such as the use of calf hutches and pens for sanitation and the prevention of physical injury is often criticized. However the farmers take the best care possible of their animals or else those animals don’t produce and the farmer is out of a livelihood. Antibiotics and rbST residue fears are wrongly based as each tank of milk is tested before it is allowed to be used. Any contaminated milk is then dumped (U.S. Department of Health and Human Services, 2009). Methane is another concern; however dairy contributes only 2.3% to the total greenhouse gases in California (Dairy Cares, n.d.).

Both the Forestry and Nursery Industries provide a huge health benefit for everyone. They take carbon dioxide from the atmosphere and use it to convert light energy into sugar energy for the plant and oxygen which is released into the atmosphere. Forests also provide a physical health benefit as they provide recreational areas for the public’s use. The health benefits of consuming dairy products have been proven over and over. The high presence of calcium, vitamin D, potassium, and protein alone show just how important these products are to a nutritious diet (Choose My Plate, n.d.). Education about these benefits has been happening for many years. Programs such as FFA, 4-H, Ag in the Classroom, and the Dairy Princess program
have been doing their part in educating the public about the Agriculture Industry successfully for many years. A standard for middle school agriculture education curriculum hasn’t been implemented. The use of current high school agriculture curriculum can be altered and substituted when developing curriculum to make sure all the information is covered. When it comes to agriculture, the more information that is out there, the more people the industry can influence and educate.
Chapter III

Methods and Materials

In today’s world, the gap between agriculture and general public is getting larger. This project intended to help close that gap by starting with the younger generations. The purpose of this project was to create area specific agriculture curriculum, for middle school ages, that corresponds with the top 3 commodities of that area, and that any person, no matter their agriculture background, will be able to present. Additional teacher resources such as PowerPoint’s, Teacher Instructional Aid, Student Follow-Along Handouts, Activities, and Industry Contact Information will be included.

PowerPoint

The PowerPoint program is very easy to use and is very versatile. The best way to present new information is verbal as well as visual. Most students are either visual learners or verbal learners so having a way to present the information in both forms is the best way for the information to stay with the student. This is why PowerPoint is the best presentation style. This way the information is completely ready to be presented and it is in an easy form to send to the teacher as well. The PowerPoint’s for each curriculum follow the Teacher Instructional Aid so all the information works perfectly when presented. These PowerPoint’s also provide the correct answer on the blank fill-in the blanks on the Student Follow-Along Handouts. In making the PowerPoint’s, keeping the slides very simple and the bullet points to a minimum on each slide to keep the audience engaged in the information.
Curriculum Set-Up/Outline

In choosing the curriculum for the projects, the age of the students had to be taken into consideration for the type information that is to be given. All the information will be tailored to represent how each industry operates in Humboldt County. The following is a very basic outline of the curriculum to be presented.

Forestry/Timber Outline

32. The History of Logging in Humboldt County

33. Type of Trees in California

34. Type of Trees most common in Humboldt County
   b. Douglas-Fir, Redwood, Giant Sequoia, Sitka Spruce

35. Tools/Equipment

36. The Uses of Trees
   a. Habitat
   b. Carbon cycle
   c. Timber and by-Products

37. Logging
   a. Beginning Procedure
   b. Safety
   c. Types and Styles of Logging
   d. The Logging Process
Nursery Production Outline

1. Plant Basics
   a. What is a seed
   b. Parts of a plant
      a. Cell Wall, Large Central Vacuole, Plastids, Stem, Leaves, Roots
   c. Plants’ needs
      i. Water, Air, Nutrients, Sunlight
   d. Planting Mediums
      i. Soil
      ii. Soilless Media
         a. Peat moss, Sand, Perlite, Vermiculite, Composted Bark, Coir
      iii. Hydroponics

2. Life Cycle of Plants
   a. Annual
   b. Biannual
   c. Perennial

3. Nursery Production
   a. Different ways to grow plants
i. Sowing, Cuttings/Propagation, Grafting

b. Facilities

i. Greenhouse

ii. Shade house

4. Main Nursery Production in Humboldt County

i. SunValley Farms

5. Activities for the Classroom

**Dairy Outline**

1. What is Dairy
   a. Common Terms

2. Breeds
   a. Holstein, Jersey, Guernsey, Brown Swiss, Ayrshire, Milking Shorthorn

3. Dairy Products

4. Basic Pats and Functions
   a. Milk Production Body Parts
   b. The Stomach of a Cow
      i. Rumen, Reticulum, Omasum, Abomasum

5. The Life of a Cow
   a. Born
      i. Explain colostrum, feeding, how they are raised, dehorning, ear-tagging, etc
   b. Yearling
i. Explain what a yearling is, how they are handled, feeding, breeding

c. 2 Year Old Cows
d. Mature Cows

i. Calving, dry cow vs. fresh cow, milking, length of lactation

6. Milk

a. Basic nutrition facts

i. Fat, Protein, Minerals, Vitamins, Water, Lactose

7. Milking Processing

a. Milking on the Dairy

b. Creamery Production

8. Humboldt Dairying and Humboldt Creamery

Instructional Aid (Teachers/Students)

Instructional Aid for both the teachers and students are provided (See Appendix B and D). The Student handouts double a way for students to follow the information while in class and as a take-home study guide/parent informative. The handouts follow the information as it is given complete with pictures and fill-in spots for learning. The Teacher Curriculum Aid has all the information that is on the slides plus additional information to allow for better understanding and question answering. Possible questions are also listed with the answer to make presentation easier for the teacher.
Activities

Activities are the best way to engage a student and for them to remember the information. I used Cal Poly’s Learn By Doing approach while creating my curriculum. These activities are low cost, quick on time, fun and educational, and compliment the information being presented. In deciding on which activities to include I looked at the total impact, available resources in the classroom, time proven success, age appropriateness, and the reflection of the information being given.

Industry Contacts

Many teachers don’t know where to look for agriculture tours so provided the teachers with industry contacts corrects this problem. There are many people in the Humboldt County community that would love to give tours to students and teach them about the different commodities. One example is of a tour given of a dairy when I was in middle school. Many of the kids in my class had never been to a dairy and didn’t know much about dairies, even though they are surrounded by them. They never had a direct line to the dairy industry so they were never able to experience it. This project is to fix this problem. Some examples of the industry contacts I used for information and tours are listed below.

- Dave Renner- Local Ferndale Dairyman. He grew up in the industry and currently manages a dairy in Ferndale. He is also involved in Farm Bureau and California Milk Advisory Board (board member) and other various organizations.
- Katherine Ziemer- She is the Executive Director at the Humboldt County Farm Bureau. She has many contacts and access to companies from the top 3 industries
in our county. She also works directly with the local junior college organic farm and the managers.

- Carolyn Luster- She works in the office at Green Diamond, the major timber company in Humboldt County. She is also the one who sets up the tours given of their mill operation and the surrounding timber land. She is actively involved in other agriculture groups in the county and is very willing to help.

Summary

To create this project there many different parts that had to be created and thought out. Everything from the presentation style to the curriculum outline has to be specifically catered to the middle school students in Humboldt County. Factors such as cost for activities, availability of materials, time in class for the information to be taught, and reliable contacts all have to be taken into consideration. These materials will be easily accessible and user friendly for anyone to use.
Chapter IV

Results

The final product of this senior project is three different ready to teach curricula (Forestry/Timber, Horticulture/Nursery, and Dairy) for any middle school teacher in Humboldt County to teach to their students. The following is the information given to the teachers for the lesson plan. This information is called the Teachers Instructional Aid. The PowerPoint’s, student handouts, activity sheets, and the letter to the teachers can be found in the Appendixes A, B, C, and D.
The Teachers Instructional Aid

FORESTRY/TIMBER

1. The History of Logging in Humboldt County
   a. Logging in Humboldt County started in 1850 with a belt of Redwood Trees that reached 108 miles in length and anywhere between 2-20 miles wide. It would take about 5 years before the lumbermen realized the value of the Redwoods as they were used to the pine, spruce, and fir trees from their homeland areas.
   b. The first saw mill was on Humboldt Bay, the Papoose, and was opened in 1850 by Martin White and James Eddy. This mill lasted only 1 year, as did a few other first year sawmills.
   c. The first successful sawmill in the county was established on February 24, 1852 by James T. Ryan and James Duff. While attempting to expand, they tried many times to ship the Redwood lumber to San Francisco but each time their ships were destroyed during the voyage.
   d. A commission of loggers in 1852 got together to determine a ‘standard of measurement’ for the logs they were processing. They created different guidelines for how best to cut or ‘scale’ the trees depending on how long and wide each type of tree was. Redwood trees however are so large that they couldn’t use this standard on them and they were left up to the person scaling (cutting/milling) the tree to decide what was best.
   e. In 1854, nine mills were operating on Humboldt Bay. The Bay was a perfect location for sawmills because they could easily ship the lumber from the Bay
down the coast of California and it is close to the main logging areas in the county.

f. Humboldt County was ranked the second California County for lumber production in 1860, sawing 30,000,000 feet of lumber per year. Most of this lumber was shipped to San Francisco.

h. Redwood trees were so unique compared to the main trees that being used that they quickly became a high demand product. Good thing the average diameter of a redwood tree to be sawed at that time was seven feet, so they were able to meet the demand.

h. Today there are still several timber companies including Green Diamond and the Humboldt Redwood Company in Humboldt County.

2. **Type of Trees in California**
   
a. The following are the main trees found in forests around California:
   

b. We will focus on those trees most common in Humboldt County.

3. **Type of Trees Most Common in Humboldt County**
   
a. **Douglas-Fir**: These trees are found in British Columbia, Western Washington, Oregon, on the Coast of California, and parts of the Sierra Nevada. They are conifers, meaning they produce cones for reproduction. They produce these cones after about 12-15 years of growth. The needles on
a Douglas-Fir are flat and they have graceful, slightly drooping limbs. They provide a habitat and seeds for birds and small animals. Most likely, Douglas-Fir lumber was used to build most of your home.

b. **Redwood.** Redwood trees can be found in about a 450 mile long by 35 mile wide strip from Southwest Oregon all the way to Monterey County, California. These trees grow best in mild climates with annual rain fall from 25-133 inches and summer fog to help give them moisture in the summer months. Redwoods start producing cones after 5-15 years of growth. They produce these cones once a year and shed the seeds in the spring. They are known to be fire and disease resistant (not fire or disease proof though). They create habitats for many birds, mammals, amphibians and even fish. They are easily identified by the deep red color of both their bark and their wood. A unique quality the Redwood tree has is after the tree is cut, dormant buds can sprout from that stump and grow, sometimes up to 6 feet in the first year.

i. **The Immortal Tree-Redcrest California:** An example of how durable the Redwood tree is the Immortal Tree. This tree is on the Avenue of the Giants Highway in Redcrest. This almost 1,000 year old Redwood has survived lightning (which removed the top of it lowering the height from 298 ft to 258 ft) fire, floods, and a determined logger who tried to cut it down in 1908, but lost the battle to this 14.5 foot wide tree.

c. **Giant Sequoia.** Giant Sequoias are very similar to the Redwood tree. However, they are found only in the Western Sierra Nevada of California.
The majority of Sequoia trees are located and protected in the Sequoia National Monument and other national parks in the Sierra Nevada in Calaveras, Fresno, Madera, Mariposa, Tulare, and Tuolumne counties. They like areas with around 35-55 inches of annual precipitation and can tolerate cold winter conditions. These trees will grow for around 20 years before they start to shed seeds and also need events to cause the cones to open up and release the seeds. These events include fire, harvest of cones by chickarees (a type of squirrel), storms (tears off branches and cones), and the long-horned wood boring beetle. The seeds in the Sequoia’s cones need to be on mineral soil to germinate. The bark on the older Sequoias can get up to 20 inches thick, which helps protect the tree from fire damage. It provides a habitat for many animals, lives for thousands of years, and grows into a massive tree. There is a 2,500 year old Giant Sequoia that is over 275 feet tall and 27 feet in diameter.

**d. Sitka Spruce.** The Sitka Spruce is found in a narrow strip of Northern California up to Alaska. This tree does best in very moist soil and in shade. Sitka Spruce trees take about 20 years to start producing seed cones which are very thin with papery like scales. The bark is also thin and can be flaky with a purplish-gray color. They are very straight growing trees that are often swollen at the base. As these trees grow best along the ocean, they make great spots for bald eagles to nest in. The Sitka Spruces has a very high strength to weight ration which makes it the perfect choice for instruments such as pianos and guitar faces, and even for items such as ladders and boats.
e. **White Fir.** White Fir trees can be found from Central Oregon, through the mountains on the coast of California, south into the Sierra Nevada, and even on the northern most mountains in Mexico. They are also found in the Rocky Mountains. Their cones develop upright on the branches and disintegrate on the trees. Their seeds germinate after the snow melts. White Fir are shade tolerant and can survive under all the brush on the forest floor as they grow taller. Their needles have a ‘frosted’ look from below and the older trees bark has a mottled, or bacon-like, appearance after being taken off the tree. White Fir trees provide great cover and food for many forest animal species, is often used as Christmas trees, and the wood is common for construction as plywood and framing wood.

4. **Tools/Equipment**

a. **Chainsaw.** A portable power saw having teeth that are linked to form an endless chain.

b. **Hard hat.** A hat made of a hard material for protection

c. **Gloves.** A fitted protective covering for the hand with a separate part for each finger and the thumb.

d. **Tape measure.** A tape of cloth, paper, or steel marked off in a linear scale for taking measurements, in this case to cut the trees to length

e. **Hearing and eye protection.** Objects designed to cover ears or eyes to protect from loud noises or foreign objects.
f. **Wedge** - A piece of material, thick and one edge and tapered to a thin edge at the other, used for influencing the direction of the falling tree.

g. **Double headed axe** - A tool with a blade on both sides of the head on a handle used for felling trees or chopping wood/lims

h. **Chokers** - A tightly fitted steel cable, also called a steel noose. The cable wraps around the tree and is secured in the bell (lock) and tightens when pulled on. Used to move trees.

i. **Loader** - Front End Loader: A tractor with wheels and a claw like front end attachment used to pick up trees. Heel Boom: A log-loader on tracks which the end of a log being loaded with bears and is steadied as it is lifted and swung into position.

j. **Yarder/cat/skidder** - Yarder: A type of bulldozer that is stationary. Cat: A type of bulldozer that is on tracks. Skidder: A type of bulldozer that is on wheels.

k. **Forwarder** - A forestry vehicle that carries felled logs from the stump to the landing area (loading area).

l. **Feller Buncher** - A forestry machine that cuts the trees and lays them down into stacks to be sent to the landing area.

m. **Processor** - A forestry machine that removes the limbs (de-lims) and cuts the logs to the required length for transport.

n. **Cork boots** - Boots worn by loggers that are leather nail-soled boots that are used for traction in the woods.

o. **Fire box** - A fire prevention equipment box just in case a fire occurs while logging, possibly from the equipment.
p. **Logging trucks**- Semi trucks used to haul logs from the woods to the milling plants. They use Wrapper cables and binders to secure the logs to the trucks.

5. **The Uses of Trees**- Trees have many uses in life including providing a habitat for animals, cleaning the air, providing solid wood materials, and many by-products.

   a. **Habitat**

      i. Forests provide a habitat (the natural environment in which organisms live) for many animals and plants. Birds, squirrels, insects, fungi, bears, mountain lions, coyotes, rabbits, snakes, ferns, flowers, ivy and more live and depend on these trees for their home. Forests provide shelter for these animals and plants to live in addition to protecting them from the sun and rain. They also produce food for animals in the form of seeds, nuts, and sap, they provide a place for plants to grown on (fungi), and provide a large area for animals to roam. Forests also provide us with many recreational areas.

   b. **Carbon Cycle**- The Carbon Cycle is the cycle that carbon is exchanged among the biosphere, hydrosphere, and atmosphere.

      i. The Carbon Cycle is important for all life on earth. Trees play a huge part in this cycle. Trees take in carbon dioxide from the atmosphere (the gas pocket that surrounds earth) and store it in their wood. They use the carbon from the carbon dioxide and convert it into sugar, which is their main energy source for growth, and oxygen through a process called photosynthesis. The oxygen is then released back into the atmosphere.
Foresters are very careful not to cause deforestation because that causes a large release of carbon dioxide and too much carbon in the atmosphere is not good. Thankfully, forests in the United States are considered ‘net carbon sinks’, which means annual growth of our forests exceeds our annual harvest. As long as we are careful about logging our forest, we will keep our environment healthy.

6. Timber and By-Products

furniture. Trees also provide material for other products as well. These products include paper, charcoal, tarpaper, paper, pencils, matches, paper, and more. cosmetics, charcoal, food, and musical instruments. (Note: it's also used in peanuts.) Pine oil: energy from burning wood and as a wood polish.

7. Logging

a. Beginning Procedure

i. Before an area can be logged, a Timber Harvest Plan has to be made.
materials, impact assessment, any surveys of the land, and confidential archeological information.

iii. The Timber harvest Plan is submitted to Cal Fire, assigned a number and is given to the review team agencies (including Department of Fish and Wildlife, Cal Fire, Water Quality, etc). After the first review of the plan it is either accepted or not accepted for filing. If accepted, the review team conducts a pre-harvest inspection of the site within 10 days of filing. A second review is held 20 days after the Pre-harvest inspection and the directors make a decision on if the site can be logged or not within 15 days after a public comment session.

iv. The report contains many different reviews and concerns about the area. The factors that are looked into before logging include (not all listed):

1. Any impacts to the watersheds (affects Coho Salmon and Steelhead) or other bodies of water
2. Endangered species (especially owls) that live there
3. If there is a good reason to log that area and if it’s legal to log that area
4. All the State and Federal laws and regulations are being followed
5. How much is going to be harvested, when was the last time it was harvested, or if it’s an old growth habitat

v. As you can see lots of inspections and consideration is taken before a tree is cut.
b. Safety

i. Safety is a major concern when it comes to logging. Trees are very heavy and don’t always fall in the direction you want them to, so extra care is taken.

1. Every logger is required to wear a hard hat, eye protection, ear protection, safety vest, and gloves.

2. If there is strong wind that day then they will not log because the wind may cause the tree to fall in the wrong direction and either hurt someone or fall on top of other trees damaging them.

3. Rain is another safety factor. Not only can it damage the equipment over time, but it can cause blades to slide, jump, or get stuck, and other equipment malfunctions which can cause injuries.

4. Being aware of your surroundings is always a good safety precaution. In logging that means standing on the uphill side of the tree, look for falling limbs above you, making sure you have a clear escape path and that you don’t fall a log across that path.

c. Types and Styles of Logging

i. Type-The two most common types of logging in Humboldt County are Selective Cut Logging and Clear Cutting.

   a. Selective Cut Logging- Selective Cut Logging can be seen as a thinning type of logging. Specific trees are targeted for removal from the logging site based on various reasons. The reasons trees are removed are to give other trees more room
to grow, they are invading rivers/creeks/lakes and are hurting the ecosystem there, or if they have a diseases. This type of logging also can be used to make a site of trees all the same age, or make it more age uneven. They are careful about which trees they removed because the extra sun that now comes through the branches can shock a young growing seedling and can cause them to die or have their growth stunted.

b. **Clearcutting** - Clearcutting is where all of the trees in a small area are removed to create an open area. These areas quickly start to grow grasses and foliage for animals. Clearcutting is often seen as a bad thing, but it’s not. Clearcutting too many areas is bad, but it also allows for a forest to re-grow and heal. This type of logging is strictly regulated in California and the site has to qualify for clearcutting including having enough trees in that area of desirable age and size.

ii. **Styles** - The style of logging used at a logging site depends on the terrain of the area. The main types of logging used in Humboldt County are Yarding/High Line Logging, Tractor Logging, Helicopter Logging, and Auto Logging.

1. **Yarding/High Line Logging** - Yarding/High Line Logging is when the fallen tree is hooked to a cable system and the cable moves the logs to the landing (collection/pick up area). The
Yarding machine is stationary and has a skyline cable with chokers that are placed on the end of the log and the cable takes the log from the falling site to the landing area. This style is good for more uneven terrain.

2. **Tractor**- With Tractor logging, a Cat or Skidder clears a path through the brush from the landing area to the falling area. The Cat or Skidder then picks up each log individually and brings it back to the landing. These machines need flatter terrain to be operated safely.
d. **The Logging Process**- After the site has been approved to be logged, all the safety precautions have been taken, and the loggers are in place, the logging is ready to begin. The process is broken down into 5 steps: Felling, Extraction, Processing, Loading, and Trucking.

i. **Felling**- Felling is the actual cutting of the tree from the stump. This process used to be done manually with an axe or a big hand saw. Today either chainsaws or machine harvesters do most of the felling which is safer and much more time and cost efficient.

ii. **Extraction**- Extraction is the removal of the tree from the felling area to a landing area (the stacking and loading area). The actual process of moving the tree with a machine is called skidding. Machines such as a Yarder, Forwarder, or Helicopter are used for extracting the tree.

iii. **Processing**- Before the tree can be loaded on to the logging truck, it has to be processed. This involved taking the branches off the tree (de-limbing), taking the top off the tree, and cutting the tree into different sized logs (bucking) according to the mill they are going to. Processing can be done by a chainsaw but can also be done by a loader with an attached de-limber, or other similar machines.

iv. **Loading**- The loading process is when after the trees have been processed into movable logs, they will be sorted according to size, stacked, and then loaded onto the logging trucks. The load is then tied down and ready for travel.
v. **Trucking** - Logging Trucks are the only way for big logs to get to the milling plant. They have size and weight limits for the trees they are hauling for safety. The trucks have safety inspections every day and can haul many loads of logs per day as well.

8. **Sawmill**

a. When the logging trucks get to the sawmill they are unloaded and the logs are put on a holding deck until they are ready to be processed.

b. When they are ready to be processed the logs are cut to length (if not already cut to length). They are then placed in the debarker and all the bark is stripped off the logs.

c. They continue into the sawmill where they are scanned and a computer decides what the best board sizes to make out of that tree are. Each tree has a different diameter so each tree will produce different sizes of lumber.

d. Trees are round so not all lumber that is cut from the tree will be usable. These scraps are separated from the usable lumber and put in the chipper to be made into very small pieces for either particle board or to be sold as shavings.

e. The lumber is then separated by size and stacked. Sometimes the lumber is planed (smoothed and leveled), bundled, or dried outside or in a kiln. It depends on where that set of lumber is going for its second life.

9. **Reforestation**

a. All areas that are logged are required to be replanted after. The reason for replanting is to keep our forests growing and to prevent erosion.
i. Erosion is a natural process that breaks things (usually soil, rocks, boulders, etc) down into smaller parts. These parts are then easily washed away or moved by wind. Over time erosion can cause an area to be go bare so it’s unable to support vegetation. Erosion also causes the soil on the banks of rivers to wash into the water. It is important to know that erosion doesn’t make things disappear; it causes a mass movement of materials which are then settle in other areas. Erosion can also cause buildup such as in rivers. Too much erosion on the hillsides next to a river can cause a sediment buildup and affect the ecosystems in the river.

b. Many timber companies, such as Green Diamond, have their own tree nurseries that grow tree plugs for replanting their logging land. After an area has been logged, a large crew comes in and replants the area with seedling trees. They have a rule of replacing every 1 tree that is cut with 2 or 3 trees. Most companies choose to replant 3 trees for every 1 tree they cut. Planting more then they took increases the survival rate of the replacement tree and keeps our forests growing and healthy.

10. ACTIVITY’S FOR FORESTRY LESSON:
   a. Online Redwood slideshow video
      i. [http://www.humboldt.edu/natmus/redwoods/slideshow.html](http://www.humboldt.edu/natmus/redwoods/slideshow.html)
      ii. [http://www.humboldt.edu/natmus/redwoods/index.html](http://www.humboldt.edu/natmus/redwoods/index.html)
   b. Green Diamond forestry tour
      a. Green Diamond offers tours of their mill and forestry land in Korbel. You can email or call them to set up a time
i. California Timberlands Division, P. O. box 68, Korbel CA 95550, (707) 668-4400, grynearson@greendiamond.com or rschulte@greendiamond.com

c. The Forest Foundation Website also has more information and materials on California Forestry

d. The Humboldt Redwood Website also has some good videos on logging.

e. One long term classroom activity you can also do is provide each student with a Redwood tree for them to put in pots and grow for the rest of the year
   a. You can order Redwood trees (only about 6-12 inches tall)
      i. The Jonsteen Company
      ii. You can also talk to local loggers or Cal Fire on getting a donation of trees.
      iii. Green Diamond also produces tree plugs and would be another good place to contact about a donation for your classroom.
Forestry References


The Teachers Instructional Aid

NURSERY PRODUCTION

1. Plant Basics
   
a. **What is a seed**- A seed is defined as a small embryonic plant enclosed in a covering called a seed coat. In other words, seeds carry the beginning of a plant inside of them along with a food storage area for the growing seed.

b. **Parts of a plant**- Just like us, plants have many organelles, cells, tissues, and organs. The main organelles are the Cell Wall, Large Central Vacuole, and Plastids. The main organs are the Flower, Stems, Leaves, and Roots.

   ii. **Cell Wall**- Cell walls provide structure to each individual cell. That is what makes plant stems strong. It is made of a strong fiber matrix structure and contains a cell membrane inside. The membrane helps keep the wrong products from entering the cell.

   iii. **Large Central Vacuole**- The Large Central Vacuole is a membrane bound storage structure. It can take up a large part of the cell and helps to put pressure on the cell wall. They can also isolate harmful materials, contains waste products, and allow the plants to support the leaves and flower structure because of the pressure it creates.

   iv. **Plastids**- Plastids are organelles that are the site of manufacturing and storage of important chemical compounds that are needed by the cell for food. There are many different Plastids in a cell and each one is defined by what they do. The major one is the Chloroplast.
1. **Chloroplasts** - Chloroplasts capture the sun’s light energy and store it while releasing oxygen and water.

v. **Plant Organs**

1. **Flower** - The flower is the reproductive part of the plant; they produce seeds which are the next generation of the plant. Flowers can be male, female, or both. The male flowers produce pollen and are called Stamen. The females receive the pollen either through the wind, birds, bees, or other insects and are called the Pistil.

vi. **Stem** - Stems provide support for the plants, storage for nutrients and energy, and provide a way to move the materials the plant needs throughout the plant.

vii. **Leaves** - Leaves are where the majority of plant’s gas exchange takes place along with Photosynthesis, which is the process of taking the sun’s light energy and turning it into energy for the plant to use.

viii. **Roots** - Roots are what provides the plant support, like an anchor on a ship. They also store excess materials, absorb water and minerals, and even make specific compounds a plant might need.

2. **Plants’ Needs** - Just like us, plants have certain requirements in order to live. They need water, air, nutrients, and sunlight.

a. **Water** - Plants need water for growth and to stay alive. The growing tissue of plants is usually made up for 80-95% water. Plants lose water through a process
called transpiration, which is a way for plants to cool themselves and for mineral movement throughout the plant. The amount of water available in a plant also affects a plant's strength and resistance to stress from insects and/or diseases.

b. **Air**- Plants need oxygen from the air. They need the oxygen for a process called respiration, which is the conversion of carbohydrates, fats, and proteins into usable energy. The breakdown of the sugar (the usable energy) into energy requires oxygen as well.

c. **Sunlight**- Sunlight is needed for photosynthesis, which is the process of converting light energy into chemical energy, or sugar. This process takes carbon dioxide from the atmosphere, light energy, and electrons and turns them into carbohydrates and oxygen. The oxygen is then released back into the atmosphere.

d. **Nutrients**- Many nutrients are needed to keep a plant strong and healthy. The essential nutrients for plants are nitrogen, potassium, phosphorus, calcium, magnesium, sulfur, iron, boron, zinc, copper, chloride, manganese, and molybdenum. Soil or soilless media are the main source of nutrients. Different soils contain different levels of each. Fertilizers are additives that contain different percentages of Nitrogen, Potassium, and Phosphorus which are needed for growth. These fertilizers can be added to soil mediums if needed.

3. **Planting Mediums**: Every plant needs something to grow in that helps provide the plant water, nutrients, and structure to grow in. There are three different mediums (a substance
through which something else is transmitted or carried) to grow plants in: Soil, Soiless Media, and Hydroponics.

a. **Soil**- Soil is a dynamic natural body composed of minerals and organic solids, gases, liquids, and living organisms which can serve as a medium for plant growth

b. **Soiless Media**- Medium for plant growth that does Not contain any natural soil. Instead it contains other material such as moss, sand, bark, and even rocks. There are many different types of soilless media including seed mixes, cutting mixes, greenhouse mixes, and nursery mixes.

i. **Peat moss**- Peat moss is partially decomposed moss, usually a moss called sphagnum. Peat moss is used in soilless media because it can hold a lot of water and is good for nutrient retention.

ii. **Sand**- Sand is weathered mineral particles, just like the sand you find on the beach. Sand is used as soilless media because it adds weight to the material that keeps the plant in place and allows for a lot of water drainage.

iii. **Perlite**- Perlite is a volcanic glass/rock that is crushed and treated with high heat to make it expand. It is usually formed from a volcanic rock called obsidian. Perlite is used in soilless media because it is very light weight, holds water well, and allows space for air in the medium.
iv. **Vermiculite**: Vermiculite is a mineral, usually from mica, that is heat treated to expand for use in soilless media. Vermiculite is very lightweight, holds a lot of water, and holds nutrients well too.

v. **Composted bark**: Composted bark is tree bark that is shredded and composted. It is very light weight and creates drainage in the potting mix.

vi. **Coir**: Coir is a natural fiber that is extracted from coconut husks. It is not very common in the use of soilless media because it is very expensive and can be high in salt which is bad for plants. Coir holds both water and nutrients very well.

c. **Hydroponics**: Hydroponics is a method of growing plants in either water or a nutrient solution without soil. Sometimes, for structural support only, perlite, gravel, mineral wool, clay pebbles, or coconut husk may be added to the growing solution.

4. **Life Cycle of Plants**: Not all plants take the same about of time to grow, develop, flower, and die. There are three different life cycles of plants: Annuals, Biannual, and Perennials.

a. **Annual**: Annual plants complete their life cycle in one year or less. This means in one year or less they grow, set seed, and die.

b. **Biannual**: Biannual plants are plants that take one year to grow, bloom, and set seed. It is not until the second year the plant dies.

c. **Perennial**: Perennial plants are plants that will bloom and set seed each year for three or more years.
5. **Nursery Production** - Nursery production of plants is very different from plants growing in nature. They often grow plants from cuttings of a plant and from grafting, the combining of tissues of one plant with the tissues from another plant in addition to growing from seeds.

   **a. Different ways to grow plants**

   i. **Sowing seeds** - Plants grown from seeds are the traditional way for plants to be grown. The seed needs soil contact, water, either light or dark (depending on the seed), and either cold or warmth (depending on the seed) in order to start to grow. Each seed needs to meet specific requirements to start the growing process. Growing plants from seeds is the best way to make sure that the plant species stays disease resistant.

   ii. **Cuttings/Propagation** - Another way plants are grown in nurseries are by cuttings. Parts of the growing mother plant are cut, usually new growing tissue with regenerating vegetation (part of the plant that can re-grow what was lost), and are then placed in a growing medium. These cuttings are placed in humid areas which help promote root growth. Cuttings keep the best traits of the mother plant, but increase the risk of disease.

   iii. **Grafting** - Grafting is a very unique and difficult way to not just grow a plant, but to combine two plants together. In this process, tissues from two different plants are fused together into one plant. The plant tissues

Nursery Production Lesson: Page 6
have to be compatible for the graft to work. There are many different ways to graft a plant and it is very hard to get the tissues to line up right. Reasons for grafting include creating a stronger and more durable trunk for some orchard trees, having more than one type of fruit on the same tree, or even to repair damage to a trunk.

6. **Facilities**- Nurseries use structures to modify the growing environment and climate for plants to both increase and control growing rate, grow seasonal plants year round, and to provide the best growing environment for the plants. There are many different types of structures but the main two are the Greenhouse and the Shade house.

   a. **Greenhouse**- A Greenhouse is a glass or plastic house/building who’s heating, cooling, and ventilation are completely controlled. They are very hot and humid because solar light enters the building warming the air which is trapped in the building by the glass/plastic. Greenhouses can create the perfect environment for plants, especially when mist is added to the building to increase the available water in the air.

   b. **Shade house**- A Shade house is a frame covered with a cloth, woven material, or wooden strips (lath strips). The cloth provides protection for the plants from rainfall, wind, and too much sun. The lath strips run north to south so the sun hits all parts of the plants during the day. These strips protect the plant from any extreme rain, wind or sun.

7. **Main Nursery Production in Humboldt County**

   a. **Sun Valley Farms**- Sun Valley Farms is the largest nursery growers of cut bulb and field flowers in the United States. The company began in Myrtle Point, Oregon by a
high school Agriculture teacher and a student with five acres of Irises and a row of
Daffodils.

b. The Arcata division is the largest growing operation and headquarters for the
company. The Arcata farm was purchased in 1969. By 1996 the farm had become a
nationwide leader in Lilies, Irises, and Tulips. Our environment of mild winters, cool
summers, humidity, and moderated sunlight makes Humboldt County perfect for
growing bulb flowers. The fields in Arcata grow Lilies, Iris, Tulips, French Tulips,
Freesia, Hyacinth, and Hydrangeas.

8. ACTIVITIES FOR THE CLASSROOM

a. The easiest activity for the students to do is to plant a young plant, and see how much
it grows in the next few weeks. With this activity they are able to take the plants
home with them after. You can talk to stores such as Nilsen’s or the garden section at
Ace for donations. Sun Valley farms can also be asked about donations.

b. The Lima Bean Experiments—There are 2 different activities you do with lima
beans

i. Exploding Jar

a. Lima beans are grown in sand in sealed jars. The pressure from them
growing makes the glass crack. The activity handout has the
instructions.

ii. Seed Germination

a. Lima beans are separated from the wet paper towels so students can
easily see the growing roots. The activity handout has the instructions.
Nursery References


The Teachers Instructional Aid

DAIRY

1. What is a Dairy Animal?

A dairy animal is an animal (bovine) that is used for the production of milk and other products that come from dairy milk.

a. Common Terms


iii. Colostrum: The first milk a cow produces and a calf drinks. It is a very thick milk and is full of antibodies for the calf.

iv. Cow: An adult female dairy animal that has had a calf.

v. Dam: The mother of a dairy animal

vi. Dry Cow: A cow that is within two months of giving birth. Her milk production stops and her udder “dries” up before producing colostrum.

vii. Fresh Cow (Freshening): A cow that has just given birth.


ix. Lactation: The stage of a cow’s life where she is producing milk after calving. The lactation length standard is 305 days.

x. Milking Machine (claw): The device used to extract and collect milk from the mammary gland in a milking parlor.

xi. Milking Parlor: The building the animals are milked. Also holds the storage tanks and other equipment necessary for milking.

xii. Parturition: The act of giving birth

xiii. Sire: The father of an animal
xiv. **Teat:** The part of the udder that releases the milk.

xv. **Udder:** The location of milk production in a cow

2. **Breeds:** There are 6 main breeds of Dairy animals: Holstein, Jersey, Guernsey, Brown Swiss, Ayrshire, and Milking Shorthorn

   a. **Holsteins:** Holsteins are the most well known dairy animal. They are very large animals and are most recognized for their typical black and white coloring; although there are also red and white Holsteins, they are not nearly as common. Of the over 9 million dairy cows in the U.S. approximately 90% of them are Holsteins. The breed originated in the Netherlands about 2,000 years ago from breeding the Batavian cattle with the Frisian cattle to create a breed that would make the best use of the land in that area. They came to America when Winthrop Chenery purchases a Holstein cow in 1852. The cow was such a good producer that more started to be imported to America. At birth a Holstein calf weighs about 90 lbs and grows to be about 1,500 lbs and 58 inches tall (4.8 feet) at the shoulder. Holsteins have the highest milk production (they make more milk) of all the breeds and can produce around 23,000 lbs. of milk (2,674 gallons) of milk each lactation period.

   b. **Jersey:** Jerseys are the second most common breed in the United States. They are the smallest in size, fawn in color, and are known for their large brown eyes and a ‘dish’ shaped head. They originated on the Island of Jersey in the English Channel off the coast of France. They are the oldest known dairy breeds with records dating back to 1771. They are favored for their high butterfat percentage and protein percentage in their milk, and the...
large quantity of milk they produce. This high butterfat percentage means their milk is perfect for the production of cheese. In fact, the extra protein in the milk is the reason why Jersey milk yields the largest amount of cheddar cheese. This yield is 12.35 pounds from 100 pounds of milk compared to the average of 10.04 pounds of cheese from 100 pounds of milk. When born, Jersey calves weigh an average of 60 lbs and grow to about 1,000 lbs. The Jersey breed is very heat tolerant and adapts well to any climate conditions. It is said that an average Jersey in the United States can produce about 16 times her bodyweight each year.

c. Guernsey- Guernsey’s originated from the Isle of Guernsey, which is a tiny island in the English Channel off the coast of France. They were developed from breeding the Norman Brindles with the Froment du Leon breed from Brittany. The Guernsey breed came to America in 1840 with Captain Belair to New York. They are a fawn and white color, often seen more orange in color then fawn, and about five feet tall at the shoulder. Guernsey’s are known best for their “Golden Guernsey” milk. Their milk has a golden tint to it because of the high concentration of beta-carotene (converted into vitamin A), which also gives carrots their color, in their milk.

d. Brown Swiss- Brown Swiss originated in the Swiss Alps and are well adapted for high altitudes and hot or cold climates. They are very docile and have strong feet and legs which made them the perfect breed for the mountain terrain. In other countries, Brown Swiss is still considered a dual purpose breed, meaning they are used for both milk and meat production. In the United States however, Brown Swiss are not dual purpose and are raised
for milk production. Their color ranges from white, light brown, brown, dark brown, and brown/black. They are very large animals known for their big brown eyes and huge ears. They produce large volumes of milk which is good for cheese-making, and have the ability to yield high fat-to-protein component ratios. An interesting fact about Brown Swiss is that almost all Brown Swiss alive today can be traced back to one cow, Jane of Vernon, who is considered to be the ‘Mother of the Brown Swiss Breed’.

e. Ayrshire- The Ayrshire originated in the County of Ayr in Scotland way before 1800. They were first called the Cunningham, then Dunlop before the name Ayrshire finally took hold. They were established by crossing some types of cattle from Europe with the native cattle of Scotland which created an animal perfect for the climate in Ayr who was a good grazer with milk ideal for the Scottish dairyman’s butter and cheese production. Ayreshires are red, reddish-brown mahogany which varies from light to dark, and white in color. Sometimes they will have a speckled pattern and were known for their horns that would reach a foot or more in length. Ayreshires are of medium size and their milk has a moderate percentage of butterfat and relatively high in protein.

f. Milking Shorthorns- Milking Shorthorns originated in Northeastern England in the Valley of the Tees River, however the significant breed changes took place in Northumberland, Durham and York. Milking Shorthorns are known as one of the oldest breeds in the world. They are red, red and white, white or roan in color. This docile breed was also seen as a dual purpose breed, today’s animals have become more dairy like are disease
resistant. They’re milk is known to have a good protein-fat ratio which is
good for cheese production.

3. Dairy Products- When people think of dairy products, the main products they think of
are fluid milk, cheese, and ice cream. There are many other products made out of milk
too. The following are the most common dairy products (not all products or by-products
will be listed):
   a. Fluid milk-This includes fat-free, low fat, whole, reduced fat, flavored milks
      buttermilk, and lactose-reduced/free milks (only if from dairy cows)
   b. Puddings
   c. Frozen yogurt
   d. Ice cream
   e. Yogurt
   f. Cheese-Such as Cheddar, Mozzarella, Swiss, Parmesan, and Jack
   g. Cottage cheese
   h. Powder milk
   i. Evaporated and Condensed milk
   j. Butter
   k. Cream
   l. Sour cream

4. Basic parts and functions- It is important to know the parts of a cow so you know how
milk is produced. Cows have some of the same body parts we do such as a throat, jaw,
thigh, and hips. Other parts of them are different, such as their stomach and those specifically for milk production.

a. Milk Production Body Parts:

i. Udder- The udder is where the milk is produced. Each cow has one udder with four separated quarters.

ii. Fore Udder and Rear Udder- The Fore udder is the half of the udder that is closest to the head of the animal, and the Rear udder is the half closed to the tail end of the animal. Both produce milk and there isn’t much of a difference besides location and size.

iii. Both Fore and Rear udder attachments- This is where the udder attaches to the cow. You want the fore (front) attachment to be nice and smooth, and the rear (back) attachment to be high and strong. This keeps the cow’s udder under her body and prevents injuries such as being stepped on because of how close to the body the attachments are.

iv. Suspensory Ligament- This is the large cleft you see on the back of a cow’s udder. This ligament is what holds the udder high on the animal and keeps it from dragging on the ground. As a cow gets older, this ligament stretches out.

v. Teat- The teat is where the milk comes out of the udder from either a calf nursing or from a milking machine.

vi. Mammary veins- Milk production needs lots of blood circulation and oxygen to operate correctly. The mammary veins are large veins that bring a large amount of blood to that area so the milk can be produced.
b. **The Stomach of a Cow** - A cow is a ruminant. This means they eat and digests plants then regurgitates and re chews the plant material (cud) before complete digestion. A cow has one stomach with four parts called the Rumen, Reticulum, Omasum, and the Abomasum.

i. **Rumen** - The rumen is the first compartment of the cow’s stomach. It can hold up to 50 gallons of material and is designed to digest high fiber feed. The rumen ferments (breaks down) the feed and either absorbs the nutrients or brings the fermented feed, called cud, back to the animals mouth to be chewed to be broken down more before further absorption.

ii. **Reticulum** - The reticulum has a honey-comb appearance and is the second compartment of the cow’s stomach. It functions very much like the rumen as it breaks down plant cells into usable nutrients for the animal.

iii. **Omasum** - In this compartment, water is added to the digesting material and then is reabsorbed along with some of the nutrients from the feed.

iv. **Abomasum** - The Abomasum is considered the ‘true stomach’ of the cow as it is the closes compartment to a non ruminant, such as you. The Abomasum is very acidic and breaks down the proteins for absorption in the intestines.

5. **The Life of a Cow**

a. **Born**

   a. The journey of a cow starts like everything else, being born. When they are born they are called calves. The female calves are taken away from the mother for safety. There is a high chance of injury from being
stepped on and of getting sick if the calf stays with its mom. Instead, they are taken into their own clean pens a few hours after being born. Bull calves are either raised by the dairyman for breeding stock or are sold at auction yards.

b. They are fed colostrum from their mom, which is a thick yellow milk full of antibodies from the mom which will help develop the calf immune system. They are fed colostrum for 3 days and then switched to milk or a milk replacer, depending of the dairyman. Most will wait 2-3 weeks before placing the calf on milk replacer. When born, calves stomachs are still developing and are unable to digest solid foods. The milk they drink skips the Rumen compartment of their stomach. At around 5 weeks, calves are introduced to hay, grain (a mixture of grains such as corn, wheat, and barley) and water. After 8 weeks the calves are weaned, which means they are taken off milk completely.

c. During these 8 weeks the calves are dehorned for safety reasons, ear tagged for records, and branding for herd identification. At this young of an age the calf doesn’t remember any of the pain.

b. Yearling

a. When the calf is one year old they are called a yearling. At this stage they are still growing but are getting close to their mature weight. They are usually put in groups with other calves around the same age. During this time a vet will come and vaccinate the animals against deadly diseases. They are watched to make sure they are growing and

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healthy animals. Some farmers will send these animals to farms that specialize in raising animals to mature weight.

c. 2 year old Cows

a. A 2 year old cow has just had her first calf and is also called a first year heifer. After having their calf, they produce colostrum for the first week to pass on their antibodies to their calf. After that they will produce regular milk. The colostrum stays separate from the rest of the milk supply and is sometimes frozen to make sure the dairyman always has good colostrum ready for a new born calf.

b. A cow will produce milk for around 305 days. During that time the cow is bred again about one or two months after calving. Two months before they calve they will be “dried off”. This dry off period is when the cow stops producing milk and store fat for producing milk after caving again.

d. Mature Cow

a. A cow is considered mature when she has had her third calf. When producing milk she is milked twice a day and produces and average of 7 gallons of milk in one day but can produce up to 12 or more gallons of milk a day just after calving. She will live on the dairy for as long as she is healthy and able to produce milk.

6. Milk

a. Milk’s main components are Fat, Protein, Minerals, Vitamins, Water and Lactose.
i. The **fat** in milk is a good source of energy.

ii. **Protein** is the building block for every part of our bodies. The protein you consume in milk will go towards building strong muscles.

iii. **Minerals** such as Calcium, Phosphorus, and Potassium. Calcium is what makes your bones strong and without it your bones lose their mass. Milk is an excellent source of calcium. Phosphorus and Potassium are needed for our body’s everyday chemical reactions within our cells.

iv. **Vitamins** A, B, D, E, and K are in milk. Vitamin A is needed for your vision, Vitamin B is important for many of our cellular processes such as energy metabolism, Vitamin D is what allows Calcium to be absorbed in the body, Vitamin E is needed for hair and skin growth and health, and Vitamin K is needed for blood clotting.

v. **Water** makes up the majority of milk, 87.5% of it in fact.

vi. **Lactose** is a naturally occurring sugar in milk. Milk is actually the only place lactose is made. That is what gives milk its sweet taste.

7. **Concerns About Milk**

   a. One of the many concerns about milk is if antibiotics and added hormones are in our milk. The answer is **no**. All milk is tested before being processed for any antibiotics, added hormones in the milk, or anything else that shouldn’t be there. If they find traces of antibiotics or added hormones that load of milk is removed, disposed of, and the farmers are fined.

   b. rBST is also a concern. rBST is a man made hormone based off of the natural occurring growth hormone BST produced in the animal. There are not many dairymen who use rBST and those that do use it appropriately. No traces of rBST
are ever in milk because the body uses the injected hormone before it has a chance to get to the milk.

8. Milk Processing
   a. Milking on the Dairy
      i. Twice a day the cows on a dairy are milked in the Milking Parlor. Some dairies even milk 3 times a day. When they enter the barn they are in a large open holding pen until it’s their turn to be milked. Most cows naturally head to the milking barn at the same time of every day. If a cow who usually is the first in the barn comings in towards the end, the dairyman knows that something may be wrong. Once they are in the milking stall their udders are rinsed and dried. Teat dip, an iodine sanitation solution, is applied and rinsed off for sanitation. The milking machine is then attached to the udder by the milking machine claw. The claw is how the milk is taken from the udder. It mimics the sucking motion a calf does when nursing. Once they are done being milk the teat dip is up on and left on to keep any bacteria out of the teat. The milk is then put into a milk tank, is cooled, and waits for pickup.
      ii. Milk trucks from a creamery come to the dairy every day, takes the milk, and the milk is tested for any problems it might have. If it passes the test the milk is then ready for processing.

   b. Creamery Production
      i. Standardization
         a. When buying items from a store, consumers want their product to be consistent. For milk to be consistent in taste and texture it
undergoes Standardization. The milk is separated into the skim portion and a cream portion of the milk. The cream portion of the milk is added back in depending on the type of milk being produced to create a 1%, 2%, low fat, or whole milk product.

ii. **Pasteurization**
   
a. Pasteurization is done to make sure the milk is safe to drink. The fluid milk is heated to 161°F for 15 seconds. This process makes sure that the milk is safe from any microbes that may make it unsafe to drink and it extends the shelf life.

iii. **Homogenization**
   
a. The natural fat in milk is in non-uniformed size globules and can cause the cream to separate from the fluid. Pasteurized milk doesn’t have to be homogenized but this process helps keep the milk from going bad. This process also reduces the fat size which allows for even distribution in the milk and improves the texture of the milk. This process uses high amounts of pressure to change the fat globule sizes.

iv. California’s milk standards are the highest set of standards in the United States. All of the milk produced in California is labeled with the Real California Seal.

9. **Humboldt Dairying and Humboldt Creamery**
   
a. The dairies in Humboldt County are different than the dairies in the rest of the state. Humboldt dairies are pasture based while the rest of the dairies are not.

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Pasture based means that the cows are house in pastures all year long instead of having to stay in barns or feed lots. Our climate allows for our dairymen to keep their cows out of the barns almost every day of the year. Although in times of bad weather the cows will stay in the barns to keep them warm and dry.

b. **Humboldt Creamery** began in 1929 by Peter Philipson when he and 152 dairy families contributing $0.10 per cow to start the Humboldt Creamery Association. One year later, in 1930 the plant was opened for business.

c. **Humboldt Creamery** produces fluid milk, butter, cheese, and ice cream, but is most well known for its ice cream production. The Costco brand Kirkland’s gallon size of vanilla ice cream is Humboldt Creamery ice cream.

d. When driving over Fernbridge you pass right by the creamery. The big pond you see next to the creamery is actually a waste water cleaner tank. Every day the processing machines and hoses get washed and cleaned. The water that is used to wash everything is put into that pond and gets recycled to be used again.

e. Humboldt Creamery started out as a Cooperative owned by the dairy family but was bought by Foster Farms in 2009.

**ACTIVITIES FOR THE CLASSROOM**

1. **Ice Cream**
   
a. This is a quick and easy activity for students to do. It does cost money to buy the ingredients, but you may be able to get a local grocery store to donate part of them.
      
i. The information for this activity is on a handout to give to students and that can be taken home.

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2. Dairy Princess

a. The California Milk Advisory Board sponsors a contest called the Dairy Princess Contest. The winner, the Dairy Princess, goes to schools and classrooms teaching about the importance of milk, and often brings a calf for the students to pet. If you are interested in having your local Dairy Princess come to your classroom contact Mary Ann Renner at (707) 725-9497 or you can contact them via their Facebook page: https://www.facebook.com/dairy.princesscontest?ref=ts&fref=ts

3. Mobile Dairy Classroom

a. The Mobile Dairy Classroom is sponsored by the Dairy Council of California. They go to schools and teach the kids about the anatomy, how milk goes from a cow to their fridge, and the agriculture technology used. The mobile classroom also brings a dairy cow with them that the students are able to pet too. You can fill out a request form; however the mobile classroom only goes to a school about every 3 years, so it is suggested to team up with other teachers and other grades for this activity.

i. http://www.healthyeating.org/Schools/Mobile-Dairy-Classroom/Check-Availability.aspx
Dairy References


Chapter V

Conclusion

Summary

Overall, this project has addressed both problems of having a lack of basic agriculture education in our middle school system and how students don’t know about the top agriculture commodities that are grown in their own counties. The curriculum created in this project has taken the top three commodities of Humboldt County and combined them into easy lesson plans, complete with a PowerPoint, Student Handouts, and a Activity Handout that are ready for teachers use. The lesson plans can be delivered to the class in one easy lesson and won’t take time from the other curriculum the students need to learn. The lesson plans will need to be updated in a few sections but most of the information is basic production, equipment, and procedure. For the teachers to get the PowerPoint’s they will need to contact the author so they can be sent. Later on an easier or more assessable way for the PowerPoint’s to be used will be addressed and figured out. For now however, they will be emailed to the teacher.

Conclusion

When starting the project the goal was to have the finished lesson plans/curriculum given to a class to see what information was easy for them to understand, what information needed to be reworked, any spots that needed removing or more information added in, and if it was easy for the teachers to follow and present. This was unable to happen because the time frame the teachers who agreed to give the lessons had didn’t not work with the completion time of the project. However, this project was made to be a long term project and they agreed to try the
information in the next school year. The teachers readily agreed to add agriculture curriculum to their lesson plans which is a very encouraging reaction to receive. After the curriculum has had a test run and been revised, the Humboldt County Farm Bureau will be contacted to see if it can included with their supply of curriculum so teacher have easy access to it. Another aspect that wasn’t able to be done, but will be slowly changed over time is the pictures on the PowerPoints. Eventually, the photos will be changed out with photos that were taken personally so they are more specific for each slide. With an easy to use curriculum the hope is that more and more middle school teachers will be willing to broaden their student’s education by include one of the top industries in the United States.

**Recommendations**

It is recommended that this curriculum in used in middle schools in Humboldt County as that is the county this curriculum is tailored for. This curriculum can also be used as a promotional tool for other agriculture programs such as 4-H, FFA, and even Farm Bureau’s Ag in the Classroom program. It is also recommended for the teachers who do use this curriculum to reach out to the community to find producers willing to give tours, speak to the class, or provide more information. Contacting local agriculture organizations will provide the teachers with producers willing to help.


Appendix A

PowerPoint

(see following pages)
Humboldt County’s Forestry Industry
The History of Logging in Humboldt County

- Logging in Humboldt County Started in 1850
- The Redwood Trees reached 108 miles in length and anywhere between 2-20 miles wide
- The first sawmill on Humboldt Bay was Papoose
- The first ‘Standard of Measurement” for logs was created in 1852
- After four years of logging in Humboldt 9 sawmills were operating on Humboldt Bay
# Types of Trees in California

The main trees found in California are:

- Douglas-Fir
- Incense-Cedar
- Jeffery Pine
- Lodgepole
- Ponderosa Pine
- Redwood
- Giant Sequoia
- Red Fir
- Sitka Spruce
- Sugar Pine
- White Fir
Types of Trees in Humboldt County
Douglas-Fir

- Found in British Columbia, Western Washington, Oregon, on the coast of California, and parts of the Sierra Nevada
- Produce cones after 12-15 years of growth
- Most likely a Douglas-Fir tree was used to build part of your home
Types of Trees in Humboldt County
Redwood

- Found in a 450 mile long and 35 mile wide strip from southwest Oregon to Monterey California
- Produce cones after 5-15 years of growth
- They are known to be fire and disease resistant
- Buds can sprout from the stump of a cut Redwood and grow into a new tree
- The Immortal Tree in Redcrest California is a Redwood tree that has survived fire, lightning, floods and logging
Types of Trees in Humboldt County
Giant Sequoia

- Found only in the western Sierra Nevada of California
- Most Giant Sequoia trees are protected in National Parks
- They need an event such as fire, storms, squirrels, or wood boring beetle to shed their seeds
- The bark on older Sequoia trees can get up to 20 inches thick which helps protect the tree from fire damage.
- There is a 2,500 year old Sequoia that is over 275 feet tall
Types of Trees in Humboldt County
Sitka Spruce

- Found in a narrow strip from northern California up to Alaska
- They take 20 years to produce seed cones which have papery scales
- The bark is thin and sometimes a purplish-gray color
- These trees grow best by the ocean and make good homes for bald eagles
- Their wood is often used for making instruments such as pianos and guitar faces.
Types of Trees in Humboldt County

White Fir

- Found from Central Oregon, Coast of California, Sierra Nevada’s, and the northern part of Mexico
- Their cones develop upright on branches and disintegrate on the trees
- Their needles have a ‘frosted’ look from below
- Older trees bark will have a mottled, or bacon-like, appearance after being taken off
- White Fir trees are commonly used as Christmas trees
Tools and Equipment

- **Chainsaw** - A portable power saw having teeth that are linked to form an endless chain.

- **Chokers** - A tightly fitted steel cable, also called a steel noose. The cable wraps around the tree and is secured in the bell (lock) and tightens when pulled on. Used to move trees.

- **Loader** - Tractors that are used to pick up trees and move them.

- **Yarder/cat/skidder** -
  - Yarder: A type of bulldozer that is stationary.
  - Cat: A type of bulldozer that is on tracks.
  - Skidder: A type of bulldozer that is on wheels.
Tools and Equipment

- **Processor**: A forestry machine that removes the limbs (de-limbs) and cuts the logs to the required length for transport.

- **Logging trucks**: Semi trucks used to haul logs from the woods to the milling plants. They use Wrapper cables and binders to secure the logs to the trucks.
The Uses of Trees-Habitat

- Habitat: the natural environment in which organisms live
- Forests provide a habitat for many animals and plants such as birds, squirrels, insects, fungi, bears, coyotes, rabbits, ferns, flowers
- Forests provide housing, food, and shelter from the rain, wind, and sun for the plants and animals
The Uses of Trees-Carbon Cycle

- Carbon Cycle: The cycle that carbon is exchanged among the biosphere, hydrosphere, and atmosphere
- Trees take in carbon dioxide from the atmosphere and store it in their wood
- They use the carbon from carbon dioxide and convert it into sugar
- Sugar is a tree's main energy source
- The conversion process of carbon to sugar makes oxygen
- The oxygen is released back into the atmosphere
The Uses of Trees - Lumber and Timber By-Products

- Lumber from trees are used for structural lumber pieces such as building houses and furniture

- They also provide many other by-products:
  
  - Paper, books, toilet paper, postage stamps, candles, crayon wax, cosmetics, corks, food cartons, musical instruments, toys, fruit, nuts, energy
Logging-The Timber Harvest Plan

- The plan is submitted to Cal Fire and reviewed by team agencies, including Department of Fish and Wildlife.

- A pre-harvest inspection of the logging site is done 10 days after submission.

- A second review is done 20 days after the pre-harvest inspection.
Logging-The Timber Harvest Plan

- This plan must contain information such as:
  - Any impacts to the watersheds or other bodies of water
  - Endangered species (especially owls) that live there
  - If there is a good reason to log that area and if it’s legal to log that area
  - All the State and federal laws and regulations are being followed
  - How much is going to be harvested, when was the last time it was harvested, or if it’s an old growth habitat
  - And much more information to make sure the land is not harmed
Logging-Safety

- Safety is very important when you are around huge trees that are falling.

- Basic logging safety includes:
  - Hard hat, eye protection, ear protection, safety vest, and gloves
  - No logging on strong wind days
Logging-Safety

- No logging during rainy season or storms
- Be aware of surroundings:
  - standing on the uphill side of the tree
  - look for falling limbs above you
  - making sure you have a clear escape path
  - and that you don’t fall a log across that path
Types and Styles of Logging

**TYPES**

- **Selective Cut Logging:**
  - Specific trees are targeted for removal from the logging site based of various reasons.
  - Give other trees more room to grow, invading rivers/creeks/lakes, or have a diseases.

- **Clearcutting:**
  - When all of the trees in a small area are removed to create an open area.
  - These areas start to grow grasses and foliage quickly
Types and Styles of Logging

STYLES

- **Yarding/High Line Logging:**
  - The fallen tree is hooked to a cable system and the cable moves the logs to the landing (collection/pick up area).

- **Tractor**
  - A Cat or Skidder clears a path through the brush from the landing area to the falling area.
  - The Cat or Skidder then picks up each log individually and brings it back to the landing.
Types and Styles of Logging

STYLES

- Helicopter Logging
  - A long cable with a choker at the end of it is attached to the log to the and the helicopter flies the log to the landing area.

- Auto Logging
  - The machine cuts, de-limbs, cuts to length, and stacks the logs
The Logging Process

- **Felling**
  - Felling is the actual cutting of the tree from the stump.

- **Extraction**
  - Extraction is the removal of the tree from the felling area to a landing area (the stacking and loading area).
The Logging Process

- **Processing**
  - De-limbing, taking the top off the tree, and cutting the tree into different sized logs (bucking).

- **Loading**
  - The loading process is when after the trees have been processed, sorted, and loaded onto the trucks.

- **Trucking**
  - Logs are loaded onto the trucks and go to the sawmills.
The Sawmill

- Logs are unloaded onto a holding deck
- First the logs are cut to length, size depends on the mill
- Next they are scanned and a computer decides what the best board sizes to make out of that tree
- Trees are round so not all lumber that is cut from the tree will be usable
The Sawmill

- Unusable lumber will be separated from the usable lumber

- These pieces are put in a chipper and made into very small pieces for either particle board or to be sold as shavings

- The lumber is then separated by size and stacked

- Sometimes the lumber is planed (smoothed and leveled), bundled, or dried outside or in a kiln.
Reforestation

- All areas that are logged are required to be replanted after.
- The reason for replanting is to keep our forests growing and to prevent erosion.
- Erosion is a natural process that breaks things, usually soil, rocks, boulders, etc, down into smaller parts.
- Erosion also causes the soil on the banks of rivers to wash into the water and cause built up sediment.
Reforestation

- After an area has been logged, a large crew comes in and replants the area with seedling trees.
- They have a rule of replacing every 1 tree that is cut with 2 or 3 trees.

Remember to take care for and enjoy the local forests!
NURSERY PRODUCTION IN HUMBOLDT COUNTY

Photo Credit: The Flower Fields
WHAT IS A SEED?

✖️ A seed is defined as a small embryonic plant enclosed in a covering called a seed coat.
✖️ In other words, seeds carry the beginning of a plant inside of them along with a food storage area for the growing seed.
× Cell Wall
  + A stiff structure around each plant cell. It protects the cell

× Large Central Vacuole
  + A membrane bound storage structure.
    × Isolates harmful materials and contains waste products
PARTS OF A PLANT

✗ Plastids
   + Organelles that are the site of manufacturing and storage of important compounds needed by the cell for food
     ✗ Chloroplasts- They capture the sun’s light energy and store it while releasing oxygen and water

✗ Flower
   + The flower is the reproductive part of the plant
   + Flowers can be either male, female, or both.
     ✗ Males parts produce pollen and are called Stamen.
     ✗ The females receive the pollen through the wind, birds, bees, or other insects and are called the Pistil.
PARTS OF A PLANT

× Stem
  + Provides support, storage for nutrients and energy, and a way to move material for the plant

× Leaves
  + Leaves are where the majority of gas exchange of the plant takes place along with Photosynthesis
    × Photosynthesis: the process of taking the sun’s light energy and turning it into energy for the plant to use.

× Roots
  + Roots are what provides the plant support, like an anchor on a ship.
  + They store excess nutrients and absorb water and mineral
PLANT’S NEEDS

- Water
  - Plants need water for growth and to stay alive. The growing tissue of plants is usually made up for 80-95% water.
  - Transpiration- A plant's way to cool themselves by water loss and for mineral movement through the plant

- Air
  - Plants need oxygen from the air
  - Respiration- using oxygen for the conversion of carbohydrates, fats, and proteins into usable energy
PLANT’S NEEDS

- Sunlight
  - Sunlight is needed for photosynthesis
  - **Photosynthesis** - Converting light energy into chemical energy, sugar
  - Oxygen is created and released into the atmosphere
PLANT’S NEEDS

- **Nutrients**
  - Nutrients are needed to keep a plant strong and healthy
  - Essential nutrients for plants are:
    - Nitrogen, Potassium, Phosphorus, Calcium, Magnesium, Sulfur, Iron, Boron, Zinc, Copper, Chloride, Manganese, and Molybdenum.
PLANTING MEDIUMS

- Planting mediums provide the plant with water and nutrients and a structure for the roots to grow in and support the plant

- **Soil Medium**
  
  - Soil is a dynamic natural body composed of minerals and organic solids, gases, liquids, and living organisms which can serve as a medium for plant growth
PLANTING MEDIUMS

- Soilless Media
  + Medium for plant growth that does Not contain any natural soil

  - Peat moss - partially decomposed moss

  - Sand - Weathered mineral particles
PLANTING MEDIUMS

- **Perlite** - Volcanic rock that is crushed and heat treated to make it expand and is white

- **Vermiculite** - Mineral, usually from mica, that is heat treated to make it expand

- **Composted Bark** - Tree bark that is shredded and composted

- **Coir** - Natural fiber that is extracted from coconut husk
PLANTING MEDIUMS

- Hydroponics
  + A method of growing plants in either water or a mineral solution without soil
  + Sometimes perlite, gravel, mineral wood, clay pebbles, or coconut husk is added for structural support
LIFE CYCLE OF PLANTS

❖ Annual
  + Annual plants complete their life cycle in one year or less. This means in one year or less they grow, set seed and die

❖ Biennial
  + Biennial plants are plants that take one year to grow, then bloom, set seed, and die the second year.

❖ Perennial
  + Perennial plants are plants that will bloom and set seed each year for three or more years.
NURSERY PRODUCTION: GROWING PLANTS

✗ Sowing Seeds
  + Plants grown from seeds are the traditional way for plants to be grown.

  + The seed needs soil contact, water, and depending on the seed, either light or dark, and either cold or warmth in order to start to grow.

✗ Cuttings/Propagation
  + Parts of the growing mother plant are cut, usually new growing tissue with regenerating vegetation
    ✗ Regenerating Vegetation: Part of the plant that can re-grow what was lost

  + They are then placed in a growing medium.
NURSERY PRODUCTION: GROWING PLANTS

- Grafting
  - Tissues from two different plants are fused together into one plant.

  - Creating a stronger and more durable trunk for some orchard trees, having more than one type of fruit on the same tree, or even to repair damage to a trunk.
Nurseries use structures to modify the growing environment and climate for plants to both increase and control growing rate as well as provide the best growing environment for the plants.
FACILITIES

- Greenhouse

- A Greenhouse is a glass or plastic house/building who’s heating, cooling, and ventilation are completely controlled.

- They are very hot and humid because solar light enters the building warming the air which is trapped in the building by the glass/plastic.
Shade House

+ A Shade house is a frame covered with a cloth, woven material, or wooden strips (lath strips).

+ The cloth provides protection for the plants from rainfall, wind, and too much sun.

+ The lath strips run north to south so the sun hits all parts of the plants during the day.

+ These strips protect part of the plant from any rain, wind or sun.
Sun Valley Farms are the largest nursery growers of cut bulb and field flowers in the United States.

The company began in Myrtle Point, Oregon by a high school Agriculture teacher and a student.

Our environment of mild winters, cool summers, humidity, and moderated sunlight makes Humboldt County perfect for growing bulb flowers.

The fields in Arcata grow Lilies, Iris’, Tulips, French Tulips, Freesia, Hyacinth, and Hydrangeas.
DON’T FORGET TO STOP AND SMELL THE ROSES!
Dairy in Humboldt County
What is a Dairy Animal?

- A dairy animal is an animal (bovine) that is used for the production of milk and other products that come from dairy milk.
Common Terms

- **Bull**: A male dairy animal.

- **Calf**: An immature dairy animal.

- **Colostrum**: The first milk a cow produces and a calf drinks.
  - It is a very thick milk and is full of antibodies for the calf.

- **Cow**: An adult female dairy animal that has had a calf.

- **Dam**: The mother of an animal

- **Fresh Cow (Freshening)**: A cow that has just given birth.

- **Heifer**: A young female dairy animal.

![Cow Image](Photo Courtesy of University of Wisconsin)
Common Terms

- **Lactation:** The stage of a cow’s life where she is producing milk after calving. The lactation length standard is 305 days.

- **Milking Parlor:** The building the animals are milked. Also holds the storage tanks and other equipment necessary for milking.

- **Teat:** The part of the udder that releases the milk.

- **Udder:** The location of milk production
Breeds—Holstein

- The most recognized breed

- Very large animals that are usually Black and White in color

- There is also a Red and White too but not as common

- Originated in the Netherlands about 2,000s ago

- They came to America in 1852 by Winthrop Chenery

- About 90lbs at birth and grow to be about 1,500 lbs when mature

- They produce large amounts of milk, around 23,000 lbs a year
Breeds—Jersey

- Second most common breed in the United States and very small in size
- Originated on the Island of Jersey in the English Channel
- Fawn colored (tan) and are known for large brown eyes and a ‘dish’ (slight indent) face
- Oldest known dairy breed with records dating back to 1771
- Their milk is high in butter fat and protein
- That means their milk is good for cheese production
- Their milk yields 12.53 lbs of cheese for every 100 lbs of milk
- They weight about 60 lbs when born and grow to about 1,000 lbs when mature
- An average Jersey in the US can produce 16 times her weight a year
Breeds—Guernsey

- Originated from the Isle of Guernsey, a tiny island in the English Channel
- The breed came to the United States in 1840 with Captain Belair
- They are fawn and white in color but can look more orange
- They are known for their “Golden Guernsey” milk
- The high concentration of beta-carotene in their milk makes it a golden color
- Beta-carotene is converted into vitamin A
Breeds—Brown Swiss

- Originated in the Swiss Alps in Switzerland
- Very docile with big and strong feed and legs
- They are very large animals known for their big brown eyes and huge ears
- Used to be a dual purpose breed, meaning used for both meat and milk production
- Today they are only for milk production
- Their coloring ranges from white/light brown to brown, brown/black
- Their milk is good for cheese making
- Almost all of the Brown Swiss today can be traced back to one cow ‘Jane of Vernon’
Breeds—Ayrshire

- Originated in the County of Ayr in Scotland before 1800
- They are medium in size and are good grazers
- They are a red or reddish-brown mahogany in color
- Sometimes they have a speckled pattern
- They were known for their horns which would reach 1 foot or more in length
- Their milk is fairly high in butterfat and protein which is good for cheese
Breeds—Milking Shorthorn

- Originated in Northeastern England in the Valley of the Tees River
- The Breed changed a lot in Northumberland, Durham, and York
- One of the oldest dairy breeds
- They were once seen as a dual purpose breed (meat and milk)
- They have recently become mainly a dairy breed in the United States
- They are known to be very disease resistant
- Their milk has a high protein-fat ratio which is needed for cheese production
Dairy Products

- Fluid Milk
  - Fat-free
  - low fat
  - reduced fat
  - whole
  - flavored
  - lactose-reduced/free
  - Buttermilk

- Cheese
  - Cheddar, Mozzarella, Swiss, Parmesan, Jack, and more

- Frozen Yogurt

- Ice Cream

- Yogurt
Dairy Products

- Cottage Cheese
- Powder Milk
- Evaporated Milk
  - Condensed Milk
- Butter
- Cream
- Sour Cream
- Puddings
Parts of a Cow
Parts: Milk Production

- Udder
  - Where the milk is produced

- Fore and Rear Udder
  - The Fore udder is the half of the udder that is closes to the head of the animal
  - The Rear udder is the half closed to the tail end of the animal.

- Fore and Rear Udder Attachments
  - This is where the udder attaches to the cow
  - This keeps the udder under the cow and safe from injury
Parts: Milk Production

- Suspensory Ligament
  - This is the large cleft you see on the back of a cow’s udder.
  - This holds the udder high on the animal

- Teat
  - The teat is where the milk comes out of the udder

- Mammary Veins
  - The mammary veins are large veins that bring a large amount of blood to that area.
  - Milk production needs lots of blood circulation and oxygen to operate correctly.
The Stomach of a Cow

- **Rumen**
  - The rumen is the first compartment of the cow’s stomach.
  - It can hold up to 50 gallons of material and is designed to digest high fiber feed.
  - The rumen ferments, or breaks down, the feed and either absorbs the nutrients or brings the fermented feed, called cud, back to the animals mouth to be chewed more before absorption.

- **Reticulum**
  - The reticulum has a honey-comb appearance and is the second compartment of the cow’s stomach.
  - It functions very much like the rumen as it breaks down plant cells into usable nutrients for the animal.
The Stomach of a Cow

- **Omasum**
  - In this compartment, water is added to the digesting material and then is reabsorbed along with some of the nutrients from the feed.

- **Abomasum**
  - The Abomasum is considered the ‘true stomach’ of the cow as it is the closes compartment to a non ruminant such as you.
  - The Abomasum is very acidic and breaks down the proteins for absorption in the intestines.
The Life of a Cow: Born

- When they are born they are called calves.

- The female calves are taken away from the mother for safety. There is a high chance of injury from being stepped on and of getting sick if the calf stays with its mom.

- They are fed colostrum from their mom, which is a thick yellow milk full of antibodies from the mom which will help increase the calf immune system.

- They are fed colostrum for 3 days and then switched to milk or a milk replacer,
The Life of a Cow: Born

- At around 5 weeks, calves are introduced to hay, grain (a mixture of grains such as corn, wheat, and barley) and water.

- After 8 weeks the calves are weaned, which means they are taken off milk completely.

- During these 8 weeks the calves are dehorned for safety reasons, ear tagged for records, and branding for herd identification.
  - At this young of an age the calf doesn’t remember any of the pain.
The Life of a Cow: Yearling

- When the calf is one year old they are called a yearling.
- They are still growing but are getting close to their mature weight.
- They are usually put in groups with other calves the same age and watched to make sure they are growing and healthy animals.
- Some farmers will send these animals to farms that specialize in raising animals to mature weight.
The Life of a Cow: 2 Year Old Cow

- A 2 year old cow has just had her first calf and is also called a first year heifer.

- After having their calf, they produce colostrum for the first week to pass on their antibodies to their calf, and then they will produce regular milk.

- A cow will produce milk for around 305 days.
The Life of a Cow: 2 Year Old Cow

- Two months after calving, the cow is bred again, will continue producing milk for 305 days, and then will ‘dry off’ for 2 months before calving.

- This ‘dry off’ period is when the cow stops producing milk and store fat for producing milk after caving again.
The Life of a Cow: Mature Cow

- A cow is considered mature when she has had her third calf.

- When producing milk she is milked twice a day and produces an average of 7 gallons of milk in one day but can produce up to 12 or more gallons of milk a day just after calving.

- She will live on the dairy for as long as she is healthy and able to produce milk.
Milk

- Fat
  - Good source of energy

- Protein
  - The building block for every part and function of our bodies

- Minerals
  - Calcium—Makes your bones strong
  - Phosphorous—For our bodies daily cell functions
  - Potassium—Also important for our bodies daily cell functions
Milk

- Vitamins
  - A-For vision
  - B-For our bodies cell functions such as energy metabolism
  - D-Allows Calcium to be absorbed by our body
  - E-For hair and skin growth
  - K-For blood clotting

- Water
  - Makes up 87.5% of milk

- Lactose
  - Natural sugar in milk
Concerns About Milk

- Antibiotics and Hormones
  - One of the many concerns about milk is if antibiotics and added hormones are in our milk.
  
  The answer is no. All milk is tested before being processed for any antibiotics or added hormones in the milk.

  - If they find traces of antibiotics or added hormones that load of milk is removed, disposed of, and the farmers are fined.
Concerns About Milk

- rBST
  - rBST is a man made hormone based off of the natural occurring growth hormone BST produced in the animal.
  - There are not many dairymen who use rBST and those that do use it appropriately.
  - No traces of rBST are found in milk when tested because the body uses the injected hormone before it has a chance to get to the milk.
Milk Processing: On the Dairy

- Twice a day the cows on a dairy are milked in the Milking Parlor

- When they enter the barn they are in a large open pen waiting for their turn to be milked.

- Once they are in the milking stall their udders are rinsed and dried

- Teat dip, an iodine sanitation solution, is applied and rinsed off

- The milking machine is then attached to the udder by the milking machine claw
Milk Processing: On the Dairy

- The claw is how the milk is taken from the udder. It mimics the sucking motion a calf does when nursing.

- The milk is then put into a milk tank, is cooled, and waits for pickup.

- Milk trucks from a creamery come to the dairy, takes the milk, and the milk is tested for any problems it might have.

- If it passes the test the milk is then ready for processing.
Milk Processing: Creamery Production

- Standardization
  - This process makes the milk more consistent in taste and texture
  - The milk is separated into the skim portion and a cream portion of the milk
  - The cream portion of the milk is added back in depending on the type of milk being produced to create a 1%, 2%, low fat, or whole milk product
Milk Processing: Creamery Production

- Pasteurization
  - Pasteurization is done to make sure the milk is safe to drink.
  - The fluid milk is heated to 161°F for 15 seconds.
  - This process makes sure that the milk is free from any microbes that may make it unsafe to drink and it extends the shelf life
Milk Processing: Creamery Production

- Homogenization
  - The natural fat in milk is non-uniformed size globules and can cause the cream to separate from the fluid.
  - Pasteurized milk doesn’t have to be homogenized but this process helps keep the milk from going bad.
  - This process also reduces the fat size which allows for even distribution in the milk. This process uses high amounts of pressure to change the fat globule sizes.
Milk Processing: Creamery Production

California’s milk standards are the highest set of standards in the United States.

All of the milk produced in California is labeled with the Real California Seal.
Dairying in Humboldt County

- Humboldt dairies are pasture based while the rest of the dairies are not.

- Pasture based means that the cows are housed in pastures all year long instead of having to stay in barns or feed lots.

- Our climate allows for our dairy’s to keep the cows outside almost every day of the year.

- In bad weather the cows will stay in the barns to keep them warm and dry.
The Humboldt Creamery

- Humboldt Creamery began in 1929 by Peter Philipsen and 152 dairy families contributing $0.10 per cow to start the Humboldt Creamery Association.

- One year later, in 1930 the plant was opened for business.

- Humboldt Creamery produces fluid milk, butter, cheese, and ice cream, but is most well known for its ice cream production.

- The Costco brand Kirkland’s gallon size of vanilla ice cream is Humboldt Creamery ice cream.
The Humboldt Creamery

- When driving over Fernbridge you pass right by the creamery.

- The big pond you see next to the creamery is actually a waste water cleaner tank.

- Every day the processing machines and hoses get washed and cleaned.

- The water that is used to wash everything is put into that pond and gets recycled to be used again.

- Humboldt Creamery started out as a Cooperative owned by the dairy family but was bought by Foster Farms in 2009.
HAVE YOU HUGGED A COW TODAY?

Photo Courtesy of The Wilk Wool Museum
Appendix B

Student Handout

(See following pages)
Forestry
The History of Logging in Humboldt County

1. Logging in Humboldt County Started in __________

2. The first _________________ for logs was created in 1852

3. After four years of logging in Humboldt 9 sawmills were operating on ________

Types of Trees in Humboldt County

Douglas-Fir:
1. Found in British Columbia, Western Washington, ______, on the coast of __________, and parts of the Sierra Nevada
2. Produce cones after _________years of growth

Redwood:
1. Found from southwest ________________ to Monterey ________________.
2. They are known to be _______________ and ________________ resistant
3. Buds can sprout from the _________ of a cut Redwood and grow into a new tree

Giant Sequoia:
1. Found only in the western ________________ of California
2. They need an event such as fire, __________, squirrels, or ________ boring beetle to shed their seeds
3. The bark on older Sequoia trees can get up to _____ inches thick which helps protect the tree from fire damage.

Sitka Spruce:
1. Found in a narrow strip from northern California up to ________________
2. The bark is thin and sometimes a ________________ color
3. These trees grow best by the ocean and make good homes for ____________
4. Their wood is used for making instruments such as _________ and guitar faces.

White Fir:
1. Found from Central Oregon, ______________, Sierra Nevada’s, and the northern part of Mexico
2. Their cones develop ________ on branches and disintegrate on the trees
3. Their needles have a ___________ look from below
4. Older trees bark will have a mottled, or __________, appearance
5. White Fir trees are commonly used as ________________

Tools and Equipment:
1. **Chainsaw**: A portable power ____ having teeth that are linked to form an endless chain
2. **Chokers**: The _______ wraps around the tree, secured, and tightens when pulled on.
3. **Loader**: Tractors that are used to ___________ trees and move them.
4. **Processor**: A forestry machine that ________ the limbs (de-limbs).

The Uses of Trees:
1. **Habitat**: The natural ____________ in which organisms live.
2. **Carbon Cycle**: They take carbon from carbon dioxide and convert it into ______
3. **Lumber**: By-products include: _______, _______, _______, ________.

Logging:
1. The _______ Harvest Plan has to be submitted to Cal ________.

Safety:
1. Hard hat, ____________, ear protection, safety vest, and ______.
2. Make sure you have a clear _________ path

Types of Logging:
1. _______________ Logging
2. ____________ cutting

Styles:
1. **Yarding/High Line Logging**: The fallen tree is hooked to a ______________ and the cable moves the logs to the landing.
2. **Tractor**: The Cat or Skidder picks up each log ____________ and brings it back to the landing
3. **Helicopter Logging**: A long cable with a choker at the end of it is attached to the log and the ____________ flies the log to the landing area.
4. **Auto Logging**: The machine cuts, ________, cuts to length, and stacks the logs

The Logging Process
1. **Felling**: Felling is the actual ________ of the tree from the stump.

2. **Extraction**: Extraction is the ________ of the tree from the felling area to a landing.

3. **Processing**: De-limbing, ____________, and cutting the tree into different sized logs

4. **Loading**: The loading process is when the trees have been ____________, sorted and loaded.

5. **Trucking**: Logs are loaded onto the trucks and go to the ________.

---

**The Sawmill**

1. Logs are unloaded onto a ____________

2. They are ____________, and a computer decides what the best board sizes to make out of that tree

3. These pieces are put in a ________ for either particle board or to be sold as ________

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**Reforestation**

1. All areas that are logged are required to be ________ after.

2. Erosion is a natural process that ____________, usually soil, rocks, boulders, etc, down into ____________ parts.

3. They have a rule of replacing every ___tree that is cut with ____ or 3 trees.
Nursery Production

What is a Seed?
1. Seeds carry the ___________ of a plant inside of them along with a _______ storage area for the growing seed.

Parts of a Plant
1. **Cell Wall:** A stiff structure around each plant cell. It _________ the cell
2. **Large Central Vacuole:** A __________ bound storage structure.
3. **Plastids:** Organelles that are the site of ___________ and ________ of important compounds needed by the cell for food
4. **Chloroplasts:** They capture the sun’s ___________ and store it while releasing oxygen and water
5. **Flower:** The flower is the ________________ part of the plant
6. **Stem:** Provides _________ , and _________ for nutrients and energy.
7. **Leaves:** Leaves are where the majority of ____ exchange of the plant takes place along with ____________.
8. **Roots:** Roots are what provides the plant _________. They store _________ nutrients and __________ water and mineral

Plant’s Needs
1. **Water:** Plants need water for growth and to stay alive. The growing tissue of plants is usually made up for 80-95% water.
2. **Air:** Plants need _______ from the air
3. **Respiration:** using oxygen for the conversion of ________, ________, and ________ into usable energy
4. **Sunlight:** Sunlight is needed for ________________.
5. **Photosynthesis:** Converting ________ energy into chemical energy, __________.
6. **Nutrients:** Nutrients are needed to keep a plant ________ and __________.

Planting Mediums
1. **Soil Medium:** Soil is a dynamic natural body composed of ___________ and organic solids, ________, liquids, and living ____________ which can serve as a medium for plant growth
2. **Soilless Media:** Medium for plant growth that does ________ contain any natural soil
3. Peat moss, _______, Perlite, _______, Composted Bark, ___
4. **Hydroponics:** A method of ________ plants in either water or a mineral solution ________ soil.

**Life Cycle of Plants**

1. **Annual:** Annual plants complete their life cycle in ________ or less.
2. **Biannual:** Biannual plants are plants that take __________ to grow, then bloom, set seed, and die the ________ year.
3. **Perennial:** Perennial plants are plants that will bloom and set seed each year for ________ or more years.

**Nursery Production**

Growing Plants:

1. **Sowing Seeds:** Plants grown from ________ are the traditional way for plants to be grown. The seed needs ________, _______, and depending on the seed, either light or dark, and either cold or warmth in order to start to grow.
2. **Cuttings/Propagation:** Parts of the growing __________ plant are cut, usually new growing tissue with __________ vegetation. **Regenerating Vegetation:** Part of the plant that can __________ what was lost
3. **Grafting:** Tissues from two different plants are fused together into __________.

Facilities:

1. **Greenhouse:** A Greenhouse is a ______ or plastic house/building who’s heating, cooling, and ventilation are ________________.
2. **Shade House:** A Shade house is a frame covered with a ______, __________, or ___________ (lath strips). It provides protection for the plants from rainfall, wind, and too much sun.

**Sun Valley Farms**

1. Sun Valley Farms are the __________ nursery growers of cut bulb and field flowers in the United States.
2. Our environment of __________, cool summers, __________, and moderated sunlight makes Humboldt County perfect for growing bulb flowers.
3. The fields in Arcata grow ______, Iris’, __________, French Tulips, ______, Hyacinth, and __________.
Dairy Production

What is a Dairy Animal?
1. A dairy animal is an animal (_______) that is used for the production of ______ and other products that come from ______ milk.

Common Terms
1. **Colostrum**: The ______ milk a cow produces and a calf drinks. It is a very thick milk and is full of ______________ for the calf.
2. **Cow**: An ________ female dairy animal that has had a calf.
3. **Teat**: The part of the udder that __________ the milk.
4. **Udder**: The __________ of milk production

Breeds

**Holstein**:
1. Very large animals that are usually ______ and ________ in color
2. Originated in the ______________ about 2,000s ago
3. They produce large amounts of milk, around _________ lbs a year

**Jersey**:
1. Originated of the Island of ___________ in the English Channel
2. _____ colored and are known for _______ eyes and a ‘dish’ (slight indent) face
3. Their milk yields _________ lbs of cheese for every 100 lbs of milk

**Guernsey**:
1. Originated from the Isle of ____________, a tiny island in the English Channel
2. They are ______ and ________ in color but can look more orange
3. They are known for their “__________ Guernsey” milk

**Brown Swiss**:
1. Originated in the ___________ in Switzerland
2. They are very large animals known for their big brown _____ and _____ ears
3. Almost all of the Brown Swiss today can be traced back to one cow ‘____ of _________’
Ayrshire:
1. Originated in the County of _______ in Scotland before 1800
2. They are a red or ________________ mahogany in color
3. Sometimes they have a ____________ pattern

Milking Shorthorn:
1. Originated in Northeastern __________ in the Valley of the _______ River
2. They were once seen as a ______ purpose breed (meat and milk)
3. They are known to be very ___________ resistant

Dairy Products
1. Fluid Milk, __________, Frozen Yogurt, __________, Yogurt, __________, Powder Milk, __________,
   Condensed Milk, _______, Cream, __________, Puddings

Parts of a Cow

Milk Production:
1. **Fore and Rear Udder**
   a. The _____ udder is the half of the udder that is ______ to the _____ of the animal
   b. The _____ udder is the half closed to the _____ end of the animal.
2. **Fore and Rear Udder Attachments**: This is where the udder ______ to the cow
3. **Suspensory Ligament**: This is the large ______ you see on the back of a cow’s udder.
4. **Mammary Veins**: The mammary veins are large ______ that bring a large amount of ______
to that area.

Stomach of a Cow:
1. **Reticulum**: The reticulum has a ______ appearance and is the second compartment of the
cow's stomach. It breaks down plant cells into usable ______ for the animal.
2. **Abomasum**: The Abomasum is considered the ‘________’ of the cow.

Life of a Cow

Born:
1. They are fed __________ from their mom, which is a thick yellow milk full of __________ from
   the mom which will help increase the calf __________ system.
2. At around 5 weeks, calves are introduced to ____, _____, and water.
Yearling:
1. When the calf is one year old they are called a ________.
2. They are usually put in groups with other calves the same ____ and watched to make sure they are _______ and _______ animals.

2 Year Old Cow:
1. A 2 year old cow has just had her ____ calf and is also called a ______________.
2. A cow will produce milk for around _____days.
3. This ‘_________’ period is when the cow _____ producing milk and store ____ for producing milk after caving again.

Mature Cow:
1. When producing milk she is milked ______ a day and produces an average of ___ gallons of milk in one day.

Milk
1. Fat: Good source of energy
2. Protein: The building block for every part and function of our bodies
3. Minerals: Calcium,__________, Potassium
4. Vitamins: A, __,D, ___, K
5. Water: Makes up ______ of milk
6. Lactose: Natural ______ in milk

Concerns About Milk
1. ______ is a man made hormone based off of the natural occurring growth hormone BST produced in the animal.
2. ______ traces of rBST are found in milk when tested because the body uses the injected hormone before it has a chance to get to the milk.

Milk Processing
On the Dairy:
1. ______ a day the cows on a dairy are milked in the Milking Parlor
2. The claw is how the milk is taken from the udder. It mimics the sucking motion a calf does when nursing.
Creamery Production:

1. **Standardization**: Makes the milk more consistent in _____ and _______. The milk is separated into the _____ portion and a _____ portion of the milk.

2. **Pasteurization**: Done to make sure the milk is _____ to drink. The fluid milk is heated to ___ for 15 seconds.

3. **Homogenization**: Reduces the _______ which allows for even distribution in the milk.

Dairying in Humboldt County

1. Pasture based means that the cows are house in ________ all year long instead of having to stay in _____ or feed _____.

Humboldt Creamery

2. Humboldt Creamery produces fluid milk, _____, cheese, and ____. The Costco brand _________ gallon size of vanilla ice cream is Humboldt Creamery ice cream.
Appendix C

Activity Handouts

(See following pages)
Homemade Ice Cream

Ingredients:
- Ice
- 1 cup Kosher/Coarse Salt
- 4 Tbsp. Sugar
- 2 Cups Half & Half
- 1 Tsp. Vanilla Extract
- Gallon-Size Ziploc Bag
- Quart-Size Ziploc Bag

Instructions:

1. Mix Sugar, Half & Half and Vanilla Extract and pour into a quart-size Ziploc bag. (You can make a batch of strawberry ice cream using the same ingredients and adding an additional tbsp. of sugar and 3/4 cup fresh strawberries and blending).

2. Place Ice and 1/2 cup of coarse salt in gallon-size Ziploc bag, place bag of ingredients on top of ice. Pour more ice and remainder 1/2 cup of salt and seal bag.

3. Shake the bag of ice and ingredients for 7-10 minutes.
Exploding Jar Handout

INSTRUCTIONS:

1. Mix together equal parts sand and lima beans into a glass jar and shake them together.

2. Pack the top of the jar with more sand so the jar is completely full.

3. Wet the sand with water, but not so much to flood it.

4. Put the lid on and place the jars in plastic bags and place in a large pan.

QUESTIONS:

What Do You Think Is Going To Happen?

Why Do You Think This Is Going To Happen?

What Actually Happened?
Seed Germination Handout

INSTRUCTIONS:

1. Soak the lima beans in water overnight.

2. Fill a glass jar with thick dark paper, construction paper works well, and fill it with crumpled paper towels.

3. Place 3-4 of the soaked lima beans along the side of the jar so they are between the construction paper and the glass.

4. Moisten the paper towels with water; do not drown the paper towels in water though.

5. Place the jars in a warm area with lots of sun and make sure the towels stay moist.

QUESTIONS:

What do you think is going to happen?

Why do you think that is going to happen?

What actually happened?
Appendix D

Teachers Aid

(See next pages)
1. The History of Logging in Humboldt County

a. Logging in Humboldt County started in 1850 with a belt of Redwood Trees that reached 108 miles in length and anywhere between 2-20 miles wide. It would take about 5 years before the lumbermen realized the value of the Redwoods as they were used to the pine, spruce, and fir trees from their home land areas.

b. The first saw mill was on Humboldt Bay, the Papoose, and was opened in 1850 by Martin White and James Eddy. This mill lasted only 1 year, as did a few other first year sawmills.

c. The first successful sawmill in the county was established on February 24, 1852 by James T. Ryan and James Duff. While attempting to expand, they tried many times to ship the Redwood lumber to San Francisco but each time their ships were destroyed during the voyage.

d. A commission of loggers in 1852 got together to determine a ‘standard of measurement’ for the logs they were processing. They created different guidelines for how best to cut or ‘scale’ the trees depending on how long and wide each type of tree was. Redwood trees however are so large that they couldn’t use this standard on them and they were left up to the person scaling (cutting/milling) the tree to decide what was best.

e. In 1854, nine mills were operating on Humboldt Bay. The Bay was a perfect location for sawmills because they could easily ship the lumber from the Bay.
down the coast of California and it is close to the main logging areas in the county.

f. Humboldt County was ranked the second California County for lumber production in 1860, sawing 30,000,000 feet of lumber per year. Most of this lumber was shipped to San Francisco.

g. Redwood trees were so unique compared to the main trees that being used that they quickly became a high demand product. Good thing the average diameter of a redwood tree to be sawed at that time was seven feet, so they were able to meet the demand.

h. Today there are still several timber companies including Green Diamond and the Humboldt Redwood Company in Humboldt County.

2. Type of Trees in California

c. The following are the main trees found in forests around California:


d. We will focus on those trees most common in Humboldt County.

3. Type of Trees Most Common in Humboldt County

a. **Douglas-Fir:** These trees are found in British Columbia, Western Washington, Oregon, on the Coast of California, and parts of the Sierra Nevada. They are conifers, meaning they produce cones for reproduction. They produce these cones after about 12-15 years of growth. The needles on
a Douglas-Fir are flat and they have graceful, slightly drooping limbs. They provide a habitat and seeds for birds and small animals. Most likely, Douglas-Fir lumber was used to build most of your home.

b. **Redwood**: Redwood trees can be found in about a 450 mile long by 35 mile wide strip from Southwest Oregon all the way to Monterey County, California. These trees grow best in mild climates with annual rain fall from 25-133 inches and summer fog to help give them moisture in the summer months. Redwoods start producing cones after 5-15 years of growth. They produce these cones once a year and shed the seeds in the spring. They are known to be fire and disease resistant (not fire or disease proof though). They create habitats for many birds, mammals, amphibians and even fish. They are easily identified by the deep red color of both their bark and their wood. A unique quality the Redwood tree has is after the tree is cut, dormant buds can sprout from that stump and grow, sometimes up to 6 feet in the first year.

i. **The Immortal Tree-Redcrest California**: An example of how durable the Redwood tree is the Immortal Tree. This tree is on the Avenue of the Giants Highway in Redcrest. This almost 1,000 year old Redwood has survived lightning (which removed the top of it lowering the height from 298 ft to 258 ft) fire, floods, and a determine logger who tried to cut it down in 1908, but lost the battle to this 14.5 foot wide tree.

c. **Giant Sequoia**: Giant Sequoias are very similar to the Redwood tree. However, they are found only in the Western Sierra Nevada of California.
The majority of Sequoia trees are located and protected in the Sequoia National Monument and other national parks in the Sierra Nevada in Calaveras, Fresno, Madera, Mariposa, Tulare, and Tuolumne counties. They like areas with around 35-55 inches of annual precipitation and can tolerate cold winter conditions. These trees will grow for around 20 years before they start to shed seeds and also need events to cause the cones to open up and release the seeds. These events include fire, harvest of cones by chickarees (a type of squirrel), storms (tears off branches and cones), and the long-horned wood boring beetle. The seeds in the Sequoia’s cones need to be on mineral soil to germinate. The bark on the older Sequoias can get up to 20 inches thick, which helps protect the tree from fire damage. It provides a habitat for many animals, lives for thousands of years, and grows into a massive tree. There is a 2,500 year old Giant Sequoia that is over 275 feet tall and 27 feet in diameter.

d. **Sitka Spruce** - The Sitka Spruce is found in a narrow strip of Northern California up to Alaska. This tree does best in very moist soil and in shade. Sitka Spruce trees take about 20 years to start producing seed cones which are very thin with papery like scales. The bark is also thin and can be flaky with a purplish-gray color. They are very straight growing trees that are often swollen at the base. As these trees grow best along the ocean, they make great spots for bald eagles to nest in. The Sitka Spruces has a very high strength to weight ration which makes it the perfect choice for instruments such as pianos and guitar faces, and even for items such as ladders and boats.
e. **White Fir:** White Fir trees can be found from Central Oregon, through the mountains on the coast of California, south into the Sierra Nevada, and even on the northern most mountains in Mexico. They are also found in the Rocky Mountains. Their cones develop upright on the branches and disintegrate on the trees. Their seeds germinate after the snow melts. White Fir are shade tolerant and can survive under all the brush on the forest floor as they grow taller. Their needles have a ‘frosted’ look from below and the older trees bark has a mottled, or bacon-like, appearance after being taken off the tree. White Fir trees provide great cover and food for many forest animal species, is often used as Christmas trees, and the wood is common for construction as plywood and framing wood.

4. Tools/Equipment

a. **Chainsaw:** A portable power saw having teeth that are linked to form an endless chain.

b. **Hard hat:** A hat made of a hard material for protection

c. **Gloves:** A fitted protective covering for the hand with a separate part for each finger and the thumb.

d. **Tape measures:** A tape of cloth, paper, or steel marked off in a linear scale for taking measurements, in this case to cut the trees to length

e. **Hearing and eye protection:** Objects designed to cover ears or eyes to protect from loud noises or foreign objects.
f. **Wedge** – A piece of material, thick and one edge and tapered to a thin edge at the other, used for influencing the direction of the falling tree.

g. **Double headed axe**- A tool with a blade on both sides of the head on a handle used for felling trees or chopping wood/limbs

h. **Chokers**- A tightly fitted steel cable, also called a steel noose. The cable wraps around the tree and is secured in the bell (lock) and tightens when pulled on. Used to move trees.

i. **Loader**- Front End Loader: A tractor with wheels and a claw like front end attachment used to pick up trees. Heel Boom: A log-loader on tracks which the end of a log being loaded with bears and is steadied as it is lifted and swung into position.

j. **Yarder/cat/skidder**- Yarder: A type of bulldozer that is stationary. Cat: A type of bulldozer that is on tracks. Skidder: A type of bulldozer that is on wheels.

k. **Forwarder**- A forestry vehicle that carries felled logs from the stump to the landing area (loading area).

l. **Feller Buncher**- A forestry machine that cuts the trees and lays them down into stacks to be sent to the landing area.

m. **Processor**- A forestry machine that removes the limbs (de-limbs) and cuts the logs to the required length for transport.

n. **Cork boots**- Boots worn by loggers that are leather nail-soled boots that are used for traction in the woods.

o. **Fire box**- A fire prevention equipment box just in case a fire occurs while logging, possibly from the equipment.
p. **Logging trucks**- Semi trucks used to haul logs from the woods to the milling plants. They use Wrapper cables and binders to secure the logs to the trucks.

5. **The Uses of Trees**- Trees have many uses in life including providing a habitat for animals, cleaning the air, providing solid wood materials, and many by-products.

d. **Habitat**

i. Forests provide a habitat (the natural environment in which organisms live) for many animals and plants. Birds, squirrels, insects, fungi, bears, mountain lions, coyotes, rabbits, snakes, ferns, flowers, ivy and more live and depend on these trees for their home. Forests provide shelter for these animals and plants to live in addition to protecting them from the sun and rain. They also produce food for animals in the form of seeds, nuts, and sap, they provide a place for plants to grown on (fungi), and provide a large area for animals to roam. Forests also provide us with many recreational areas.

e. **Carbon Cycle**- The Carbon Cycle is the cycle that carbon is exchanged among the biosphere, hydrosphere, and atmosphere.

i. The Carbon Cycle is important for all life on earth. Trees play a huge part in this cycle. Trees take in carbon dioxide from the atmosphere (the gas pocket that surrounds earth) and store it in their wood. They use the carbon from the carbon dioxide and convert it into sugar, which is their main energy source for growth, and oxygen through a process called photosynthesis. The oxygen is then released back into the atmosphere.
Foresters are very careful not to cause deforestation because that causes a large release of carbon dioxide and too much carbon in the atmosphere is not good. Thankfully, forests in the United States are considered ‘net carbon sinks’, which means annual growth of our forests exceeds our annual harvest. As long as we are careful about logging our forest, we will keep our environment healthy.

6. Timber and By-Products

   a. Trees are used for structural lumber pieces such as for building houses and furniture. Trees also provide material for other products as well. These products include paper, books, toilet paper, postage stamps, candles, crayon wax, cosmetics, corks, food cartons, musical instruments, toys, fruit, nuts (not peanuts), pine oil, energy from burning wood, and even nail polish.

7. Logging

   a. Beginning Procedure

      i. Before an area can be logged, a Timber Harvest Plan has to be made, reviewed, and approved by Cal Fire. The Timber Harvest Plans started because of the Forest Practice Act of 1973 which said that the goal of maximum sustained production of timber products is achieved while giving value and consideration to the environment.

      ii. The Timber Harvest Plan has to include a legal description and information on the site being logged, operational provisions, supporting
materials, impact assessment, any surveys of the land, and confidential archeological information.

iii. The Timber harvest Plan is submitted to Cal Fire, assigned a number and is given to the review team agencies (including Department of Fish and Wildlife, Cal Fire, Water Quality, etc). After the first review of the plan it is either accepted or not accepted for filing. If accepted, the review team conducts a pre-harvest inspection of the site within 10 days of filing. A second review is held 20 days after the Pre-harvest inspection and the directors make a decision on if the site can be logged or not within 15 days after a public comment session.

iv. The report contains many different reviews and concerns about the area. The factors that are looked into before logging include (not all listed):

1. Any impacts to the watersheds (affects Coho Salmon and Steelhead) or other bodies of water
2. Endangered species (especially owls) that live there
3. If there is a good reason to log that area and if it’s legal to log that area
4. All the State and Federal laws and regulations are being followed
5. How much is going to be harvested, when was the last time it was harvested, or if it’s an old growth habitat

v. As you can see lots of inspections and consideration is taken before a tree is cut.
b. Safety

i. Safety is a major concern when it comes to logging. Trees are very heavy and don’t always fall in the direction you want them to, so extra care is taken.

1. Every logger is required to wear a hard hat, eye protection, ear protection, safety vest, and gloves.
2. If there is strong wind that day then they will not log because the wind may cause the tree to fall in the wrong direction and either hurt someone or fall on top of other trees damaging them.
3. Rain is another safety factor. Not only can it damage the equipment over time, but it can cause blades to slide, jump, or get stuck, and other equipment malfunctions which can cause injuries.
4. Being aware of your surroundings is always a good safety precaution. In logging that means standing on the uphill side of the tree, look for falling limbs above you, making sure you have a clear escape path and that you don’t fall a log across that path.

c. Types and Styles of Logging

i. Type-The two most common types of logging in Humboldt County are Selective Cut Logging and Clear Cutting.

a. Selective Cut Logging- Selective Cut Logging can be seen as a thinning type of logging. Specific trees are targeted for removal from the logging site based of various reasons. The reasons trees are removed are to give other trees more room
to grow, they are invading rivers/creeks/lakes and are hurting the ecosystem there, or if they have a diseases. This type of logging also can be used to make a site of trees all the same age, or make it more age uneven. They are careful about which trees they removed because the extra sun that now comes through the branches can shock a young growing seedling and can cause them to die or have their growth stunted.

b. **Clearcutting** - Clearcutting is where all of the trees in a small area are removed to create an open area. These areas quickly start to grow grasses and foliage for animals. Clearcutting is often seen as a bad thing, but it’s not. Clearcutting too many areas is bad, but it also allows for a forest to re-grow and heal. This type of logging is strictly regulated in California and the site has to qualify for clearcutting including having enough trees in that area of desirable age and size.

ii. **Styles** - The style of logging used at a logging site depends on the terrain of the area. The main types of logging used in Humboldt County are Yarding/High Line Logging, Tractor Logging, Helicopter Logging, and Auto Logging.

1. **Yarding/High Line Logging** - Yarding/High Line Logging is when the fallen tree is hooked to a cable system and the cable moves the logs to the landing (collection/pick up area). The
Yarding machine is stationary and has a skyline cable with chokers that are placed on the end of the log and the cable takes the log from the falling site to the landing area. This style is good for more uneven terrain.

2. **Tractor**- With Tractor logging, a Cat or Skidder clears a path through the brush from the landing area to the falling area. The Cat or Skidder then picks up each log individually and brings it back to the landing. These machines need flatter terrain to be operated safely.

3. **Helicopter Logging**- Helicopter Logging is exactly as it sounds. The Helicopter has a long cable with a choker at the end of it. The loggers on the ground attach the log to the end of the cable and the helicopter flies the log to the landing area. This technique is ideal for mountain areas with really rough ground.

4. **Auto Logging**- Auto Logging is a relatively new type of logging. For this machine, the operator sits inside a cab and moves the arm to the desired tree. The end of the arm had a claw clamp with a saw. The claw holds the tree while the saw cuts the tree down and it gently falls to the ground. This Auto Logger can also de-limb the tree right away instead of having to have another machine to do that.
d. The Logging Process- After the site has been approved to be logged, all the safety precautions have been taken, and the loggers are in place, the logging is ready to begin. The process is broken down into 5 steps: Felling, Extraction, Processing, Loading, and Trucking.

i. Felling- Felling is the actual cutting of the tree from the stump. This process used to be done manually with an axe or a big hand saw. Today either chainsaws or machine harvesters do most of the felling which is safer and much more time and cost efficient.

ii. Extraction- Extraction is the removal of the tree from the felling area to a landing area (the stacking and loading area). The actual process of moving the tree with a machine is called skidding. Machines such as a Yarder, Forwarder, or Helicopter are used for extracting the tree.

iii. Processing- Before the tree can be loaded on to the logging truck, it has to be processed. This involved taking the branches off the tree (de-limbing), taking the top off the tree, and cutting the tree into different sized logs (bucking) according to the mill they are going to. Processing can be done by a chainsaw but can also be done by a loader with an attached de-limber, or other similar machines.

iv. Loading- The loading process is when after the trees have been processed into movable logs, they will be sorted according to size, stacked, and then loaded onto the logging trucks. The load is then tied down and ready for travel.
v. **Trucking** - Logging Trucks are the only way for big logs to get to the milling plant. They have size and weight limits for the trees they are hauling for safety. The trucks have safety inspections every day and can haul many loads of logs per day as well.

8. **Sawmill**

a. When the logging trucks get to the sawmill they are unloaded and the logs are put on a holding deck until they are ready to be processed.

b. When they are ready to be processed the logs are cut to length (if not already cut to length). They are then placed in the debarker and all the bark is stripped off the logs.

c. They continue into the sawmill where they are scanned and a computer decides what the best board sizes to make out of that tree are. Each tree has a different diameter so each tree will produce different sizes of lumber.

d. Trees are round so not all lumber that is cut from the tree will be usable. These scraps are separated from the usable lumber and put in the chipper to be made into very small pieces for either particle board or to be sold as shavings.

e. The lumber is then separated by size and stacked. Sometimes the lumber is planed (smoothed and leveled), bundled, or dried outside or in a kiln. It depends on where that set of lumber is going for its second life.

9. **Reforestation**

a. All areas that are logged are required to be replanted after. The reason for replanting is to keep our forests growing and to prevent erosion.
i. Erosion is a natural process that breaks things (usually soil, rocks, boulders, etc) down into smaller parts. These parts are then easily washed away or moved by wind. Over time erosion can cause an area to be go bare so it’s unable to support vegetation. Erosion also causes the soil on the banks of rivers to wash into the water. It is important to know that erosion doesn’t make things disappear; it causes a mass movement of materials which are then settle in other areas. Erosion can also cause buildup such as in rivers. Too much erosion on the hillsides next to a river can cause a sediment buildup and affect the ecosystems in the river.

b. Many timber companies, such as Green Diamond, have their own tree nurseries that grow tree plugs for replanting their logging land. After an area has been logged, a large crew comes in and replants the area with seedling trees. They have a rule of replacing every 1 tree that is cut with 2 or 3 trees. Most companies choose to replant 3 trees for every 1 tree they cut. Planting more then they took increases the survival rate of the replacement tree and keeps our forests growing and healthy.

10. ACTIVITIES FOR FORESTRY LESSON:
   a. Online Redwood slideshow video

   b. Green Diamond forestry tour
      a. Green Diamond offers tours of their mill and forestry land in Korbel. You can email or call them to set up a time
i. California Timberlands Division, P. O. box 68, Korbel CA 95550,  
(707) 668-4400, grynearson@greendiamond.com or  
rschulte@greendiamond.com

c. The Forest Foundation Website also has more information and materials on  
California Forestry  

d. The Humboldt Redwood Website also has some good videos on logging.  

e. One long term classroom activity you can also do is provide each student with a  
Redwood tree for them to put in pots and grow for the rest of the year  
a. You can order Redwood trees (only about 6-12 inches tall)  
i. The Jonsteen Company  
ii. You can also talk to local loggers or Cal Fire on getting a donation of  
trees.  
iii. Green Diamond also produces tree plugs and would be another good  
place to contact about a donation for your classroom.
Forestry References


The Teachers Instructional Aid

NURSERY PRODECTION

1. Plant Basics

   a. **What is a seed**- A seed is defined as a small embryonic plant enclosed in a covering called a seed coat. In other words, seeds carry the beginning of a plant inside of them along with a food storage area for the growing seed.

   b. **Parts of a plant**- Just like us, plants have many organelles, cells, tissues, and organs. The main organelles are the Cell Wall, Large Central Vacuole, and Plastids. The main organs are the Flower, Stems, Leaves, and Roots

      ii. **Cell Wall**- Cell walls provide structure to each individual cell. That is what makes plant stems strong. It is made of a strong fiber matrix structure and contains a cell membrane inside. The membrane helps keep the wrong products from entering the cell.

      iii. **Large Central Vacuole**- The Large Central Vacuole is a membrane bound storage structure. It can take up a large part of the cell and helps to put pressure on the cell wall. They can also isolate harmful materials, contains waste products, and allow the plants to support the leaves and flower structure because of the pressure it creates.

      iv. **Plastids**- Plastids are organelles that are the site of manufacturing and storage of important chemical compounds that are needed by the cell for food. There are many different Plastids in a cell and each one is defined by what they do. The major one is the Chloroplast.
1. **Chloroplasts**- Chloroplasts capture the sun’s light energy and store it while releasing oxygen and water.

v. **Plant Organs**

1. **Flower**- The flower is the reproductive part of the plant; they produce seeds which are the next generation of the plant. Flowers can be male, female, or both. The Male flowers produce pollen and are called Stamen. The females receive the pollen either through the wind, birds, bees, or other insects and are called the Pistil.

vi. **Stem**- Stems provide support for the plants, storage for nutrients and energy, and provide a way to move the materials the plant needs throughout the plant.

vii. **Leaves**- Leaves are where the majority of plant’s gas exchange takes place along with Photosynthesis, which is the process of taking the sun’s light energy and turning it into energy for the plant to use.

viii. **Roots**- Roots are what provides the plant support, like an anchor on a ship. They also store excess materials, absorb water and minerals, and even make specific compounds a plant might need.

2. **Plants’ Needs**- Just like us, plants have certain requirements in order to live. They need water, air, nutrients, and sunlight.

   a. **Water**- Plants need water for growth and to stay alive. The growing tissue of plants is usually made up for 80-95% water. Plants loose water through a process
called transpiration, which is a way for plants to cool themselves and for mineral movement throughout the plant. The amount of water available in a plant also affects a plant's strength and resistance to stress from insects and/or diseases.

b. **Air**- Plants need oxygen from the air. They need the oxygen for a process called respiration, which is the conversion of carbohydrates, fats, and proteins into usable energy. The breakdown of the sugar (the usable energy) into energy requires oxygen as well.

c. **Sunlight**- Sunlight is needed for photosynthesis, which is the process of converting light energy into chemical energy, or sugar. This process takes carbon dioxide from the atmosphere, light energy, and electrons and turns them into carbohydrates and oxygen. The oxygen is then released back into the atmosphere.

d. **Nutrients**- Many nutrients are needed to keep a plant strong and healthy. The essential nutrients for plants are nitrogen, potassium, phosphorus, calcium, magnesium, sulfur, iron, boron, zinc, copper, chloride, manganese, and molybdenum. Soil or soilless media are the main source of nutrients. Different soils contain different levels of each. Fertilizers are additives that contain different percentages of Nitrogen, Potassium, and Phosphorus which are needed for growth. These fertilizers can be added to soil mediums if needed.

3. **Planting Mediums**: Every plant needs something to grow in that helps provide the plant water, nutrients, and structure to grow in. There are three different mediums (a substance
through which something else is transmitted or carried) to grow plants in: Soil, Soilless Media, and Hydroponics.

a. **Soil**- Soil is a dynamic natural body composed of minerals and organic solids, gases, liquids, and living organisms which can serve as a medium for plant growth

b. **Soilless Media**- Medium for plant growth that does Not contain any natural soil. Instead it contains other material such as moss, sand, bark, and even rocks. There are many different types of soilless media including seed mixes, cutting mixes, greenhouse mixes, and nursery mixes.

  i. **Peat moss**- Peat moss is partially decomposed moss, usually a moss called sphagnum. Peat moss is used in soilless media because it can hold a lot of water and is good for nutrient retention.

  ii. **Sand**- Sand is weathered mineral particles, just like the sand you find on the beach. Sand is used as soilless media because it adds weight to the material that keeps the plant in place and allows for a lot of water drainage.

  iii. **Perlite**- Perlite is a volcanic glass/rock that is crushed and treated with high heat to make it expand. It is usually formed from a volcanic rock called obsidian. Perlite is used in soilless media because it is very light weight, holds water well, and allows space for air in the medium.
iv. **Vermiculite**- Vermiculite is a mineral, usually from mica, that is heat treated to expand for use in soilless media. Vermiculite is very light weight, holds a lot of water, and holds nutrients well too.

v. **Composted bark**- Composted bark is tree bark that is shredded and composted. It is very light weight and creates drainage in the potting mix.

vi. **Coir**- Coir is a natural fiber that is extracted from coconut husks. It is not very common in the use of soilless media because it is very expensive and can be high in salt which is bad for plants. Coir holds both water and nutrients very well.

c. **Hydroponics**- Hydroponics is a method of growing plants in either water or a nutrient solution without soil. Sometimes, for structural support only, perlite, gravel, mineral wool, clay pebbles, or coconut husk may be added to the growing solution.

4. **Life Cycle of Plants**- Not all plants take the same about of time to grow, develop, flower, and die. There are three different life cycles of plants: Annuals, Biannual, and Perennials.

   a. **Annual**- Annual plants complete their life cycle in one year or less. This means in one year or less they grow, set seed, and die.

   b. **Biannual**- Biannual plants are plants that take one year to grow, bloom, and set seed. It is not until the second year the plant dies.

   c. **Perennial**- Perennial plants are plants that will bloom and set seed each year for three or more years.
5. **Nursery Production**- Nursery production of plants is very different from plants growing in nature. They often grow plants from cuttings of a plant and from grafting, the combining of tissues of one plant with the tissues from another plant in addition to growing from seeds.

**a. Different ways to grow plants**

i. **Sowing seeds**- Plants grown from seeds are the traditional way for plants to be grown. The seed needs soil contact, water, either light or dark (depending on the seed), and either cold or warmth (depending on the seed) in order to start to grow. Each seed needs to meet specific requirements to start the growing process. Growing plants from seeds is the best way to make sure that the plant species stays disease resistant.

ii. **Cuttings/Propagation**- Another way plants are grown in nurseries are by cuttings. Parts of the growing mother plant are cut, usually new growing tissue with regenerating vegetation (part of the plant that can re-grow what was lost), and are then placed in a growing medium. These cuttings are placed in humid areas which help promote root growth. Cuttings keep the best traits of the mother plant, but increase the risk of disease.

iii. **Grafting**- Grafting is a very unique and difficult way to not just grow a plant, but to combine two plants together. In this process, tissues from two different plants are fused together into one plant. The plant tissues
have to be compatible for the graft to work. There are many different ways to graph a plant and it is very hard to get the tissues to line up right. Reasons for grafting include creating a stronger and more durable trunk for some orchard trees, having more than one type of fruit on the same tree, or even to repair damage to a trunk.

6. **Facilities**- Nurseries use structures to modify the growing environment and climate for plants to both increase and control growing rate, grow seasonal plants year round, and to provide the best growing environment for the plants. There are many different types of structures but the main two are the Greenhouse and the Shade house.

   a. **Greenhouse**- A Greenhouse is a glass or plastic house/building who’s heating, cooling, and ventilation are completely controlled. They are very hot and humid because solar light enters the building warming the air which is trapped in the building by the glass/plastic. Greenhouses can create the perfect environment for plants, especially when mist is added to the building to increase the available water in the air.

   b. **Shade house**- A Shade house is a frame covered with a cloth, woven material, or wooden strips (lath strips). The cloth provides protection for the plants from rainfall, wind, and too much sun. The lath strips run north to south so the sun hits all parts of the plants during the day. These strips protect the plant from any extreme rain, wind or sun.

7. **Main Nursery Production in Humboldt County**

   a. **Sun Valley Farms**- Sun Valley Farms is the largest nursery growers of cut bulb and field flowers in the United States. The company began in Myrtle Point, Oregon by a
high school Agriculture teacher and a student with five acres of Irises and a row of Daffodils.

b. The Arcata division is the largest growing operation and headquarters for the company. The Arcata farm was purchased in 1969. By 1996 the farm had become a nationwide leader in Lilies, Irises, and Tulips. Our environment of mild winters, cool summers, humidity, and moderated sunlight makes Humboldt County perfect for growing bulb flowers. The fields in Arcata grow Lilies, Iris, Tulips, French Tulips, Freesia, Hyacinth, and Hydrangeas.

8. ACTIVITIES FOR THE CLASSROOM

a. The easiest activity for the students to do is to plant a young plant, and see how much it grows in the next few weeks. With this activity they are able to take the plants home with them after. You can talk to stores such as Nilsen’s or the garden section at Ace for donations. Sun Valley farms can also be asked about donations.

b. The Lima Bean Experiments-There are 2 different activities you do with lima beans

   i. Exploding Jar

      a. Lima beans are grown in sand in sealed jars. The pressure from them growing makes the glass crack. The activity handout has the instructions.

   iv. Seed Germination

      a. Lima beans are separated from the wet paper towels so students can easily see the growing roots. The activity handout has the instructions.
Nursery References


1. **What is a Dairy Animal?**

A dairy animal is an animal (bovine) that is used for the production of milk and other products that come from dairy milk.

   a. **Common Terms**

   i. **Bull**: A male dairy animal.
   
   ii. **Calf**: An immature dairy animal.

   iii. **Colostrum**: The first milk a cow produces and a calf drinks. It is a very thick milk and is full of antibodies for the calf.

   iv. **Cow**: An adult female dairy animal that has had a calf.

   v. **Dam**: The mother of a dairy animal.

   vi. **Dry Cow**: A cow that is within two months of giving birth. Her milk production stops and her udder “dries” up before producing colostrum.

   vii. **Fresh Cow (Freshening)**: A cow that has just given birth.

   viii. **Heifer**: A young female dairy animal.

   ix. **Lactation**: The stage of a cow’s life where she is producing milk after calving. The lactation length standard is 305 days.

   x. **Milking Machine (claw)**: The device used to extract and collect milk from the mammary gland in a milking parlor.

   xi. **Milking Parlor**: The building the animals are milked. Also holds the storage tanks and other equipment necessary for milking.

   xii. **Parturition**: The act of giving birth
xiii. **Sire:** The father of an animal

xiv. **Teat:** The part of the udder that releases the milk.

xv. **Udder:** The location of milk production in a cow

2. **Breed**-There are 6 main breeds of Dairy animals: Holstein, Jersey, Guernsey, Brown Swiss, Ayrshire, and Milking Shorthorn

   a. **Holsteins**- Holsteins are the most well known dairy animal. They are very large animals and are most recognized for their typical black and white coloring; although there are also red and white Holsteins, they are not nearly as common. Of the over 9 million dairy cows in the U.S. approximately 90% of them are Holsteins. The breed originated in the Netherlands about 2,000 years ago from breeding the Batavian cattle with the Friesian cattle to create a breed that would make the best use of the land in that area. They came to America when Winthrop Chenery purchases a Holstein cow in 1852. The cow was such a good producer that more started to be imported to America. At birth a Holstein calf weighs about 90 lbs and grows to be about 1,500 lbs and 58 inches tall (4.8 feet) at the shoulder. Holsteins have the highest milk production (they make more milk) of all the breeds and can produce around 23,000 lbs. of milk (2,674 gallons) of milk each lactation period.

   b. **Jersey**- Jerseys are the second most common breed in the United States. They are the smallest in size, fawn in color, and are known for their large brown eyes and a ‘dish’ shaped head. They originated on the Island of Jersey in the English Channel off the coast of France. They are the oldest
known dairy breeds with records dating back to 1771. They are favored for their high butterfat percentage and protein percentage in their milk, and the large quantity of milk they produce. This high butterfat percentage means their milk is perfect for the production of cheese. In fact, the extra protein in the milk is the reason why Jersey milk yields the largest amount of cheddar cheese. This yield is 12.35 pounds from 100 pounds of milk compared to the average of 10.04 pounds of cheese from 100 pounds of milk. When born, Jersey calves weigh an average of 60 lbs and grow to about 1,000 lbs. The Jersey breed is very heat tolerant and adapts well to any climate conditions. It is said that an average Jersey in the United States can produce about 16 times her bodyweight each year.

c. Guernsey- Guernsey’s originated from the Isle of Guernsey, which is a tiny island in the English Channel off the coast of France. They were developed from breeding the Norman Brindles with the Froment du Leon breed from Brittany. The Guernsey breed came to America in 1840 with Captain Belair to New York. They are a fawn and white color, often seen more orange in color than fawn, and about five feet tall at the shoulder. Guernsey’s are known best for their “Golden Guernsey” milk. Their milk has a golden tint to it because of the high concentration of beta-carotene (converted into vitamin A), which also gives carrots their color, in their milk.

d. Brown Swiss- Brown Swiss originated in the Swiss Alps and are well adapted for high altitudes and hot or cold climates. They are very docile and have strong feet and legs which made them the perfect breed for the
mountain terrain. In other countries, Brown Swiss is still considered a dual purpose breed, meaning they are used for both milk and meat production. In the United States however, Brown Swiss are not dual purpose and are raised for milk production. Their color ranges from white, light brown, brown, dark brown, and brown/black. They are very large animals known for their big brown eyes and huge ears. They produce large volumes of milk which is good for cheese-making, and have the ability to yield high fat-to-protein component ratios. An interesting fact about Brown Swiss is that almost all Brown Swiss alive today can be traced back to one cow, Jane of Vernon, who is considered to be the ‘Mother of the Brown Swiss Breed”.

e. Ayrshire- The Ayrshire originated in the County of Ayr in Scotland way before 1800. They were first called the Cunningham, then Dunlop before the name Ayrshire finally took hold. They were established by crossing some types of cattle from Europe with the native cattle of Scotland which created an animal perfect for the climate in Ayr who was a good grazer with milk ideal for the Scottish dairyman’s butter and cheese production. Ayrshires are red, reddish-brown mahogany which varies from light to dark, and white in color. Sometimes they will have a speckled pattern and were known for their horns that would reach a foot or more in length. Ayrshires are of medium size and their milk has a moderate percentage of butterfat and relatively high in protein.

f. Milking Shorthorns- Milking Shorthorns originated in Northeastern England in the Valley of the Tees River, however the significant breed
changes took place in Northumberland, Durham and York. Milking
Shorthorns are known as one of the oldest breeds in the world. They are red, red and white, white or roan in color. This docile breed was also seen as a
dual purpose breed, today’s animals have become more dairy like are disease
resistant. They’re milk is known to have a good protein-fat ratio which is
good for cheese production.

3. **Dairy Products**- When people think of dairy products, the main products they think of are fluid milk, cheese, and ice cream. There are many other products made out of milk too. The following are the most common dairy products (not all products or by-products will be listed):

   a. Fluid milk-This includes fat-free, low fat, whole, reduced fat, flavored milks
      buttermilk, and lactose-reduced/free milks (only if from dairy cows)

   b. Puddings

   c. Frozen yogurt

   d. Ice cream

   e. Yogurt

   f. Cheese-Such as Cheddar, Mozzarella, Swiss, Parmesan, and Jack

   g. Cottage cheese

   h. Powder milk

   i. Evaporated and Condensed milk

   j. Butter

   k. Cream
4. **Basic parts and functions:** It is important to know the parts of a cow so you know how milk is produced. Cows have some of the same body parts we do such as a throat, jaw, thigh, and hips. Other parts of them are different, such as their stomach and those specifically for milk production.

   a. **Milk Production Body Parts:**

   i. **Udder:** The udder is where the milk is produced. Each cow has one udder with four separated quarters.

   ii. **Fore Udder and Rear Udder:** The Fore udder is the half of the udder that is closes to the head of the animal, and the Rear udder is the half closed to the tail end of the animal. Both produce milk and there isn’t much of a difference besides location and size.

   iii. **Both Fore and Rear udder attachments:** This is where the udder attaches to the cow. You want the fore (front) attachment to be nice and smooth, and the rear (back) attachment to be high and strong. This keeps the cow’s udder under her body and prevents injuries such as being stepped on because of how close to the body the attachments are.

   iv. **Suspensory Ligament:** This is the large cleft you see on the back of a cow’s udder. This ligament is what holds the udder high on the animal and keeps if from dragging on the ground. As a cow gets older, this ligament stretches out.
v. **Teat**- The teat is where the milk comes out of the udder from either a calf nursing or from a milking machine.

vi. **Mammary veins**- Milk production needs lots of blood circulation and oxygen to operate correctly. The mammary veins are large veins that bring a large amount of blood to that area so the milk can be produced.

b. **The Stomach of a Cow**- A cow is a ruminant. This means they eat and digests plants then regurgitates and re chews the plant material (cud) before complete digestion. A cow has one stomach with four parts called the Rumen, Reticulum, Omasum, and the Abomasum.

i. **Rumen**- The rumen is the first compartment of the cow’s stomach. It can hold up to 50 gallons of material and is designed to digest high fiber feed. The rumen ferments (breaks down) the feed and either absorbs the nutrients or brings the fermented feed, called cud, back to the animals mouth to be chewed to be broken down more before further absorption.

ii. **Reticulum**- The reticulum has a honey-comb appearance and is the second compartment of the cow’s stomach. It functions very much like the rumen as it breaks down plant cells into usable nutrients for the animal.

iii. **Omasum**- In this compartment, water is added to the digesting material and then is reabsorbed along with some of the nutrients from the feed.

iv. **Abomasum**- The Abomasum is considered the ‘true stomach’ of the cow as it is the closes compartment to a non ruminant, such as you. The Abomasum is very acidic and breaks down the proteins for absorption in the intestines.
5. The Life of a Cow

e. Born

a. The journey of a cow starts like everything else, being born. When they are born they are called calves. The female calves are taken away from the mother for safety. There is a high chance of injury from being stepped on and of getting sick if the calf stays with its mom. Instead, they are taken into their own clean pens a few hours after being born. Bull calves are either raised by the dairyman for breeding stock or are sold at auction yards.

b. They are fed colostrum from their mom, which is a thick yellow milk full of antibodies from the mom which will help develop the calf immune system. They are fed colostrum for 3 days and then switched to milk or a milk replacer, depending of the dairyman. Most will wait 2-3 weeks before placing the calf on milk replacer. When born, calves stomachs are still developing and are unable to digest solid foods. The milk they drink skips the Rumen compartment of their stomach. At around 5 weeks, calves are introduced to hay, grain (a mixture of grains such as corn, wheat, and barley) and water. After 8 weeks the calves are weaned, which means they are taken off milk completely.

c. During these 8 weeks the calves are dehorned for safety reasons, ear tagged for records, and branding for herd identification. At this young of an age the calf doesn’t remember any of the pain.
f. Yearling

a. When the calf is one year old they are called a yearling. At this stage they are still growing but are getting close to their mature weight. They are usually put in groups with other calves around the same age. During this time a vet will come and vaccinate the animals against deadly diseases. They are watched to make sure they are growing and healthy animals. Some farmers will send these animals to farms that specialize in raising animals to mature weight.

g. 2 year old Cows

a. A 2 year old cow has just had her first calf and is also called a first year heifer. After having their calf, they produce colostrum for the first week to pass on their antibodies to their calf. After that they will produce regular milk. The colostrum stays separate from the rest of the milk supply and is sometimes frozen to make sure the dairyman always has good colostrum ready for a new born calf.

b. A cow will produce milk for around 305 days. During that time the cow is bred again about one or two months after calving. Two months before they calve they will be ‘dried off”. This dry off period is when the cow stops producing milk and store fat for producing milk after caving again.

h. Mature Cow

a. A cow is considered mature when she has had her third calf. When producing milk she is milked twice a day and produces and average of
7 gallons of milk in one day but can produce up to 12 or more gallons of milk a day just after calving. She will live on the dairy for as long as she is healthy and able to produce milk.

6. Milk

a. Milk’s main components are **Fat, Protein, Minerals, Vitamins, Water and Lactose**.

   i. The **fat** in milk is a good source of energy.

   ii. **Protein** is the building block for every part of our bodies. The protein you consume in milk will go towards building strong muscles.

   iii. **Minerals** such as Calcium, Phosphorus, and Potassium. Calcium is what makes your bones strong and without it your bones lose their mass. Milk is an excellent source of calcium. Phosphorus and Potassium are needed for our body’s everyday chemical reactions within our cells.

   iv. **Vitamins** A, B, D, E, and K are in milk. Vitamin A is needed for your vision, Vitamin B is important for many of our cellular processes such as energy metabolism, Vitamin D is what allows Calcium to be absorbed in the body, Vitamin E is needed for hair and skin growth and health, and Vitamin K is needed for blood clotting.

   v. **Water** makes up the majority of milk, 87.5% of it in fact.

   vi. **Lactose** is a naturally occurring sugar in milk. Milk is actually the only place lactose is made. That is what gives milk its sweet taste.
7. **Concerns About Milk**

   a. One of the many concerns about milk is if antibiotics and added hormones are in our milk. The answer is no. All milk is tested before being processed for any antibiotics, added hormones in the milk, or anything else that shouldn’t be there. If they find traces of antibiotics or added hormones that load of milk is removed, disposed of, and the farmers are fined.

   b. rBST is also a concern. rBST is a man made hormone based off of the natural occurring growth hormone BST produced in the animal. There are not many dairymen who use rBST and those that do use it appropriately. No traces of rBST are ever in milk because the body uses the injected hormone before it has a chance to get to the milk.

8. **Milk Processing**

   a. **Milking on the Dairy**

      i. Twice a day the cows on a dairy are milked in the Milking Parlor. Some dairies even milk 3 times a day. When they enter the barn they are in a large open holding pen until it’s their turn to be milked. Most cows naturally head to the milking barn at the same time of every day. If a cow who usually is the first in the barn comings in towards the end, the dairyman knows that something may be wrong. Once they are in the milking stall their udders are rinsed and dried. Teat dip, an iodine sanitation solution, is applied and rinsed off for sanitation. The milking machine is then attached to the udder by the milking machine claw. The
claw is how the milk is taken from the udder. It mimics the sucking motion a calf does when nursing. Once they are done being milk the teat dip is up on and left on to keep any bacteria out of the teat. The milk is then put into a milk tank, is cooled, and waits for pickup.

ii. Milk trucks from a creamery come to the dairy every day, takes the milk, and the milk is tested for any problems it might have. If it passes the test the milk is then ready for processing.

b. Creamery Production

i. Standardization

a. When buying items from a store, consumers want their product to be consistent. For milk to be consistent in taste and texture it undergoes Standardization. The milk is separated into the skim portion and a cream portion of the milk. The cream portion of the milk is added back in depending on the type of milk being produced to create a 1%, 2%, low fat, or whole milk product.

ii. Pasteurization

a. Pasteurization is done to make sure the milk is safe to drink. The fluid milk is heated to 161°F for 15 seconds. This process makes sure that the milk is safe from any microbes that may make it unsafe to drink and it extends the shelf life.

iii. Homogenization

a. The natural fat in milk is in non-uniformed size globules and can cause the cream to separate from the fluid. Pasteurized
milk doesn’t have to be homogenized but this process helps keep the milk from going bad. This process also reduces the fat size which allows for even distribution in the milk and improves the texture of the milk. This process uses high amounts of pressure to change the fat globule sizes.

iv. California’s milk standards are the highest set of standards in the United States. All of the milk produced in California is labeled with the Real California Seal.

9. Humboldt Dairying and Humboldt Creamery

a. The dairies in Humboldt County are different than the dairies in the rest of the state. Humboldt dairies are pasture based while the rest of the dairies are not. Pasture based means that the cows are house in pastures all year long instead of having to stay in barns or feed lots. Our climate allows for our dairymen to keep their cows out of the barns almost every day of the year. Although in times of bad weather the cows will stay in the barns to keep them warm and dry.

b. Humboldt Creamery began in 1929 by Peter Philipsen when he and 152 dairy families contributing $0.10 per cow to start the Humboldt Creamery Association. One year later, in 1930 the plant was opened for business.

c. Humboldt Creamery produces fluid milk, butter, cheese, and ice cream, but is most well known for its ice cream production. The Costco brand Kirkland’s gallon size of vanilla ice cream is Humboldt Creamery ice cream.
d. When driving over Fernbridge you pass right by the creamery. The big pond you see next to the creamery is actually a waste water cleaner tank. Every day the processing machines and hoses get washed and cleaned. The water that is used to wash everything is put into that pond and gets recycled to be used again.

e. Humboldt Creamery started out as a Cooperative owned by the dairy family but was bought by Foster Farms in 2009.

ACTIVITIES FOR THE CLASSROOM

1. Ice Cream

   a. This is a quick and easy activity for students to do. It does cost money to buy the ingredients, but you may be able to get a local grocery store to donate part of them.

      i. The information for this activity is on a handout to give to students and that can be taken home.

2. Dairy Princess

   a. The California Milk Advisory Board sponsors a contest called the Dairy Princess Contest. The winner, the Dairy Princess, goes to schools and classrooms teaching about the importance of milk, and often brings a calf for the students to pet. If you are interested in having your local Dairy Princess come to your classroom contact Mary Ann Renner at (707) 725-9497 or you can contact them via their Facebook page: https://www.facebook.com/dairy.princesscontest?ref=ts&fref=ts
3. Mobile Dairy Classroom

   a. The Mobile Dairy Classroom is sponsored by the Dairy Council of California. They go to schools and teach the kids about the anatomy, how milk goes from a cow to their fridge, and the agriculture technology used. The mobile classroom also brings a dairy cow with them that the students are able to bet too. You can fill out a request form; however the mobile classroom only goes to a school about every 3 years, so it is suggested to team up with other teachers and other grades for this activity.

   i. http://www.healthyeating.org/Schools/Mobile-Dairy-Classroom/Check-Availability.aspx
Dairy References


Dear Teachers,

Thanks you for deciding to include Agriculture into your students’ lives! Agriculture is a very diverse industry and has a place for everyone to be involved. The first step for involvement is to learn about the industry. Living in Humboldt County, both you and your students are surrounded by agriculture. Humboldt’s top three agriculture commodities are Forestry/Timber Production, Nursery Production, and Dairy Production.

This curriculum is ready to be used. There are PowerPoint’s to present in class along with corresponding handouts for you students to fill out. You have all the information from those PowerPoint’s on your Instructional Aid plus additional information as well. The best way for students to learn is by doing hands on activities. Each lesson has suggested activities and industry contacts for tours or speakers. Please engage your students in these activities as they are quick, easy, educational, and most importantly, fun.

I hope you continue to include agriculture in your students’ education as it is the backbone of our county and our world. Please let me know if you have any questions, comments, or concerns.

Sincerely,

Alayna Renner
aarenner@calpoly.edu