University of California Cooperative Extension Sonoma County, Division of Agriculture and Natural Resources

A fourth through sixth grade curriculum introducing rangelands, their functions, why they are important and how to protect them.

Our Rangelands

Exploring the Rangelands of Sonoma County and Beyond

Our Rangelands

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Our Rangelands

Lesson Plans and Activities for Grades 4-6

How to use this Binder and Disc

This curriculum will give your students a valuable insight into a resource that comprises 55% of the total land area of California, our rangelands. Each lesson will enlighten and inspire students to care for and protect this vital resouce. The lessons are grouped into five units which include three to six lessons each. Every lesson is accompanied by an activity, activity variations, activity extensions, and the resources required for the activity.

Additionally, the California Concepts Standards Correlations are given at the beginning of each lesson. A variety of concepts for each grade are covered by this curriculum, from Life Sciences and Ecology to Social Science and Experimentation.

All lessons, activities, activity resources and pictures are included on the disc. To use the disc, you must have Adobe Acrobat Reader. If you do not have Acrobat Reader, you can download it for free at www.adobe.com.

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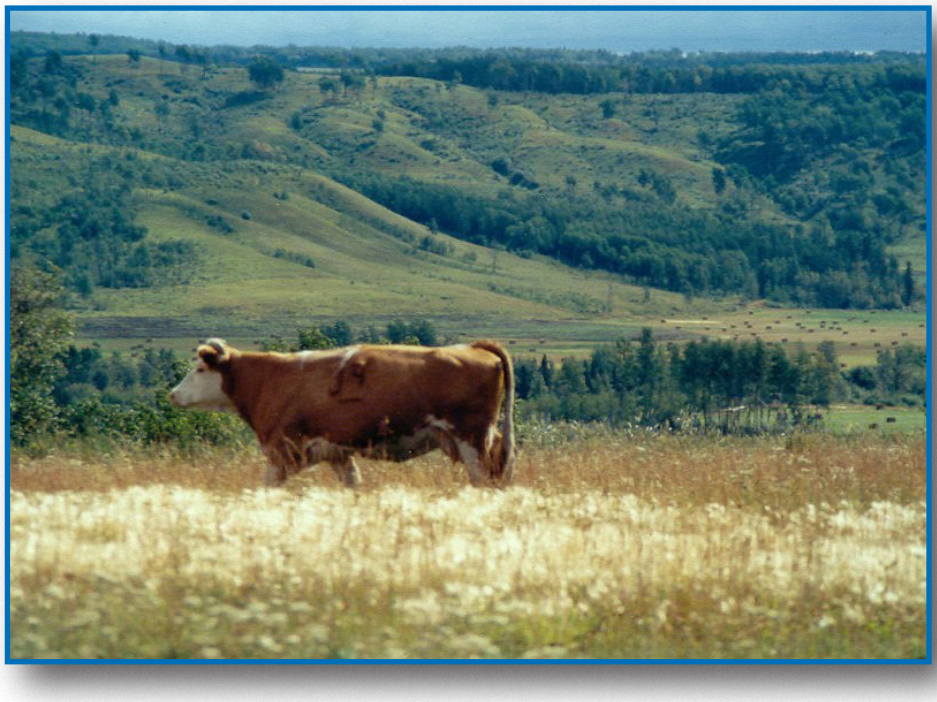
UNIT I

Introduction to California Range and Livestock



The background information and activities in this section are an introduction for teachers and students. This section provides a basic definition of and exploration into what rangeland is and its associated products are.

Activities include:

Rangeland Investigations

What Comes from the Range

Milk Please

Hamburger Explorations

1. Rangeland Investigations

Purpose

- Become familiar with the concept of rangelands
- Begin the exploration into California's rangelands and livestock

Concepts/Content Standards Correlation

Grade 4 Science
Life Sciences- 2a, 2b, 3a, 3b
Investigation and Experimentation- 6b, 6g

Grade 4 History- Social Science
4.1.3, 4.1.4, 4.1.5, 4.4.6

Grade 5 Science
Investigation and Experimentation- 6a

Grade 5 History- Social Science
5.3.4, 5.3.5

Grade 6 Science
Ecology (Life Science) 5a-e
Resources- 6b, 6c
Investigation and Experimentation- 7b, 7f

Materials

- Rangeland Investigation Worksheet 1- Song Lyrics to Home on the Range
- Rangeland Investigation Worksheet 2- California's Land Form
- Lawn trimmings or grass clippings, approximately a filled paper grocery bag
- Option- Assign students to bring in a sample of grasses, lawn clippings
- Glue

Time

Preparation: 15- 30 minutes
Discussions and Activities: 1.5- 2 hours

Rangelands are a primary resource of America. Range occupies nearly one billion acres of land area in the United States. California has about 57 million acres of rangelands with 42% of these acres owned privately. Rangelands of the American West are characterized by varying elevations, soil types, climates and plant and animal communities. Range is divided into 6 different regions, with each region containing plants uniform in kind and abundance. In California, rangelands encompass coastal areas, the Central Valley, Coast Ranges and foothills and Sierra Nevada Mountain Range and foothills.

Range habitat is important for wildlife, water quality and a source of water for agriculture. Rangelands also provide opportunities for industry using raw materials like timber and minerals. Rangelands preserve open space on the landscape and provide recreation, residential uses, natural beauty and clean air.

Grazing by livestock is another primary value and use of California's rangelands. Livestock species of cattle, sheep, goats, horses and other grazing animals live on the land. From these animals we produce a wide range of products for our survival and enjoyment. In California the health, productivity and resources of rangelands are extremely important. 89,000 square miles, or 55%, of California's 160,000 square miles are covered by rangelands!

Range Managers work with the land to provide the food, water and space their livestock need for growth and development. Effective and efficient management differs from site to site, as the physical environment, livestock breeds and rangeland production goals differ. The management of rangelands and livestock is a complex, challenging business that requires great skill, hard work, dedication and motivation. Raising livestock and managing land is a 24-hour a day, 365 days a year job.

Please use the resources provided, your library, pictures in magazines and the Internet to provide images and examples of rangelands and livestock. If possible, refer to or visit an appropriate example of grazing animals and rangeland nearby. Introducing a local, familiar example will help students successfully comprehend and explore California's rangelands.

Procedure

Preparation

- Label your school's location on Worksheet 2- California's Land Form
- Copy Rangeland Introduction- Worksheet 1 and Worksheet 2 for students
- Review the lyrics and practice Home on the Range song
- Obtain lawn/grass clippings, approximately a loosely packed paper grocery bag full OR as sign students to bring a sample of lawn/grass clippings for the activity

Part A- What is Range?

Discussion

- Review the importance of rangelands and various other details from the background information section.
- Introduce rangelands and livestock as a special feature of California and as something the class will be learning about over the year.

- Survey the students to engage them in the importance and relevance of rangelands by asking: "Who likes ice cream?", "Who eats cheese?", "Who likes to eat hamburgers?", "How much do you know about ice cream, cheese and hamburgers- where they come from and how these things are made?"
- Comment "Through our studies of California's rangelands, we will be learning about these and many other things we need and enjoy in our life. We begin our study of rangelands by learning a song. Some of you might have heard this song before".

Activity

1. Hand out copies of Worksheet 1- Home on the Range Song Lyrics, have students read the lyrics and underline unfamiliar words and phrases.
2. Review the meaning of the unfamiliar words and phrases of the song.
3. Select 2- 4 verses to sing with the students. Read the selected verses aloud, together as a class.
4. Practice by just humming the tune. With Internet access, use the www.Bussongs.com website to play Home on the Range song tune.
5. Combine the lyrics with the tune- sing the song.
6. After performing the song, discuss: "According to this song, what is range?", " What animals are on the range?", "Do we have deer and antelope here in California? (Yes!)", "Do we have buffalo? (NO!)", "Do we have rangeland in California? (Yes!)".
7. Ask "What other animals do you think we raise on the range?". List these livestock species of animals on the board - cattle, sheep, goats, llamas and horses.

Part B- How much Rangeland is in California?

Discussion

- Show your example of grass/lawn clippings OR have them share the grass clippings they brought into class.
- Ask students if they think that the grazing animals listed would eat grass. Tell students that these animals not only like to eat grass, they love it! Ask students if they think there are grasses on rangelands? (YES!)
- Explain that there are other plants besides grasses growing on rangelands but for now, we will use grass to show the amount of California covered by rangelands.

Activity

1. Pass out Worksheet 2- California's Land Form, have students identify their school's location.
2. As a class, identify and label local features and significant California features on the map (Sacramento, the Pacific Ocean, major mountain ranges, major rivers, a nearby creek, agricultural areas, parks, highways, cities…).
3. Have the class compute the following word problem: California is 160,000 square miles large. There are 89,000 square miles of rangelands in California. What percent of California is covered by rangelands? Answer: approximately 55% of California is covered by rangelands.
4. Cover 55% of California's land with glue and then adhere the grass clippings by having students estimate and cover approximately half of the landform using appropriate locations

for rangelands- Coast Ranges, Sierra Nevada and foothills, coastal areas and Northern California OR having students divide California's Land Form into 4 equal portions, folding the paper horizontally. Ask students to compute how many of these sections must be filled in to roughly represent 55%.

5. Let dry and display students work.
6. Concluding discussion:

- Do you think all of California's rangelands are where we covered with grass? Answer: This map represents the total amount of land covered, not exact locations.
- Is having healthy rangelands important?
- What other plants besides grasses do you think grow on rangelands? Answer: Trees, shrubs, wildflowers and other plants.
- Where do the plants get their energy to grow from?
- Are there creeks and rivers running through rangelands? Answer: Yes.

Conclusion

A significant portion of California is covered by rangelands. The presence and health of this land is important for California and all its inhabitants.

Variations

- Find a place or source at the school to collect grass/lawn clippings from.
- Replace grass collection and gluing with shading and coloring in Worksheet 2- California's Land Form.
- Cover a larger map of California to represent the 55% of California covered by rangelands.
- Obtain copies of California road maps for students to use instead of using Worksheet2- California's Land Form.

Extensions

- Take a field trip to a farm, dairy, ranch, petting zoo, zoo or other place where grazing animals are.
- Take the completed Worksheet 2- California's Land Form and place pictures from magazines, stickers or drawings of livestock that use rangeland on top of the grass. You can also represent other features of rangelands like creeks, barns, fences, trees, shrubs, roads, vehicles and electrical lines.

2. What Comes from the Range?

Purpose

- To investigate a variety of products and by-products produced from livestock species raised on ranches, farms and rangelands.
- To connect the students' life to the concept of livestock and rangelands.

Concepts/Content Standards Correlation

Grade 4 Science

Life Sciences- 2a, 3a

Investigation and Experimentation- 6a, 6b

Grade 5 Science

Investigation and Experimentation- 6a

Grade 6 Science

Ecology (Life Science) 5a, 5b, 5c

Resources- 6a, 6c

Investigation and Experimentation- 7b

Materials

- 15 – 30 items from What Comes from the Range? Product List (collect items or assign students products to bring into class from home)
- Copies of Worksheet 1- Products and Animal Origins for students
- Images of cattle, sheep, goats and llamas grazing and living on rangelands
- Old magazines and Sunday newspaper sections with food and human interest contents

Time

Preparation: 30 minutes

Discussion and Activity: 1. 5 hours

Rangeland has many uses with a primary, agricultural use being the raising of animals (livestock) like cattle, sheep, goats, horses and llamas to produce a wide range of products and by-products. Most everyday we use a variety of these products. Some products have a direct connection and resemblance to the animal of origin, like steaks or hamburgers or milk.

There are also products that contain by-products from livestock. Gelatin from bones, hooves, horns and hides is used to make ice cream, yogurt, Jell-o, pudding, candy and 35 millimeter film. Fat (fatty acids) from livestock hides produce ingredients used to make candles, cellophane, crayons, cosmetics (shaving cream, lotions, soaps, shampoos), pet food, oil for machinery and linoleum. Rennet taken from calves' stomachs is used to make cheese and baby formula. Medical products like insulin for diabetics can be made with ingredients from a cow's pancreas. Glands and blood from cows produce other medicines and cartilage can be used during plastic surgery. The creation of by-products allows for 99% of a cow to be used.

Wool from sheep, llamas and goats provide fibers for weaving fabric used to make socks, pants, skirts, sweaters, mittens and hats. For example, a particular breed of goat's wool is used to make an extremely soft and elegant fabric called cashmere. Milk from cows, sheep and goats provide us with many food products including milk, cheeses, butter and ice cream. There are by-products from the production of milk. For example, whey is a by-product that can be an ingredient used in cookies, crackers and breads.

We enjoy, encounter and rely on animal products and by-products daily. Studying and investigating familiar products' livestock and rangeland origins provides a relevant and engaging basis for the students' learning experience.

Procedure

Preparation

- Gather 15 - 30 items or assign items from the Product List for students to bring.
- Place products around the room, label each product with a simply worded descriptive title (jerky, hamburger, ice cream).
- Make copies of Worksheet 1- Products and Animal Origins.
- Gather and have students bring in old magazines with food and people content.

Discussion

- Write the title "Grazers of Rangelands" on the board. Have students list and write the grazers that use rangelands- cattle, sheep, goats and llamas.
- Inform students that we use products from these animals being raised on rangelands.
- Review that sometimes the product's origin to an animal is clear and sometimes the product will contain an animal ingredient with the animal of origin not as obvious. Give examples like a piece of meat (product) from cattle versus the fatty acids (by-product) of cows being used as ingredients in shaving cream and soaps.
- Introduce activity to the students as an investigation into the variety of products and by-products that come from livestock living on farms, ranches and rangelands.

Activity - Part A

1. Hand out and review Worksheet 1- Products and Animal Origins with the students.

2. Have students visit 15 products around the room, record each item and circle which animal (cattle, sheep, goat, llama or other) the product or animal ingredient in the product came from.
3. Encourage students to carefully investigate the products. Have students read labels and notice any animal images or references on the packaging to help identify the animal origin. Try to have clothes and wool items with tags so students can read about the animal origin. If the students are still unsure of the product's animal origin, have them take a guess.
4. When students complete their worksheets, as a class, review and discuss each product and their animal or animal ingredient origins.
5. Concluding Discussion:

- How often, per day, do we encounter animal products and by-products?
- Do we rely on and enjoy these products?
- Are livestock and rangelands an important part of our lives too?
- Many of the animal ingredients and by-products can come from either cattle or sheep and possibly another species of livestock. A majority of the animal by-products come from cattle.
- What's an example of an animal product that is used in your family?

Part B

1. List and review other items from the Product List, focus class on cattle products and by-products.
2. Have students use magazines and newspapers to find and cut out pictures of products with cattle origins.
3. As a whole class, as individuals or as working groups, create a collage of these products. With out magazines or newspapers, have students draw products on pieces of paper, cut around these images and make the collage.
4. Use a picture or drawing of a cow as the center of the collage. When complete, display collages in the classroom.

Conclusion

Livestock like cattle, sheep, goats and llamas are raised on rangelands and provide us with many products. Our enjoyment and daily needs are connected to these animals and to California's rangeland resources.

Variations

- Cut out a large cow silhouette shape and paste pictures of products inside this outline.
- Use butcher block paper and have whole class make one collage with product images.
- Instead of making a collage, make a mobile with the center being an image of a cow surrounded by images of the products.

Extensions

- Create a group meal from the products brought in for this activity (for example a pizza or soup).
- Have each student bring in an animal product from home and hold a product tasting.
- Assign homework for the students to complete Worksheet 1- Products and Animal Origins using items at home.
- Have students research individual livestock species and related products.

3. Milk Please!

Purpose

- To develop an understanding of milk and milk products' livestock and rangeland origins.
- To relate students' lives to milk production, products, livestock and rangelands.
- To know California's role in milk production.

Concepts/Content Standards Correlation

Grade 4 Science

Life Sciences- 2a, 2b, 3a, 3c

Investigation and Experimentation- 6d

Grade 5 Science

Life Sciences- 2a

Investigation and Experimentation- 6a

Grade 6 Science

Ecology (Life Science) 5a, 5b, 5c, 5e

Resources- 6a, 6b, 6c

Materials

- May I Have Some Milk, Please? Worksheet 1- Identity Cards
- May I Have Some Milk, Please? Worksheet 2- Consumer Checklist
- Product List in What Comes from the Range? (previous activity)
- An example of milk products and items with milk product ingredients
- Empty plastic gallon milk "jug"/ container

Time

Part A Background Investigations

Prepartion: 10 minutes

Discussion and Activity: 45 minutes

Part B The Game

Prepartion: 20 minutes

Discussion and Activity: 45 minutes

The nationally developed Food Guide Pyramid indicates that the consumption of milk and milk products is one important component of a healthy daily diet. However, some people are allergic to dairy products so make sure to check in with students before consuming any. Milk and milk products have a daily presence in our lives, are an important commodity for California, and provide a relevant and engaging base for learning.

Dairy farming is the process of raising livestock breeds from the multi-stomach ruminant family of cows, goats and sheep for their milk. Humans provide for the livestock's food, water and space needed to produce milk. Each day a dairy cow will drink approximately 30 gallons of water to produce 6 gallons of milk. It takes about 10 pounds of milk to make one pound of cheese with the average cow producing 2,100 pounds of milk or 210 pounds of cheese a month. The average cow can produce approximately 46,000 glasses of milk a year.

Cows get the nutrition to produce milk by drinking water and by eating grasses, plants growing on the land, chopped up plants and grasses called silage and grains like corn. Usually, a cow is milked two times per day by machines in facilities called "milking parlors". The milk flows through pipes, is stored in refrigerated tanks and its quality is checked.

The milk is then transported by trucks to a creamery where it is processed, packaged and produced. After processing, it is transported to a distribution center and to wholesale markets like restaurants and grocery stores. After all these steps, the milk and milk products are available for the public to consume. Milk and milk products are perishable items, so efficient and smooth production and distribution is important.

Currently in California there are 1,960 dairies processing milk and 72 of those are in Sonoma County. In the year 2007, sales of milk contributed $7.33 billion to California's economy. California is the top milk-producing state nationwide, contributing 22% of the nation's milk supply. The production and sale of milk provides California with fresh dairy products, jobs and agricultural open space. Several counties in California are heavily invested in the raising of dairy cows and the processing of milk. Even if your specific county does not produce much in the way of dairy products, not too far away in California you will find some part of this process taking place.

Procedure

Preparation

Part A

- Gather examples or assign students to bring in milk products. See '*What Comes from the Range?*' activity for a listing of products.
- Colored pens and/or pencils
- Paper

Part B

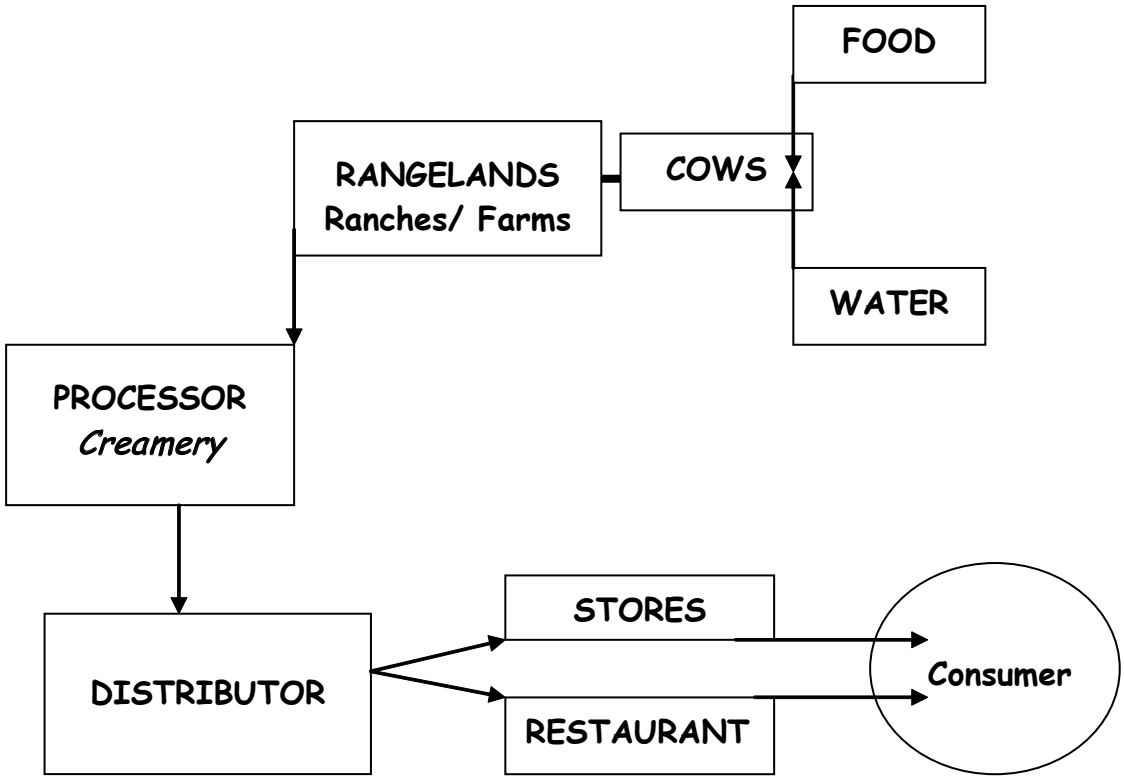
- Calculate the number of Identity Cards needed to play
- Prepare one Identity Card per student- recommended to laminate cards

Discussion and Activity

Part A- Background Investigations

1. Review and list each example of milk products gathered.

2. Brainstorm and list additional dairy products and products with dairy ingredients like cookies, cakes, crackers, breads, muffins, candy, milk chocolate, ice cream, whipped cream, milkshakes and types of cheeses.
3. Review the packaging for information about who (what company) produced the product and where it was produced.
4. Name and list local places where a consumer can purchase these products.
5. Draw , review and detail the steps that milk takes from dairy farms to the consumers (following milk from the grass to the glass!):



6. Have students identify their favorite product from milk and/or milk products. Draw this item on the paper provided.
7. Have students use each step reviewed to create an explanation, short story or poem about how their favorite product was produced.
8. Have students share their drawings and writings.
9. Concluding Discussion:

- Did you know this much energy and this many steps went into the production of milk and your favorite product?
- Is milk a perishable (something that can spoil) product? What does this mean for the milk producers?
- Using the background information, share with students additional details about the dairy industry and its role in California.

Part B-The Game

Objective of the Game: For students to create a group representing the correct order and steps to get

a glass of milk to a consumer. Winning combinations have 8 identities in order:

Consumer, Restaurant, Distributor, Processor, Ranch, Cow, Food, Water OR

Consumer, Store, Distributor, Processor, Ranch, Cow, Food, Water

Notes for Preparation of Identity Cards:

- Copy and cut as many Identity Cards as there are students playing
- To determine which Identity Cards to use for playing:

  -use as many winning combinations of the 8 identities as possible

  -divide total number of student players by 8, this is how many consumers can get a glass of milk

  -with total numbers of players not divisible by 8, randomly choose additional Identity Cards to have one card for each player
- See Variations section below for additional suggestions on adjusting game and player numbers.

Playing the Game

1. Explain the rules of this game indoors after completing Part A of this activity. Draw a sketch of the game to review the rules of play and the 8 parts of a winning combination.
2. Assemble class outside, standing in a circle preferably on a grassy playing field. Establish physical boundaries of the game playing field.
3. Distribute one Identity Card to each student, emphasize the importance of keeping their new identity secret. Have students memorize their identity and place the Identity Card into a pocket.
4. Have only the Consumers reveal their identity and give each Consumer a copy of the Consumer Checklist to use when playing the game.
5. Have all students, except Consumers, spread out on the playing field and stand still.
6. Have Consumers stand behind the start/finish line.
7. Countdown to start the game, sending the Consumers out to gather the steps (students) needed to get a glass of milk.
8. First, the Consumer will the will be looking for a student who is a Store or Restaurant. The Consumer will approach one student at a time, using a yes or no question. The Consumer will ask each student individually "Are you the Store?" or "Are you the a Restaurant?". Students playing may only reply "yes" or "no" based on the truth of their Identity Card. Once the Consumer has found the first student, the team will then look for the second student needed- the Distributor. As the Consumer's team builds, in order the students hold hands or chain elbows creating a single file chain.
9. The Consumer team "wins" and is finished when a winning combination of students crosses the finish line together!
10. Verify the order and steps of each winning team by collecting the Identity Cards from students.
11. Play until all Consumers have either succeeded or not.

Conclusion

There are several steps involved in milk production. In California, a variety of natural and human resources are combined to supply the milk and milk products that consumers need and enjoy.

Variations

When playing the Game:

- Be creative in deciding how to distribute the Identity Cards! You could distribute extra resources (food, water, cows) and not enough consumers or extra consumers with out enough resources. You could withhold Water Identity Cards from the game and discuss the events of drought. You could withhold Cow Identity Cards to simulate disease among the cattle population. Every scenario has a special story to discuss and review for how, when and why this could really happen. With a complicated system like milk production, many things can happen along the way.
- Use adults, parents or volunteers to create the number of players you want.
- Share a treat like ice cream, chocolate milk or cheese and crackers with the students after successful completion of this activity.

Extensions

- Visit a dairy farm, cheese factory or other processing plant related to dairy products.
- Go to a petting zoo that has cows or goats you can milk.
- Invite a dairy farmer or rancher to visit your class.
- Research how to and then make ice cream with the class.
- Do a tasting between goat's and cow's milk and milk products like cheese.

3. Hamburger Explorations

Purpose

- To develop an understanding of meat production's livestock and rangeland origins.
- To relate students' lives to meat production, livestock and rangelands.
- To learn about California's role in the production of meat and meat products

Concepts/Content Standards Correlation

Grade 4 Science

Life Sciences- 2a, 2b, 3a, 3c

Grade 5 Science

Investigation and Experimentation- 6a

Grade 6 Science

Ecology (Life Science) 5a, 5b, 5c, 5e

Resources- 6a, 6b, 6c

Materials

- Hamburger Explorations Worksheet 1
- Product List in What Comes from the Range? (previous activity)
- Colored pens/pencils

Time

Preparation: 10 minutes

Discussions and Activities: 1.5 hours

The nationally developed Food Guide Pyramid indicates that the consumption of protein is one important component of a healthy daily diet. Most people need and enjoy a variety of meat products that come from beef cattle and other livestock. In California, just as with dairy farming, meat production is a labor and resource intensive industry with several stages and businesses raising livestock and producing the variety of meat products we use everyday. For this activity, refer to What Comes from the Range? activity for a listing of meat products and by-products from beef cattle and other livestock.

Meat production is the conversion of feed into marketable livestock. California's variety of climates, natural rangelands and crops like grain offers many opportunities for raising animals like cattle for producing meat. California's landscape has geographic diversity and favorable environmental conditions supporting four types of cattle raising operations that together produce beef products and by-products for our consumption.

Four Types of Cattle Operations:

1. *Cow-Calf* provides other operations with calves to raise.
2. *Seedstock* is a specialized type of Cow-Calf operation which aims to make genetic improvements in cattle breeds to benefit the entire beef industry. Seedstock animals are replacement females for other Seedstock or Cow-Calf operations.
3. *Stocker* operations grow male (steer) and female (heifer) calves using rangelands and other roughages (feeds high in fiber like hay).
4. *Feedlots* water, feed, care and grow large numbers of confined cattle into marketable cattle for beef production.

California accounted for 7.8% of the US revenue for livestock and livestock products and all but one county is producing beef cattle. In 2007, "cattle and calf" was the 6th largest agricultural commodity of California at $1.78 billion. The raising of sheep for wool and meat produced $42.6 million. California's rangelands and agricultural resources support the raising of livestock to produce meat products for our survival and enjoyment. The cycles involved in meat production are a relevant and interesting base for learning.

Procedure

Preparation

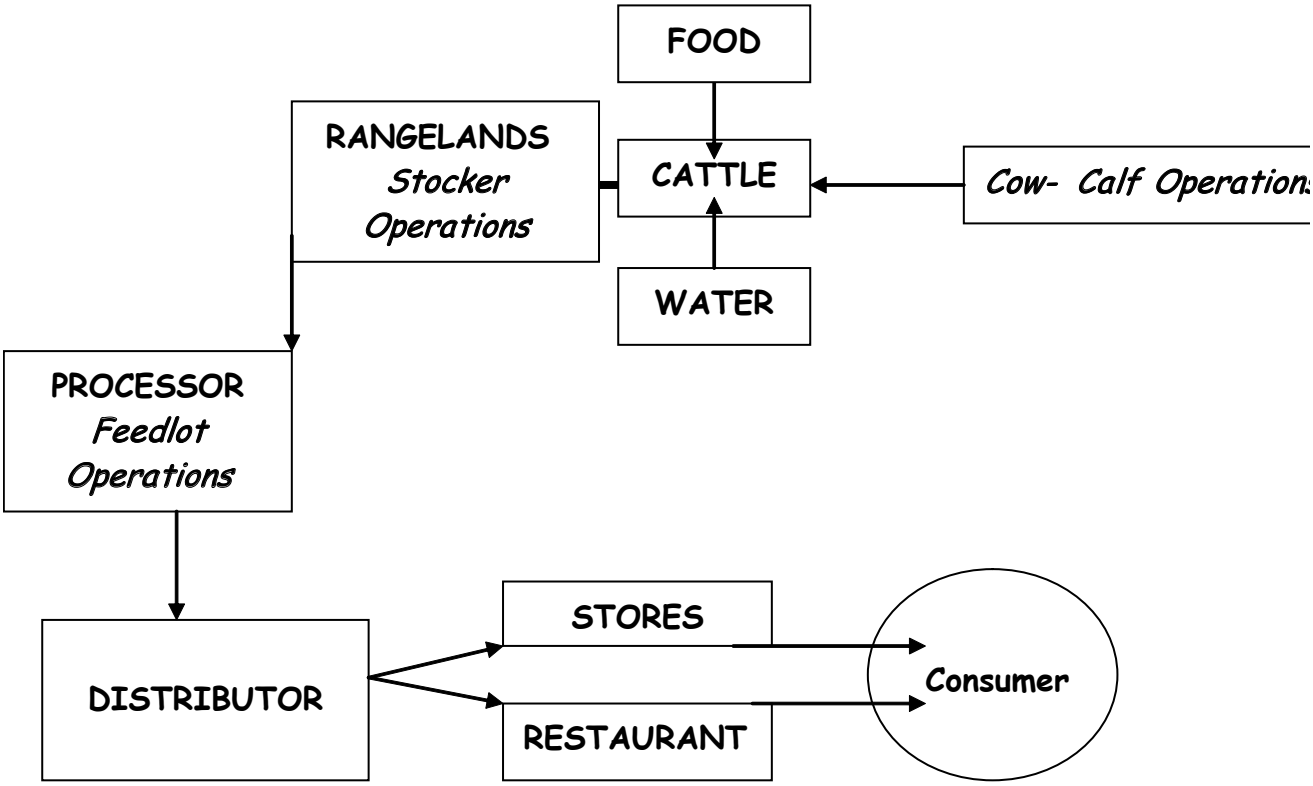
- Make copies of Hamburger Explorations Worksheet 1 for students

Discussion

Note- Prior to this discussion and activity, know if there are any students in the class that do not eat meat/ beef products.

- Survey class by asking: "Who likes to eat meat?", "Do you know much about the cycles involved in producing the livestock and the meat we enjoy?", "We are going to learn about it!"
- Have students think of their favorite food with meat. One student at a time describe or draw and name their favorite food.
- Discuss and record the animals used to make the favorite foods listed.
- Identify which animals are the grazers, herbivores, of rangelands. Review carnivore (meat eating animal), herbivore (plant eating animals) and omnivore (animals that eat both meat and plants) descriptions.

- Ask students "Who likes to eat hamburgers?". Tell students "We will be exploring all the energy and steps that go into creating a hamburger. Sometimes we pick up a hamburger as 'fast food', however it takes time to grow, process and transport all the ingredients that make up the hamburger. The hamburger started out 2 years ago and with time, energy and resources it is now the meat we eat today.
- It takes approximately 18 – 24 months to raise beef cattle for meat production.
- Draw and review the steps involved in producing beef products (the ground beef patty of the hamburger) as follows:



Activity

1. Discuss and name a local restaurant where a consumer could by a hamburger.
2. Hand out Worksheet 1.
3. Have students complete the worksheet, connecting the descriptions of each hamburger ingredient to the corresponding description.
4. Review correct answers and matches for Worksheet 1
5. Have students color and add details to their hamburgers once they have connected all the layers.
6. Concluding Discussion:

- Did you know this much energy and this many steps went into the production of meat and your favorite food?
- Is meat a perishable (something that can spoil) product? What does this mean for the meat producers?
- Guess how many people it took to get the hamburger from the farms to the table?
- Using the background information, share with the students additional details about the meat

industry and its role in California.

- Discuss meat products that come from other livestock breeds in California like lamb and goats.

Conclusion

In California, a variety of natural and human resources are used for meat production. Different types of cattle operations provide the livestock raised to produce the meat products and by-products we eat and enjoy daily.

Variations

- Create an overhead transparency of Worksheet 1 and complete with class instead of each student completing worksheet.
- Have students cut out each layer description and paste on the correct layer of the hamburger illustration.
- Complete Worksheet 1 and then have students cut out each layer of the hamburger illustration and paste together to build a hamburger.

Extensions

- Trace the process involved in the production of French Fries.
- Have a hamburger feast after completion of this activity.
- Research which parts of the cattle's carcass provides the different cuts of meat we eat.
- Have students bring in and share a sample of their favorite food dishes listed in this activity.

UNIT II

Animals on the Range

This section provides a detailed look at historic and current grazers of California's rangelands. This includes information and activities about livestock species and feeding issues of nutrtion and palatability.

Activities include:

Historic Grazers
Today's Grazers
Good Food
Good Food Too

1. Historic Grazers

Purpose

- To develop an understanding of California's historic landscape and large grazing animal presence
- To relate a timeline of geologic event to historic happenings.

Concepts/Content Standards Correlation

Grade 4 Science

Life Sciences- 2a, 2b, 3a, 3b

Investigation and Experimentation- 6b, 6g

Grade 4 History- Social Science

4.1.3, 4.1.4, 4.1.5, 4.4.6

Grade 5 Science

Investigation and Experimentation- 6a

Grade 5 History- Social Science

5.3.4, 5.3.5

Grade 6 Science

Ecology (Life Science) 5a-e

Resources- 6b, 6c

Investigation and Experimentation- 7b, 7f

Materials

- Worksheet 1- California's Grazers and Predators Timeline
- Overhead transparency of Worksheet 1
- Tape measure
- A pound of something that students can hold (flour, apples in a bag, paper etc.)

Time

Preparation: 10 minutes

Discussion and Activity: 45 minutes to 1 hour

Over 12,000 years ago in California, there was thought to exist a diversity of animals, insects, vegetation and other living organisms that interacted with the environment and shaped the landscape. Historically the landscape supported a variety of grazers that traveled through the land munching grasses and browsing on plants, trees and woody shrubs. These historic grazers are referred as "mammalian megafauna" and were mammals at least as large as the pronghorn antelope. In California, until approximately 10,000 years ago, mastodon, mammoth, three kinds of ground sloths, horse, tapir, peccary, large camel, smaller camel or llama, elk, deer, two kinds of pronghorn, four-horned pronghorn, bison, shrub ox and woodland musk ox roamed and grazed the land.

Each population of mammalian megafauna possesed specific adaptations for grazing which enabled a diverse community of grazers and browers to co-exist. There were also historical predators of these grazers, which include sabrecat, short-faced bear (horse-sized), wolf, "African" lion and possibly the American cheetah. Most likely the ancient mammalian megafauna existed in large numbers and herded together for protection from their predators. Climatic change is thought to have caused the extinction of the megafauna and historic predators, about 10,000 years ago (during the Pleistocene epoch). Approximately 8,000 to 5,000 years ago extreme hot and dry conditions developed in California.

In California's more recent past, for thousands of years, Native American communities survived on the landscape and managed, harvested and tended to the oak woodlands, grasslands and savannas that compromise a significant portion of today's rangelands. From the 1550's to the 1800, nations like Spain, Russia and Mexico arrived and began to transform the landscape. Agricultural ventures of growing food and raising livestock were common use of the land. Some 500 species of non-native grasses and plants have been introduced to California during this most recent time. Many of the grasses have been introduced for the benefit of raising livestock. Many of the introduced plants and grasses can handle the influences of grazing livestock and produce desirable growth characteristics and nutritional qualities.

California's native plants and grasses support the wild grazers of the land which include deer, elk, antelope and bighorn sheep. With the arrival of other nations and domestic livestock, disease was passed to these wild grazers which severley degraded their health and numbers. Due to over hunting, the California native tule elk, were hunted to near extinction and in 1864 hunting of the elk was banned. Extinction for the elk was feared, but by 1910 more than 400 elk were surviving at a ranch in the San Joaquin Valley. Today, there are 18 locations where tule elk survive and there are similar recovery programs for several other populations of California's wild grazers.

Today in California public and private rangelands support domestic grazers like cows, sheep, goats and horses, as well as minimal populations of wild grazing animals. Best management practices of the land for grazing animals prevents overgrazing and has a positive effect on the land. Proper grazing of rangelands can enhance the vegetation, recycle nutrients, help plant seeds, control the encroachment of brushes onto grasslands, encourage wildflowers to grow and help control non-native grass populations.

Procedure

Preparation

- Make copies of Worksheet 1- California's Grazers and Predators Timeline
- Make an overhead projection of Worksheet 1- California's Grazers and Predators Timeline
- Find a one pound weight of something the students can hold
- Have tape measure

Discussion

- Share selected information with students about the historic grazers of California.
- Have students close their eyes and imagine California with large grazing animals roaming around. Have them imagine the large, fur covered, elephant-like mammoths and mastodons. Mammoths (scientific name Mammuthus) had longer tusks, a wider head, and were mostly taller (12 feet compared to 6 feet) than mastodons. In geologic time mastodons evolved earlier and lasted longer than mammoths.
- Have students guess:
  - how tall a mammoth stood
  - how long it was
  - how much it weighed
- Use several student as helpers and the tape measure to demonstrate the size dimensions of the mammoth as follows:
  - Height (to top of head): 12 feet
  - Height (to top of shoulders): 9 feet
  - Length (from trunk to tail): 11.5 feet
  - Weight (approximate for mature male): 3 tons or 6,000 pounds
- Have students hold the pound object and imagine the mammoth weighing 6,000 times.
- Introduce timeline activity as an investigation into the distant past of California.

Activity

1. Guide the class through the activity using an overhead projection of Worksheet 1- California's Grazers and Predators Timeline.
2. Hand out Worksheet 1, review timeline events listed.
3. With student's input, add other events to the timeline.
4. Have students identify which animals are the current and historical grazers and predators of California and write the names under the appropriate time frame and list.
5. Identify the animals that are both historic and current species surviving in California.
6. Concluding discussion:

- Did you know that California was home to historic grazing animals?
- What is similar and what is different between the historic grazers and the grazers using California's rangeland today?
- What is similar and what is different between the historic predators and the predators of California's rangeland today?
- How are historic and current grazing animals important to us and our lives?

Conclusion

Over time the grazing animals and predators using California's landscape have changed due to many different influences. Today as in history, modern day grazers use a signigicant portion of California's

landscape, consume the vegetation and influence the landscape including grasslands, savanahs and oak woodlands.

Variations

- Assign each student a historic grazer or predator to research, have them present their findings before, during or after this activity.
- Have students add personal dates to their timelines.
- To demonstrate mammoth's size dimensions to the students, use string or ribbon instead of a tape measure.

Extensions

- Take this timeline and have students create a large scale replica, complete with labels and drawings of the events and animals listed.
- Have students create a life-size version of a mammoth using various materials.
- Have students use the information reviewed and conduct further research to create an educational display about California's historic grazers and predators.
- Complete a timeline and similar activity for another animal group like birds, reptiles, amphibians or insects.

2. Today's Grazers

Purpose

- To review different domestic livestock species and breeds using California rangelands.
- To relate the different livestock species and breeds to different the products we consume.

Concepts/Content Standards Correlation

Grade 4 Science

Life Sciences- 2a, 2b, 3a, 3b, 3c

Investigation and Experimentation- 6b, 6g

Grade 5 Science

Life Sciences-2a

Investigation and Experimentation- 6a

Grade 6 Science

Ecology (Life Science)- 5a-e

Resources- 6a,6b, 6c

Materials

- Worksheet 1- Word Search for California's Domestic Grazing Livestock Breeds
- Worksheet 2- Create a Word Search of Products from California's Domestic Grazing Livestock Breeds

Time

Preparation: 10 minutes

Activity: approximately 1.5 hours

A livestock breed is defined as a grouping of animals that, through selection and breeding, have come to resemble one another and are able to pass those traits uniformly on to their offspring. Today in California there are several species and breeds of livestock like cattle, sheep, goats and horses using rangelands. The variety of domestic livestock breeds raised provides a variety of animal products and by-products we use and enjoy. For example, Holstein cattle have been bred for milk production and are the highest milk producing cattle breed in the world. Angus breeds are considered beef cattle and are known for the quality and taste of its meat.

Traits like hair and skin color, presence or absence of horns, growth rates, carcass merit, disease resistance and ability to survive in differing habitats are examples of the variations among breeds of the same specie. As well cattle, sheep and goats have varying feeding patterns, preferences and uses of the land. The combined presence of livestock breeds shapes California's landscape and rangelands, provides animal products for consumption and contributes to the economy. California is currently the top dairy producing state in the United States of America. Meat, wool and other livestock production is $/ year in California…. In California, cattle are the most abundant livestock species raised followed by sheep and then goats.

Cattle

There are approximately 275 breeds of cattle in the world. Today in the United States of America, there are over 40 breeds of beef cattle, like Angus, Hereford and Brahman, being raised to produce meat, other animal products and by-products. Common dairy breeds raised to produce milk and milk products include Brown Swiss, Holstein and Jersey.

Sheep

There are more than 200 distinct breeds of sheep occurring worldwide. Sheep are thought to be among the first animals domesticated over 6,000 years ago. Around 3,000 B.C common features observable in today's sheep appeared in Mesopotamian and Babylonian art and books. Over time, selections for wool type, carcass merit, flocking instinct and other traits have produced distinct wool, meat and milk breeds. Suffolk and Hampshire are raised to produce meat. Merino, Columbia, Corriedale, and Targee produce different types of wool. Other breeds like Romney and Cotswald produce long wool, are adapted for cold and moist conditions but also require large amount of feed. East Fresian and Rideau Arcott breeds provide milk and milk products like cheese.

Goats

It is thought that between 6,000 and 7,000 B.C the goat was also among the earliest domesticated animals. Evidence of goat remains have been found at archaeological sites in western Asia such as Jericho and Choga. Unlike sheep, goats can easily revert to their feral and wild behaviors given a chance. The house cat is the only other domestic species which will return to a wild state as rapidly as a goat.

On average a mature dairy goat female weighs 150 pounds, and produces a gallon of milk per day with the top producers averaging two gallons per day. The five major breeds of dairy goats in the United States are Alpine, LaMancha, Nubian, Saanen and Toggenburg. The Nubian and Alpine breeds are considered an all-purpose breed useful for meat, milk and hide production. The Cashmere and Angora goat breeds are raised for the fine, soft wool used for clothing and other products.

Procedure

Preparation

- Copy Worksheets 1 and 2 for students.
- Have a copy of What Comes from Range activity

Discussion

- Discuss and explain the difference between species and breeds of species. Use a familiar group of animals for an example (dogs or cats) . Have students list the different breeds of dogs or cats that they know. Have students describe the differences amongst those breeds listed.
- Tell students they are going to learn about the breeds of the grazing livestock species that use California's rangelands and provide us with many products we use.
- List the three groups of grazing livestock used for this activity- Cattle, Sheep and Goats.
- Review the name and different traits of each species' breed listed in the word search.
- Review products that would come from these different breeds.
- Share additional information from the background section about California's grazing livestock species and breeds.

Activity

1. Hand out Worksheet 1- Word Search for California's Domestic Grazing Livestock Breeds.
2. Review the directions for completing word search.
3. Have students complete word search.
4. Collect students work or have each other grade correct answers.
5. Hand out Worksheet 2- Create a Word Search of Products from California's Domestic Grazing Livestock Breeds.
6. Assist students with the listing of products that can come from each of California's grazing livestock species. Use Product list from What Comes from the Range Activity to help.
7. Once students complete their list of products, have students use pencil to place their product names in the empty word search. Words can be placed forwards, backwards or diagonally.
8. Once all the products have been placed into the word search, have students fill in remaining empty squares with random letters.
9. Complete puzzle by tracing the penciled letters over with pen.
10. Have students trade word searches and complete each others.

Conclusion

There are many different breeds of cattle, sheep and goats that use California's rangelands. We consume many different products that originate from a variety of animal species and breeds. The health of California's livestock and rangelands is a necessary and important part of our survival, health and economy.

Variations

- Have students complete both Worksheet 1 and 2 while working with younger students.
- Have another class or someone from home complete the word search from students' Worksheet 2.
- Have students use words from both Worksheet 1 and 2 to make a crossword puzzle complete with numbered clues and a corresponding puzzle

Extensions

- Arrange a field trip to observe some of California's grazing livestock species.
- Arrange for a community member to bring in a grazing livestock species to school.

3. Good Food

Purpose

- To explore the 6 major food groups and our food preferences
- To combine information about a healthy, balanced diet with the students' preferences

Concepts/Content Standards Correlation

Grade 4 Science

Life Sciences- 2a, 2b, 3a, 3b

Grade 5 Science

Life Sciences-2a, 2e, 2f, 2g

Investigation and Experimentation- 6a

Grade 6 Science

Ecology (Life Science)- 5a-e

Resources- 6b, 6c

Investigation and Experimentation- 7f

Materials

- Worksheet 1- What I Like to Eat, What is Healthy
- Method and supplies for binding students' books

Time

Preparation: 20 minutes

Activity: approximately 1.5 - 2 hours

Plants transform the sun's energy into energy that can be consumed by humans and other animals for survival. The United States Department of Agriculture's Human Nutrition Information Services Department developed the Food Guide Pyramid to provide nutritional information about healthy food choices. A combination of food from the 6 food groups and suggested portion sizes constitutes a balanced diet needed to support a healthy, well-functioning body. (find the food guide pyamid and related information at MyPyramid.gov).

Developing a healthy diet combines our food preferences with information about what a healthy body requires. Humans have many choices when it comes to what kind and how much food to eat and with our individual preferences for taste, smell and texture, designing a healthy balanced diet is difficult but important! This activity is designed to help the students combine their food preferences with the concept and information of a healthy, balanced diet.

Each animal species has specific adaptations for consuming the food necessary for survival. Humans are omnivores, adapted to consume a varied diet consisting of many different meat and plant materials. Grazing livestock are herbivores, designed for eating only plant materials. Predators of wild and grazing animals like mountain lions will mostly eat meat and are thought of as carnivores. Humans do not have the internal digestion system to support a diet of only grasses and plants just as a cow can not survive on a diet of meat.

Procedure

Preparation

- Copy Worksheet 1- What I Like to Eat, What is Healthy for the students
- Choose method and gather supplies or binding student books (punching holes in pages and/or binding book pages together with staples, brads, binder rings, twine)

Discussion

- Talk with students about the different foods they like and don't like to eat.
- Place these items on a list with Like and Don't Like titles.
- When a food items is both liked and not, write its name on both lists.
- Place a Preferences title and list the reasons why students place items on the list they do (taste, smell, texture…).
- Go through all the foods listed, circling the choices that are part of a healthy diet. (to help, use the food guide pyramid and related information at MyPyramid.gov)
- Review items that are both liked and nutritional, food choices which represent the combination between our preferences and items that are part of a healthy daily diet.
- Have students think of other nutritional food items they like to add on the Like list.
- Review the Food Guide Pyramid's recommended serving sizes and 6 major food groups:
    1. Bread, cereal, rice and pasta
    2. Fruit
    3. Vegetable
    4. Milk, yogurt and cheese
    5. Meat poultry, fish, dry beans, eggs and nuts
    6. Fats, oils and sweets (the use sparingly group)

- Assigning and label each food item listed to the appropriate major food group.
- Tell students that they are each going to create their own book about the food they like to eat and their favorite foods that are part of a healthy daily diet.

Activity

1. Hand out Worksheet 1 and review directions for the activity.
2. Have students fill in each of the 10 boxes with a picture and written description about their food preferences.
3. Have students cut out each of the 10 boxes, creating the 10 pages of their book.
4. Explain and demonstrate method for binding the pages together into a book (punching holes and/or binding book pages together with staples, brads, binder rings, duct tape…).
5. Help students bind their books.
6. Have students share their books with each other.

Conclusion

The plants and animals we eat give us the energy needed to survive. The nationally developed Food Guide Pyramid describes the 6 major food groups which combine to complete a healthy daily diet. Combining personal taste preferences with information about good food choices help shape a diet designed to keep the body healthy and functioning well.

Variations

- Laminate student's book pages before binding them together.
- Have students complete Worksheet 1 in student groups or while working with younger students.
- Have students read their books to younger students.
- Have students dedicate and give the book as a thank you present to their parents.

Extensions

- Have students make a larger size copy of their books using their own writing, drawings and page additions.
- Create a class meal by assigning food items to 6 student groups each representing one of the Food Guide Pyramid's food groups.

4. Good Food Too

Purpose

- To apply concept of human nutritional needs and food preferences for developing an understanding of California's grazing livestock nutritional needs and food preferences.
- To develop an understand of the food energy required to raise grazing livestock and produce animal products.

Concepts/Content Standards Correlation

Grade 4 Science

Life Sciences- 2a, 2b, 3a, 3b

Grade 5 Science

Life Sciences- 2a, 2e, 2f, 2g

Investigation and Experimentation- 6a

Grade 6 Science

Ecology (Life Science)- 5a-e

Resources- 6b, 6c

Investigation and Experimentation- 7f

Materials

- Worksheet 2- Keeping California's Grazing Livestock Alive
- One, 6 sided dice per playing group of 4 students
- A one pound weight of something like corn, wheat berries or rice secured in a clear plastic bag.
- One plastic gallon "milk" jug

Time

Preparation: 15 minutes

Discussion and Activity: 1-1.5 hours

Domestic grazing livestock are herbivores, possessing jaw structures, teeth, stomachs and digestion systems adapted for consuming energy from grasses and plants. Grazing domestic livestock species have taste preferences, like humans, for the variety of plant food items available. Different plant types growing on the land like grasses, shrubs, trees, broad-leafed plants and vines have varying palatability (desired taste) and nutritional qualities for the livestock.

The energy inputs required to raise livestock differ with the grazing operation's geographical location, production goals, and the life cycle stages, species and breeds of the animals being raised. An appropriate diet for livestock is designed to efficiently produce healthy animals, usually combining grazing livestock on the land's vegetation along with food supplements, vitamins, minerals, by-product feeds (beet tops or tomato pomace), medicines, hormones and medical attention as needed. The methods used for livestock care, feeding, supplementation and medication are regulated by state and federal government standards and guidelines.

Livestock need energy, protein, minerals and vitamins for nutrition, growth and development. Energy comes from the digestion and metabolism of all nutrients with the primary source coming from carbohydrates (sugars, starches and cellulose). Protein builds and maintains the soft tissues, other than fat. Protein also repairs tissue and produces muscles, hair, hooves and horns. Minerals like salt, calcium and phosphorus and vitamins are also necessary for proper bone and tooth health among many other functions. Other energy sources are needed to help the animals grow, lactate (produce milk), gestate (reproduction functions), be active and maintain their health.

The various species of grasses, shrubs, trees, clovers and other plants have varying nutritional values. Clover is highest in the protein value, with 20- 22 % of the plant available to the grazers as protein. Grasses are usually between 8 – 10 % protein and other broad leaf plants (wildflowers, shrubs and green leafy plants) are about 7% protein. More food energy growing on the land means less money and additional food energy needed to fulfill the animals' nutritional needs and production goals.

Typically, cattle will also be fed grains, dried grasses like hay and silage (chopped up plants and grasses) to meet nutritional and production needs. In one day, on average, one head of cattle can eat 50 pounds of silage and 15 pounds of grain (corn, barley, wheat) and up to 45 gallons of water. In addition, food supplements like molasses for protein, salt licks (NaCl) for minerals and Vitamin A can be supplied to raise livestock like cattle. Optimizing livestock health may also include providing anti-worming medications, antibiotics for disease protection and hormone supplements to promote weight gain for sterilized livestock. Hormone supplements replace the normally occurring steroid hormones the animal would produce if not sterilized.

The raising of livestock is a complex job that demands physical strength, experience and around-the-clock work and dedication. It takes a skilled farmer and ranch manager to keep the animals healthy, fed and watered. As well, the manager is responsible for the complex job of producing animals while not over-grazing or damaging the land. Running a successful business producing livestock and maintaining the land's optimal conditions supporting healthy soil, water and plant resources takes knowledge, skill, hard work and the dedication of management to accomplish these goals.

Procedure

Preparation

- Copy Worksheet 2- Keeping California's Grazing Livestock Alive
- Obtain one dice per student group
- Get a one pound weight of something like corn, wheat berries or rice and secure in a clear plastic bag
- Fill plastic gallon "milk" jug with water

Discussion

- Remind students of the Good Food Part 1 Activity- what we like to eat and what is healthy. Tell students that they are going to explore the same ideas of food preferences and nutritional value related to the feeding and raising of livestock.
- We are going to explore the food energy consumed by a cow being raised for milk production
- Show students the plastic gallon milk jug. Ask students to guess how many gallons of milk one healthy cow can produce each day (approximately 6 gallons)? Then ask students how much water does that cow need to drink a day to make the 6 gallons of milk (approximately 30 gallons).
- Ask students what other energy cows need to consume besides water (food).
- Review and list the types and amounts of food consumed while using the one pound example for a visual aid:

  - 50 pounds of silage which is chopped up plants and grasses

  - 15 pounds of grain like corn, barley and wheat

  - Varying quantities of grasses, clover, leaf plants, shrubs and trees growing on the land, if available

- Inform students that a gallon of water weighs around 8.2 pounds. Calculate with the class the approximate poundage of energy a cow takes in each day to make 6 gallons of milk. Answer: 8.2 x 30 = 246 pounds of water per day. 246 + 50 pounds silage + 15 pounds grain = 311 pounds of food energy a day to make 6 gallons (or roughly 6 x 8.2 = 49.2 pounds) of milk each day.
- Relate the students' food preferences and why they have them (smell, texture, appearance etc..) to the livestock. Ask students if they think grazing livestock have preferences for different types of plant food.
- Discuss that cattle and other grazing animals on the range eat a variety of food and do have taste preferences as well. A bush does not taste the same as grass. The animals have preferences, called palatability, of what they like and do not like to eat just like we do.
- Also like humans, there are nutritional requirements to meet for supporting the growth and development of livestock. (See background information.)
- Different plants, grains, silage and food supplements have varying protein and nutritional content to offer the animal. (See background information.)
- Farmers and ranch managers combine the livestock's preferences for grazing the plants available on the land with additional sources of feed, supplements and medicine designed to meet the nutritional needs and production goals of the animal.
- Review additional information about the various components of livestock care, feeding and medication from the background information.

Activity

1. Introduce the game and describe the objective: each student will have the opportunity to raise one head of dairy cattle, providing what it needs to survive and stay healthy.
2. Students will play the game in teams of 4 players, all four students are ranch managers for their individual head of cattle.
3. Hand out Worksheet 2- Keeping California's Grazing Livestock Alive to the students groups.

4. Explain to students how to play the game as follows:

- Each student on the team takes a turn rolling the dice and recording their score on the Worksheet
- To complete the game, each student will have taken 12 turns.

  Each roll represents an input into the cows' life:

  1 = drought, disease, sickness (this roll's value is –1)

  2 = leafed plants

  3 = grasses

  4 = clovers

  5 = water, molasses, cow licks

  6 = silage, grain and hay

- The food energy values for each roll 2, 3, 4, 5 and 6 represents the increasing nutritional values of the food items listed.
- One of each food resource needs to be rolled by the end of the the 12 turns, (2, 3, 4 ,5 and 6). Just like humans, a healthy diet for cows is usually a combination of the different food energies.
- When totaling all 12 rolls, the cow needs a score of 36 or higher. This represents the cow receiving enough food energy for healthy survival, growth and development!
- A roll of one represents something "negative" happening to the cow (not having enough water to drink, disease or sickness) and thusly is a negative value, subtracting from the total.

5. Have students play the game, provide a timeframe for completion.

6. At the end of the game, discuss the specific results of each student group- who had cattle that survived, who did not and what happened, was successful at first?

7. Concluding discussion: What did your cattle get the most of? Was there anything that your cattle needed that it did not get? What was it you cattle got the most of. How did drought, disease and sickness affect your cattle? What is the original energy source for all of the food the cows eat (the sun)?

Conclusion

Raising livestock is a job that requires know-how, hard work and many resources. Ranch managers and farmers have many skills, knowing how to keep the animals healthy, fed and watered. Every livestock species raised requires a combination of food energies to provide the nutrition required for growth and development of healthy animals and animal products. Usually, a combination of the plants growing on the land, food supplements and medication make up a complete diet for livestock.

Variations

- Have students that did not get the cattle to survive during the game, continue rolling the dice until they have been able to provide for what the animal needs.
- On Worksheet 2, have students write down the energy input corresponding to each roll.

Extensions

- Have students draw a picture and name the dairy cow they were raising for the game. Complete the picture with drawings and labels of the various food energy types and other features needed for the cow's survival. Or have the students write a story about their cow's life as it happened during the game.

UNIT III

Who's Home on the Range?

This section explores ecology, food chains and the web of life on rangelands. It includes a detailed look into plant growth and development.

Activities include:

Web of life

Food Chains

Roots, Stems, and Leaves

The 5 Plant Types

The Great Grass Race

1. Food Chains

Purpose

- Apply the concept of ecosystems and food chains to rangeland habitat.
- Explore rangelands as home to many resources and uses.
- Investigate humans' relationship to rangeland ecosystem producers and consumers.
- All organisms need energy and matter to live and grow
- Living organisms depend on one another and their environment for survival

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 2a, 2b, 2c, 3a, 3b, 3d

Grade 5

Life Sciences- 2a, 2e, 2f, 2g

Investigation and Experimentation- 6a, 6g

Grade 6

Energy in the Earth System- 4a, 4b

Ecology (Life Science) 5a-e

Resources- 6b, 6c

Investigation and Experimentation- 7f

Materials

- Copies of Food Chains Worksheet 1- Home on the Range Players List
- Copies of Food Chains Worksheet 2- Food Chains

Time

Preparation: 5 minutes

Discussion and Activity: 1 hours

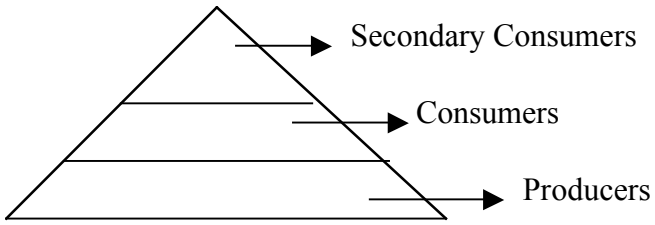
Grazing by livestock is one important value of rangeland in California. Range habitat supports wildlife, water, and soil resources and is a source of water for agriculture. Rangelands also provide opportunities for industry using raw materials like timber and minerals as well as for recreation, residential uses and value in natural beauty and clean air.

Ecology is literally the study of "home" interpreted from its Latin root. We study ourselves when we study the interactions of rangelands' physical site characteristics of (non-living components) and the living organisms that inhabit the land. In California, we rely on the functions of range habitat and its resources to support healthy livestock, wildlife, water and soil.

Procedure

Preparation

- Copy Worksheet 2- Keeping California's Grazing Livestock Alive
- Make copies of Food Chains Worksheet 1- Home on the Range Players List
- Make copies of Food Chains Worksheet 2- Food Chains
- Draw this Energy Pyramid on the board:



Discussion

- List and discuss examples at each level and have students list examples too.
- Discuss the similarities and differences between how producers, consumers, secondary consumers and decomposers survive- receiving and giving energy.
- Introduce concept and list examples of decomposers .
- Introduce the concept of competition amongst species, including humans, for survival
  - What is the original energy source fueling the Producers? Draw a picture of the sun next to the Energy Pyramid at this point.
  - Why are there more producers than consumers?
- This is an exploration into food chains and energy flows on rangeland. We value and rely on rangeland (see background information) for our survival and enjoyment. We rely on and are part of rangeland ecosystems and food chains. Conclusion

Activity

1. Have students read Food Chains Worksheet 1- Home on the Range Players List.
2. Look at the Food Chains Worksheet 2- Food Chains and review the directions.
3. Emphasize the need to create a realistic food chain of events.
4. Students place the names and a drawing of each player inside the worksheet's titled circles.
5. Complete the worksheet by placing arrows from one circle to another- representing the flow of

energy from one player to the next.

6. Display students' work and/or have students give a presentation about the food chain they completed.

Conclusion

Rangeland habitat is home for producing and consuming "players" along with the resources of sun, soil, water and air. Energy passes from the sun to plants and then on to other living organisms. We rely on rangeland ecosystems and food chains for our survival too.

Variations

- Have students cut out each circle in the food chains.

Extensions

- Research the animals and plant players listed in this exercise. Create food chains using detailed and accurate information about each player.
- Have students complete another worksheet using their favorite food, vegetable or ice cream as a consumer. Fill in each circle with the players that would produce the final product for ahuman consumer.
- Discuss and investigate the use of the word consumer in relation to economics- supply and demand.

2. Web of Life

Purpose

- Explore the interconnectedness of all forms of life.
- Create a visual representation of the Web of Life's interconnected group of individuals living organisms.
- Recognize that humans are part of the web of life.
- Learn how all energy for life comes from the sun.
- Learn how rangelands are an important part of the web of life.

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 2a, 2b, 2c, 3a, 3b, 3d

Grade 5

Life Sciences- 2a, 2e, 2f, 2g

Investigation and Experimentation- 6a, 6g

Grade 6

Energy in the Earth System- 4a, 4b

Ecology (Life Science) 5a-e

Resources- 6b, 6c

Investigation and Experimentation- 7f

Materials

- Copies of Food Chains Worksheet 1- Home on the Range Players List
- Ball of string or yarn

Time

Preparation: 5 minutes

Discussion and Activity: approximately 45 minutes

All living organisms on earth depend on energy from food whose energy is originally provided by the sun. The sun provides food energy for plants' growth, from which all other living organisms depend. A complex, interconnected flow of energy, known as the Web of Life, exists between all living organisms on Earth. The Web of Life is an interdependent collection of food chains.

An ecosystem is a community of living organisms interacting with the physical environment. A balance between living organisms and the quality and quantity of soil, water, food and air resources maintains all life on Earth. Energy flows as life cycles through each living individual in their community. Humans are part of the inter- dependent Web of Life.

The ecology of rangelands makes a good example of inter-related food chains creating a complex Food Web/ Web of Life. Natural resources form the foundation of the interconnected Web of Life. The healthy functioning of rangelands requires working ecosystem functions, an intact web of life and on-going stewardship to maintain its health. In California, 55% of the land surface is covered in rangelands so its state of health is very important to our health.

Procedure

Preparation

- Copy Food Chains Worksheet 1- Home on the Range Players List

Discussion

- Tell students to imagine a spider's web with many pieces of silk intertwined and stuck together
- Ask them what "Web of Life" might mean to them
- Have a few students give their definition of the "Web of Life"
- Review components of food chains - sun, primary producers, consumers, secondary consumers and decomposers.
- Ask students how much of California's land mass is in rangelands (55%) and if they think that rangelands are important in the Web of Life?
- Explain that this activity will show the important part rangelands play in the Web of Life.

Activity

Works best with students standing or sitting in a circle

1. Have students use the Food Chains Worksheet 1- Home on the Range Worksheet and Players List for this activity.
2. Show the ball of string and explain how it represents the energy of sunlight.
3. Ask a student to list a specific living organism that uses the sun's energy directly (a plant) using the Players List to generate their responses.
4. While holding the yarn, pass/toss the ball to that student. Have that student hold the yarn tightly and pass the yarn ball to another student who can use their energy.
5. Make sure the group is including organisms from all the major trophic levels (producer, consumer, secondary consumers and detritivores)
6. Continue passing yarn ball until all students are connected. You may have students that are plants and insects hold more than one piece of yarn, as their roles may be needed more than once to

include all students.

7. Have students observe how they created a way to see the connections between all rangeland plants and animals. Further explore how they are connected by changing a player in the web. For example, have a tree burn down. Ask the tree to tug on their string, while others observe if they feel the tug. Have those who felt the tug of the tree then tug on their yarn. Continue until all the students have felt the tug from that one action
8. Have students discuss while observing and answer questions:
    a. Does the energy of sunlight pass through all living things in the web?
    b. Does every living thing need sunlight to survive?
    c. What would happen if the energy from the sun disappeared?
    d. Are we humans part of this web of life?
    e. Do we need this web of life to be healthy?

Conclusion

All life is interconnected. We rely on the energy from sunlight to grow both our plant and animal food sources. A healthy, intact web of life contains a diversity of living organisms that rely on each other for survival.

Variations

- Have the students each make up their own players to create a web of life
- When creating the web of life, have some students be humans

Extensions

- Have students draw a picture about the web of life they created
- Have students write a story about the web of life they create

3. Roots, Stems and Leaves

Purpose

- Explore 6 plant parts
- Review the function of each plant part for growth and development
- Investigate local examples of plants and plant parts
- Plants and animals have structures for respiration, digestion, waste disposal and transport of materials
- All organisms need energy and matter to grow
- Living organisms depend on one another and their environment for survival
- Sun is the major source of energy for living organisms

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 2a, 2b, 3a, 3b, 3c

Grade 5

Life Sciences- 2a, 2e, 2f, 2g

Investigation and Experimentation- 6c, 6g

Grade 6

Energy in Earth Systems- 4a, 4b

Ecology (Life Science) 5a-e

Resources- 6b, 6c

Materials

- Location on school campus where plants are growing ring or yarn

Time

Preparation: 10 minutes

Discussion and Activity: 1 hour

Generally speaking, there are 6 parts to a plant. The parts are present during various stages of the plant's life. The following are the six plant parts.

Roots are the underground branching network of tissues that absorb water and nutrients from the soil.

Stems of flowers, grass blades and trees transport the food and water and give the plant structure.

Leaves produce energy (sugar) from the sun. Leaves have many shapes like the needles of a pine tree, leaves of an oak tree and blades of grass.

Flowers hold the reproductive organs of the plant to produce and receive pollen. When a flower becomes pollinated it develops into the fruit and seed.

Fruit protects and stores the developing seeds of the plant.

Seeds store the energy of the plant's next generation

Rangeland plants are living organisms that use nutrients, water, air and sunlight for growth, development and reproduction. Plants make their own food and in turn feed livestock. In turn, we use livestock for food and to produce fiber and other animal by-products. Learning about plants is learning about our selves. Starting to identify local examples of plant types and plant parts will help students' comprehension of future activities relating to rangeland plants and ecosystems.

Procedure

Preparation

- Find examples of plants growing on the school's campus

Part A

Discussion

- Draw an example of a plant on the board, detail and label the 6 plant parts. Review the name and function of each plant part.
- Ask students what we use plants for in our lives and list responses on the board.
- Just like we have legs for walking, hearts for pumping blood and teeth for chewing food, plants have different parts too. We are going think more about plants and the different parts that make up a plant.

Activity

1. Students stand up and get some personal space with outstretched arms.
2. Have students "transform" themselves into a plant of their choice.
3. Now they are plants, ask students what part of them are their roots? Bend down and touch the feet. Continue with the order of plant parts and movements as follows:

Roots:	Feet- bend down and touch
Stems:	Legs- straighten up and grip at the knees
Leaves:	Arms- outstretch with hands flapping like leaves
Flower:	Face- frame with hands out like petals

Fruit: Hands- cup together with one clapping motion

Seed: Cupped Hands- slowly peel a part hands, drop out seeds

4. Repeat the 6 plant parts and motions while creating a rhythm.
5. Recite the names and movements faster with each repetition.

Part B

Activity

1. Take students on a tour of their school campus finding plants to study.
2. Divide students into groups and assign a plant to study.
3. Students draw a full size picture of their plant.
4. Students label their drawing's 6 plant parts (all 6 parts do not need to be present).
5. Have students display work or give a presentation to whole group.

Conclusion

A vascular plant has 6 different parts that each performs a different function for the plant. Plants are important because they cycle nutrients and absorb energy from the sun make oxygen and share the energy with other living organisms.

Variations

- Have students think of foods that we eat from each of the 6 plant parts.
- Create a feast with one food from each of the 6 plant parts.
- List the uses of various plants and plant parts.
- Have students draw a picture of their favorite vegetable and then label the 6 plant parts.
- Learn the 6 plant parts and body movements to teach to another class of students.

Extensions

- Have the students pick one of the plant parts. Then as a homework assignment, have them each bring in one example of a kind of food that is that plant part. For example:

  Roots- potatoes, carrots, radishes

  Stems- celery, broccoli and cauliflower stems, stems on herbs like basil, cilantro

  Leaves- lettuce, spinach, herbs like cilantro and basil, cabbage

  Flowers- rose petals, nasturtiums, artichoke, broccoli and cauliflower

  Fruits- apples, oranges, pears, strawberries, melons

  Seeds- beans, nuts, sesame, poppy, seeds on strawberries

4. The Five Plant Types

Purpose

- Explore the diversity of plant types present on California rangelands
- Learn about the connection of plant species to the survival of livestock, wildlife and healthy ecosystems
- Learn that plants are the primary source of energy entering food chains
- Organisms in ecosystems exchange energy and nutrients among themselves and with their environment

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 2a, 2b, 3a, 3b, 3c

Grade 5

Life Sciences- 2a, 2e, 2f, 2g

Investigation and Experimentation- 6c, 6g

Grade 6

Energy in Earth Systems- 4a, 4b

Ecology (Life Science) 5a-e

Resources- 6b, 6c

Materials

- Playing "field" to play game on
- The 5 Types of Plants Worksheet 1

Time

Preparation: 10 minutes

Discussion and Activity: 45 minutes

The identification and nutritional value of range plants is of great importance to healthy growth and development of livestock. Range livestock and wildlife have four principle nutritional needs- digestible dry matter, protein, and minerals like phosphorus and vitamins like vitamin A.

The site (environment) characteristics influence plant's growth and development.. Different species of plants grow on rangeland only where their requirements for growth are satisfied. Rangeland plants support livestock and effective land management includes knowing the different species of grasses and plants present. All range plants are valuable, providing cover for domestic and wild animals, soil protection, and landscape beauty. Range plants freely exchange their energy and nutrients with other living organisms.

Range plants can be divided into 5 types: Trees, Shrubs, Forbs, Grasses and Grass- like plants. See The 5 Plant Types Worksheet 1 for definitions and examples. Each plant species has distinctive life spans, nutrient requirements, reproductive strategies and structures for growth and development. Perennial plants live three or more years and annuals complete their life cycle in less than one year. Shrubs and trees are always perennials. Forbs, grasses and grass-like plants can be perennials or annuals.

Plants are of great significance to the survival of all living organisms. Humans rely on and are a part of the plant life that inhabits rangelands.

Procedure

Preparation

- Copy The 5 Plant Types Worksheet 1 for students

Discussion

- Choose details from the background information to share with students.
- Have students list off resources that plants need for survival (sun, water, air, soil).
- Review how humans have certain food energy requirements for survival and how we get these needs met by eating plants and animals.
- Review how humans have many food choices with varying nutritional value.
- There are many different types (species) of plants in our world and on rangeland. Plants are sources of energy for all living organisms to use.
- Livestock eat the plants of the range habitat. Wildlife use plants for shelter and food.
- We are going to explore the five different forms that plants have.

Activity

1. Hand out the The 5 Plant Types Worksheet 1
2. Allow students enough time to read the first page and create questions from the reading.
3. Review the 5 categories of plant types listed, have students think of other examples of each type of plant.
4. Introduce page two of the worksheet. Have students use vocabulary provided to complete the sentences.
5. When finished, review and correct answers with students.

Conclusion

The world of plants is comprised of different types and species of plants. Trees, shurbs, forbs and grasses are an important part of the range ecosystem. We rely on range habitat and other plants to convert the sun's energy for our survival.

Variations

- Complete lesson by touring the school campus, naming the type the plants present.
- Bring in an example or find a specimen at school of each plant type.
- Create a drawing for each of the 5 types of plants.
- Have students create their own sentences, short story or poem using vocabulary words provided.

Extensions

- Research other plants that can be found on the range or in the local environment.
- Create a play, mural or other type of entertainment/art using the 5 types of plants.
- Investigate and name at least one product that we use from each of the 5 types of plants.
- Plant an example of each one of the 5 types of plants.
- Visit a nursery to further investigate the 5 types of plants.

5. The Great Grass Race

Purpose

- Explore plants present in rangeland ecosystems.
- Relate the presence of plants to the survival of livestock, wildlife and a healthy functioning ecosystem
- Plants are the primary source of matter and energy entering most food chains
- Rangeland plants have varying structures for growth and development
- Organisms in ecosystems grow and develop by exchanging energy and nutrients among themselves and with their environment
- Grasses are an important feature of rangeland habitats and Earth

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 2a, 2b, 3a, 3b, 3c

Grade 5

Life Sciences- 2a, 2e, 2f, 2g

Investigation and Experimentation- 6c, 6g

Grade 6

Energy in Earth Systems- 4a, 4b

Ecology (Life Science) 5a-e

Resources- 6b, 6c

Materials

- Playing "field" to play game on

Time

Preparation: 15 minutes

Discussion and Activity: 1 hour

The most important and widely distributed group of forage plants for range livestock is the grass family. Grasses cover more than a fifth of the land surface on earth and grow in all climates. Grass covers 9% of the land in California! The extensive and fibrous root systems of grasses help prevent erosion by holding soil and increase the intake of water from rain or snowmelt. Barely, wheat, oats, rice and corn are also member of the grass family. These grass crops are a main source of food calories for humans and for the animals we consume.

The importance of grass in grazing animal diets has been known since animals were first domesticated. Most all types of grasses are palatable (edible) to livestock. Grasses can provide all essential nutrients for foraging animals. Cows, horses, deer and other ungulates (hoofed animals) eat many kinds of grass. Grass seeds feed birds. Rodents like rabbits and mice ingest all parts of the grasses.

The structure of grasses deserves special attention because of their abundance and ability to support livestock. Gasses and grass like plant species have varying nutritional values, life spans and structures for growth and development.

Procedure

For this exercise, grasses are divided into two groups.

1. Annuals- rely heavily on seeds for reproduction and grow from seed to maturation in less than one year. Some examples of rangeland annual grasses: ryegrasses and foxtail fescue.

2. Bunching- are perennial grasses and cover the ground in dense clumps and spread by aboveground or underground roots. Some examples of rangleland bunching grasses: Idaho fescue and rice grasses.

Preparation

- Choose a location for the game- mark starting and finishing lines

Discussion

- Choose details from the background information to share with students
- Have students list off resources (food, water, air, shelter) that livestock and wildlife need for survival. Discuss similarities to human needs.
- Detail how rangeland plants are able to support livestock and wildlife.
- Focus discussion on food and review what kinds of food livestock eat.
- Discuss the importance of grass in the diet of livestock
- Write the words Annual Grass and Bunching Grass on the board. Describe the different life spans, growth and development structures of both.
- For this activity we are going to play as the two different types of grasses we discussed. Half of the class is going to be Annual Grasses and the other half Bunching Grasses.
- In this game both groups are trying to survive- not to beat the other team!
- To survive, you must complete you life cycle like the type of grass that you are. Divide class into two teams and describe the game tasks to complete. Use the Great Grass Race Diagram to describe the game.

Activity

1. Choose playing "field" (or blacktop or gymnasium area) and mark starting line and finish line

2. Divide class in half, forming two teams. Choose one team as the Annuals and one team the Bunching.
3. Explain that this game is meant to explore the different methods grasses use to grow. In this game the annuals have one year to complete their lifecycle and the perennials have longer. The different tasks of each team will reflect this difference, with both winning upon completion of their task. Each team begins in a single file line with the first player touching the starting line.
4. See diagram for picture of this activity in the Activity Resources section.

Annuals- one student at a time runs to the finish line and back. Once back, that member sits down at the back of the line. Then the next annual team member runs the course. Continue until all members have run and are sitting single file behind the finish line.

Bunching- the fist student jumps towards the finish line from a standing position. The next student then stands next to player number 1 and jumps from standing. Player 3 stands next to player 2 and jumps from standing. Continue this pattern until every perennial member is across the finish line.

Conclusion

There are differences in the way grasses grow and if they get what they need to survive, both methods help the plant reproduce. The annual plants worked individually to cover the field and get finished. The bunching grasses were slower to cross the finish line, but were working together to get there. Either method allowed the individual grass teams to finish (to survive). Since grass species cover 9% of California's land, it is an important resource to appreciate.

Variations

- Change the location, size or course of the playing field
- Find two examples of grasses that match the two different types of the game- clump of grass for bunching and use other grasses that are easily pulled up for annuals
- Divide the class into smaller sized groups and let them choose which type of grass they will play
- Time the teams playing and have each team work to improve their time

Extensions

- Dig up the two different examples of grasses and look at the roots, noting the differences and similarities between them
- Take an underground or above ground stem from a grass and grow in the classroom
- Plant annual grass seeds in the classroom

UNIT IV

Rangeland Resources

This section focuses on the soil and water resources of California rangelands. Activities and information detail the management, benefits and values of soil and water.

Activities include:

What is a Watershed
We are all Water Stewards
Celebrate Water
Soil-utions
Let's Make Mud Shakes
Racing to Run-Off

1. What's a Watershed

Purpose

- Learn about watersheds, how water moves over the land into waterways and to the ocean
- Build a watershed model to strengthen understanding of watershed concepts

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 3a

Earth Sciences- 4, 5a, 5c

Investigation and Experimentation- 6c

Grade 5

Physical Sciences- 1g

Earth Sciences- 3a – e, 4b

Investigation and Experimentation- 6a

Grade 6

Shaping Earth's Surface- 2a – d

Heat- 3a, 3c

Ecology (Life Science) 5b, 5e

Resources- 6b

Investigation and Experimentation- 7a, 7f, 7h

Materials

- Thick white paper (60 1b stock or more), 8.5 x 11", one piece per student group
- Spray bottles (large, 16 ounce size)
- Water-soluble markers of blue and red colors- one for each group of students
- Permanent markers of green, blue, black and red- one for each group of students

Time

Preparation: 10 minutes

Discussion and Activity: 45 minutes

There are over 3.5 million miles of rivers and creeks flowing in the United States of America! Planet Earth is referred to as the Blue Planet because water covers about 75% of Earth's surface and creates a dominating blue color as seen from space. The whole world is part of one water cycle and one watershed. Water cycles over the whole planet and delivers the water necessary for all life on Earth.

A watershed is an area of land that drains (sheds) its water into a common body of water. From farms to rangelands to our homes, wherever we are, we are part of a watershed. The water will drain over the land and into a near-by water body like a lake, creek, stream, river or drainage ditch. The beginning or "headwaters" of a watershed is usually higher in elevation with networks of tributary creeks coming together, flowing downhill. In California, the majority of watersheds flow downhill through rangelands into the Pacific Ocean.

Good water quality in a watershed is a product of all the activities happening in that watershed. Everything we do, all of our actions collect inside our watershed and create the health and quality of the groundwater and surface water. In California's watersheds we have rangelands and we drive, shop, eat, waste, recreate, grow food, entertain ourselves, go to school, parks, malls, hospitals, work, play sports, schools and much more.

Just like veins that network over the human body and deliver blood to sustain life, creeks make a branching network of surface and ground water to deliver and hold our water. Riparian habitat encompasses the area that surrounds creeks, rivers and wetlands. Riparian corridors are the networks of creeks that run over the land and are of vital importance to native Californian mammals, reptiles, amphibians, birds, fish, insects and plant life. 75% of California's amphibian species and 50% of the reptile species rely on riparian habitat for survival. Healthy riparian habitat maintains good water quality, keeps water temperatures cool, prevents erosion, provides habitat and is beautiful.

In regards to livestock and range, because most of the states surface water flows through rangleland, it is important to manage the land to protect this precious resource. Building an understanding of the local watershed builds a personal connection to and awareness of the water cycling in our daily lives. Individuals who know how they fit into a watershed play a vital role in maintaining their watershed's health.

Procedure

Preparation

- Set up the materials needed for activity

Discussion

- Survey class by asking: "Do you know a local creek's name- by your house or this school?", "What is a watershed?", "Who knows the name of the watershed we live in?"
- Explain what a watershed is and how our creeks find their way to a close-by body of water.
- Have students demonstrate a basic watershed by using their hands:

  -Have students hold their hands palms and touching at the wrists with fingers closed and fingertips pointed up

  -The fingertips are mountain tops (headwaters), the spaces between the fingers are creeks and the palms are wetlands- the places where the water collects

  -Use spray bottle to demonstrate rain falling onto the hand watershed model

  -Have students observe what happens to the water as it is sprayed into their mini watersheds? Where does the water go? Where does it collect, where does it run off the hands? What direction

does the water flow and why? Say "We are going to learn more about watersheds".

Activity

1. Have students think about the land and the watershed they live in.
2. List off activities that they do in their watershed.
3. Keep listing items until it is obvious that "EVERYTHING" happens in a watershed!
4. Do a quick demonstration of how to create the watershed model and how the model will be part of a real storm event - a spray bottle spraying.
5. Have students work in small groups to build their own watershed model:

   -Crumple thick white paper, unfold slightly, lay paper out while keeping the crumples intact, creating a variety of high and low places.

   -Use markers and draw watershed features as suggested below.

   -*Permanent Markers*

   Red- Use dash lines to mark the ridge tops: the highest places on the paper

   Blue- Trace the creeks: the paper's depressed creases, the places where water will gather and flow down. Fill in the wetlands and lakes: the lowest lying, flat areas that will fill with water as it rains.

   Green- Place habitat and natural features around your model: riparian habitat, parks, redwood forests, oak woodlands, agriculture…

   Black- Draw in structures: shopping malls, roads, schools, hospitals, cities…

   -*Water-soluble Markers*

   Blue- Trace some of the creeks, lakes and wetlands places

   Red- Mark areas of potential pollution: landfills, waste, oil spills…
6. Once the students have finished their models, get into small groups.
7. Watch each students' model while they "spray bottle" storm over their watershed.
8. Observe how the creeks, lakes, wetlands and other watershed features react to the storm water. Watch where the blue marker flows to and what the red pollution areas do.
9. Students can dry and keep their watershed models or recycle the paper.

Conclusion

There are 16 million acres of grazed rangeland in the foothill areas of California's Sierra Nevada mountain range. These lands are where most of our states surface water flows. The management of these lands to protect surface water flows and water quality is essential. Building an understanding of watersheds creates a personal connection and awareness of the water cycling in our daily lives. Individuals who know how they fit into a watershed can play a vital role in maintaining their watershed's health.

Variations

- Have students work as individuals on one watershed model.

- Have students redo their watershed models once they have seen the water spray flow over their models.

Extensions

- Find local maps to show your local watershed.
- Research the names and histories of local creeks.
- Have local biologist or naturalist come to the class to present about watersheds.

2. We Are All Water Stewards

Purpose

- Understand water flows downhill and carries common pollutants into local waterways
- Connect everyday behavior in our watersheds to the water quality in the local waterways
- Learn about common water pollutants and their potential sources
- Discuss solutions to common water pollutants

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 3a, 3b

Earth Sciences- 5a, 5c

Investigation and Experimentation- 6c, 6d

Grade 5

Physical Sciences- 1g

Earth Sciences- 3a – e, 4b

Investigation and Experimentation- 6a, 6c

Grade 6

Shaping Earth's Surface- 2a – d

Heat- 3a, 3c

Ecology (Life Science) 5b, 5e

Resources- 6b

Materials

- We Are All Water Stewards- Common Water Pollutants Cards
- 10 household items (see Pollutant Cards for items)

Time

Preparation: 15 minutes to make Pollutant Cards

Discussion and Activity: 30 minutes to 1 hour

Almost all of California's surface water passes through the state's 57 million acres of rangeland. Approximately 9,000 miles of streams and 125,000 acres of wetlands occur on California rangelands. The overall health of rangelands influences the health of water running over the land. As water moves over the land and throughout the watershed, it performs many important jobs like transporting sediment, feeding stream-side vegetation, recharging ground water supplies and providing water for humans, wild and range animals. Water also is a crucial element in growing our food, fiber and other materials like lumber.

Rangeland operations depend on water resources to feed and water their livestock. The people that manage rangelands (Rangeland Managers) understand that the health of the land and its surface waters (creeks, rivers, lakes) directly affect the quality and supply of water. There are many different ways to manage livestock on rangelands to support healthy water resources. High quality surface water resources on rangelands do not happen by accident, it takes purposeful work, planning and forethought to accomplish the goal of growing healthy water.

It is important that rangelands care for the land and water resources. Each individual also has an important role to play in keeping water resources unpolluted. No matter where you are, you are part of a watershed. What you do will get carried away by water, downhill to the closest creek or other water body. Most areas in California drain all the way downhill until reaching the Pacific Ocean! Every piece of trash and drop of oil delivered to the environment has an affect.

We all play a part in the health of the land we live on. From farms to rangelands to the homes we live in, we effect our environment. Rangelands cover 89,000 square miles, or 55%, of California's 160,000 square miles. We hope that the rangelands of California will contribute activities that maintain and restore the land. Outside of the rangelands, we each can make a difference everyday by acting in ways to keep our local environment thriving and healthy. All of us, together, create a strong, healthy California that in turn keeps us healthy and strong.

The Water Cycle: Process in which water travels from the Earth's surface to the atmosphere and then back to the Earth's surface again. The process is constant with the same water molecules cycling around and around throughout time.

Procedure

Preparation

- Collect each of the 10 household items listed on each pollutant card
- Have one water container that is large and preferably see-through
- Make one set of Pollutant Cards

Discussion

- Review basic water cycle concepts.
- Review how water flows downhill over all the land and transports water and pollutants from the land.
- In California, we get our drinking water from the water that flows over (surface water) and under (ground water) the land. California's water also supports agriculture like growing plant and animals food.
- Review additional details from Background Information about California and rangelands, like how most all of our states water flows through rangelands.
- Ask students if they think that California's rangelands have an effect on the water that flows over

the land? Can rangelands help water quality be good? What can rangelands do to make water quality poor?

- How about the water that flows around where we live, can we have a good or bad effect on water quality here?

Activity

1. Divide students into 10 groups. Hand out one Pollutant Card to each student group.
2. Have students review and understand the information on their Pollutant Card.
3. Explain how the large container of water represents the water flowing over the land.
4. Have each student group, on at a time, inform the whole class about their pollutant and then scatter their pollutant into the water container.
5. Once all student groups have placed their pollutant, have the students look up close and see the quality of the water.
6. Discuss with students about how their homes and school are part of a similar system. Discuss what we can do everyday to keep our waterways healthy. Discuss who we benefit by keeping our local waterways clean and healthy.

Conclusion

Our bodies are composed of an average 75% water and to be healthy we need fresh, unpolluted water for living, drinking, growing food and animals. Since a large amount of California is covered in rangelands (55%), the water cycling through these lands is an important part of how our water stays fresh and unpolluted. We each can contribute to healthy water by making sure not contribute any of the common pollutants.

Variations

- Create a filter for the water container (cheese cloth or other mesh). Have students compare what pollutants were still able to reach the water source and what pollutants were filtered.
- Have students experiment with the amount of each pollutant being used.

Extensions

- Do a creek or other area clean-up.
- Learn about the local storm drain system.
- Have students write and draw flyers announcing what individuals can do to positively effect water quality.
- Have each student group design a flyer describing their pollutant and how to be a solution to it.
- Find and complete a water quality testing kit.

3. Celebrate Water

Purpose

- Understand the precious nature of fresh water on Earth
- Appreciate the importance of water in our lives
- Comprehend that we need fresh, unpolluted water for our survival

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 3a

Earth Sciences- 4, 5a, 5c

Grade 5

Physical Sciences- 1g

Earth Sciences- 3a – e, 4b

Grade 6

Shaping Earth's Surface- 2a – d

Heat- 3a, 3c

Ecology (Life Science) 5b, 5e

Resources- 6b

Materials

- paper and pen/pencil for each student
- Globe (table top or inflatable)
- A 5 gallon bucket
- Measuring cups
- Eyedropper

Time

Discussion: 10 minutes

Activity: 45 minutes

Planet Earth is often referred to as the Blue Planet because from space, the large amount of water covering the surface of the Earth creates a dominating blue color. Earth's surface is covered in approximately 75% water and 25% land. The whole Earth is part of one water cycle and one watershed with water constantly cycling around the planet and flowing over the land. The processes of water flowing and cycling through the atmosphere, over land and through water bodies is what creates and delivers the clean water necessary for all life on earth to survive. Water is a precious resource and there is a limited amount of fresh water on the Earth.

Distribution of water in the world:

Location	*Percent of World's Water*
Saltwater in Oceans	97.2%
Ice caps and glaciers	2.14%
Groundwater	.61%
Surface water	.009%
Soil moisture	.0005%

Humans require water for living and in our country, we also use it for entertainment. Not any type of water can fill our requirements; we need our water to be clean, unpolluted and healthy. Human communities live among water cycling and flowing processes that create and distribute fresh, clean water. A large variety of human activities contribute pollutants to our local waterways and affect the quality of water we rely on.

We each can dispose of toxics properly (lawn and garden supplies and household cleaning products), conserve water and keep pollutants (like litter, soap, paint, oil) out of our waterways. Learning and practicing how to reduce or eliminate our pollutants is crucial for maintaining the clean, healthy water we rely on for survival.

Groundwater is water located in spaces between soil pores and in spaces between underground geologic features. An aquifer is an underground rock or soil area that holds and yields a large amount of water. Groundwater is recharged from water sources like rain, creeks, rivers, lakes and wetlands. Surface water is another name for the water bodies above the soil's surface.

Building an appreciation of water creates a great opportunity to understand this life giving resource. Having fresh, clean, unpolluted water to PLAY with is also a special opportunity as 1/3 of the world's human population (2.1 billion of 6.5 billion people) do not have access to fresh water and certainly not enough to play with!

Procedure

Preparation

- Gather materials needed for activity
- Fill 5 gallon bucket with water

Part A

Discussion

- Review importance of fresh, unpolluted water in our lives and the precious nature of this resource.
- Ask students "Who thinks that water is important to life on Earth?", "Are there any creatures on Earth that can live without water?", "What type of water do humans require for survival?" (fresh,

clean, unpolluted water), "Who here is thankful for the fresh, clean water we use everyday?"

- Review how we are each connected to our local creeks and how we can care for our local water resources by keeping pollutants out of waterways (We Are All Water Stewards activity)
- Healthy water equals healthy people because so much of our body is made up of water!
- Share additional details from background information
- Have students guess the % water in each of the following items:

Item	*% Water*
Human body	70
Whale	75
Pizza	49
Oranges	89
Lettuce	96
Ice Cream	61
Potato Chips	2

Activity

1. Use a globe and pretend to squeeze all the Earth's water into a 5 gallon bucket full of water.
2. Ask for a student volunteer to help with the demonstration (optional).
3. Ask the volunteer to use the measuring cup and guess how much of the 5 gallons (all the world's water) is FRESH water (not salty water).
4. 2 cups represents the entire amount of FRESH water on Earth.
5. Have students list where this fresh water is located on Earth: groundwater, lakes, rivers, creeks, ponds, puddles, soil moisture, swimming pools, toilets and frozen in polar ice caps.
6. Have students guess how much of the 2 cups fresh water is "locked" away in the polar ice caps, use the globe to point out North and South poles' ice caps.
7. 1 ½ cups of water represents all the fresh water frozen in ice caps.
8. Pour this amount (1 ½ cups) back in to the 5 gallon bucket.
9. The remaining ½ cup now represents all the fresh water available for us to use, this is all the surface water and ground water on Earth.
10. Question students on how much of the ½ cup is ground water and how much is surface water. Discuss the difference between ground and surface water.
11. The amount of Earth's surface water (lakes, rivers, creeks, puddles…) is equal to ONE drop out - show with water dropper. One drop out of 5 gallons represents the amount of water on earth that is in our surface waters.
12. Ask students how they feel about this demonstration. Do they think that water is a precious resource to care for, appreciate and not waste?

Part B

Activity

1. Have students think about all the things we use fresh, unpolluted water for. Have them write out 5 or more things that we need fresh, unpolluted water for in our lives.
2. Tell the group that you will keep track of the answers by listing them on the board. No one can repeat someone else's answer.
3. Go around the class, one student at a time, and have them each say a use for fresh, unpolluted water.
4. On their turn, if a student repeats an answer or they cannot come up with one, they are "out". Have those "out" students sit down. Keep those still in the game standing up.
5. Continue going around to each student that is in the game until there are one, two or three remaining students. Give these "winners" a round of applause.

Conclusion

Water is something to celebrate because it keeps us alive. Healthy water equals healthy people. There is a limited amount of fresh water on Earth that keeps us all alive. We need fresh, unpolluted water to grow the animals and food we rely on for survival. We are mostly spoiled in California when it comes to having enough, fresh, unpolluted water to use for all the things we do. It is wise to appreciate the resources that spoil you!

Variations

- Have students do Activity Part B in groups
- For Activity Part B, time students while they write uses of water. Have all students compare their lists. The student with the most, non-repeated answers is the "winner".
- In Activity Part B, keep all students in the game and continue to play until the whole group has exhausted their answers.

Extensions

- Have students write a thank you note to fresh, unpolluted water.
- Create a play/ skit presentation to give to other classes about the appreciation of fresh, unpolluted water.

4. Soil-utions

Purpose

- Understand about the importance healthy soil resources
- Learn about soil's role in nutrient cycling
- Connect rangeland soil resources to the health of plant and animal populations

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 2a, 2b, 2c, 3a, 3b, 3d

Earth Sciences- 4a, 4b, 5a, b, c

Investigation and Experimentation- 6a - f

Grade 5

Life Sciences- 2e, 2f, 2g

Earth Sciences- 3a – e

Investigation and Experimentation- 6a, 6b, 6c, 6f, 6g, 6h, 6i

Grade 6

Shaping Earth's Surface- 2a, 2b, 2c, 2d

Heat- 3a

Ecology (Life Science) 5a-e

Resources- 6a, 6b, 6c

Investigation and Experimentation- 7a, 7b, 7e, 7h

Materials

- Soil-utions Worksheet 1
- Soil testing kit for each student group (testing phosphorus, nitrogen and potassium)

Time

Preparation: 15 minutes

Discussion and Activities: 1 hour

Soil is the upper most layer of earth's surface. We all rely on healthy soil for the growing plants it supports. Plants provide the rest of the world's living organisms with the energy needed to survive. We depend on soil to produce the plants that we use for food, fiber and the raising of animals. Soil holds the nutrients and minerals needed by growing plants, it is a vital resource for all living organisms.

Healthy soil resources support the variety of uses we rely on for our survival. From recreation to agriculture to housing, the soil supports those activities. The overall health and activities of rangelands influences the health of the soil. Rangeland operations rely on soil to grow food for the animals being raised. Rangeland managers understand that the health of the soil directly effects their operations. There are many different ways to manage livestock on rangelands to support healthy soil resources. High quality soil on rangelands do not happen by accident, it takes purposeful work, planning and forethought to accomplish the goal of growing healthy soil. Things like erosion, soil compaction, bare ground and nutrient capacity are issues rangelands address in keeping soil resources functioning and healthy. Roger Bowe, a New Mexico rancher says "Bare soil is the rancher's number one enemy."

The condition of the soil helps grasses and other plants to grow. The condition of the soil can effect how well the plant grows and how nutritious the plant is. Plants and people are similar, as they each need nutrients, vitamins and minerals to survive. Plants get their nutrients from the soil and we eat plants and animals that ate plants to survive. The condition of the soil is important to our health too.

We all play a part in the health of the land we live on. From farms to rangelands to the homes we live in, we effect our environment. Rangelands cover 89,000 square miles, or 55%, of California's 160,000 square miles. We hope that the rangelands of California will contribute activities that maintain and restore the land and soil resources. Outside of the rangelands, we each can make a difference everyday by acting in ways to keep our local environment thriving and healthy. All of us, together, create a strong, healthy California that in turn keeps us healthy and strong.

Procedure

Preparation

- Make copies of the Soil-ution Worksheet 1 for each student and/or student group.
- Read instructions on soil test kit (practice using kit before using with students).
- Decide on locations to collect and test soil samples.

Discussion

- Soil is important for all life on earth to survive. Healthy, nutritious soil produces healthy plants that support a variety of life on earth.
- Plants are like people, as we both need nutrients to survive. The right amount of nutrients is needed to stay healthy. Just as a human can take too many vitamin pills, so can the soil get too many nutrients. Just as a human can be low on nutrients and become weak, so can the soil.

Activity

1. Hand out the worksheet to each student or group. Explain that they are to become soil doctors, testing the nutrient quality of local soils. Review how to complete the activity and complete the worksheet.
2. Divide up the tasks needed to perform the testing among the students.
3. Follow the directions on the soil testing kits.

4. Test as many soil locations as desired.
5. Share each group's results with the whole class.
6. Discuss the results of the tests preformed and what it might mean about the locations where the soil was tested.
7. Ask the students if the predictions they made were accurate or not.

Conclusion

Soil is important to all life on earth. Soil is composed of different nutrients that affect the growth of the plants. The more nutritious the soil is, the more nutritious the plant becomes. All life on Earth needs nutrients to grow and soil plays an important part in nutrient cycling.

Variations

- Have students decide where to collect the soil samples.
- Have students add things to the soil before testing (like water or juice or wood ash).

Extensions

- Have students continue to study additional soil samples, have them bring soil samples from home.
- Connect the sites tested in this activity with the sites to collect soil samples in the next activity "Let's Make Mudshakes".

5. Let's Make Mudshakes

Purpose

- Explore different types of soil and soil particle sizes
- Understand that smaller soil particle sizes have less space for air to surround the molecule and thus, these small particles stick together more, like clay
- Understand large soil particle sizes like sand have a lot of space in between the particles, a lot of room for air and the quick passage of things like water

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 2a, 2b, 2c, 3a, 3b, 3d

Earth Sciences- 4a, 4b, 5a, b, c

Investigation and Experimentation- 6a - f

Grade 5

Life Sciences- 2e, 2f, 2g

Earth Sciences- 3a – e

Investigation and Experimentation- 6a, 6b, 6c, 6f, 6g, 6h, 6i

Grade 6

Shaping Earth's Surface- 2a, 2b, 2c, 2d

Heat- 3a

Ecology (Life Science) 5a-e

Resources- 6a, 6b, 6c

Investigation and Experimentation- 7a, 7b, 7e, 7h

Materials

- Basketball, softball and golf ball OR handball, baseball and a marble
- Jar of sand
- Sample of clay, preferably natural clay-like soil
- Garden soil
- Several clear, glass jars with lids (quart size canning jars)
- Mailing labels and markers for lids

Time

Preparation: 15 minutes

Discussion and Activities: 1 hour

Soil type is one of the factors affecting plant growth. California is covered in a variety of soil types, therefore a variety of plant species and ecosystems are also present in California. For example, the soils that support the plants and grasses of rangelands vary differently from the sandy soils of coastal habitats.

The size and composition of individual soil particles also vary depending on the type of soil. Clay soils have small soil particles that fit together tightly, with little or no space in between for air or water. Sand, in comparison, is made up of larger, individual soil particles that create space for air and water to pass freely among this soil type.

Soil usually contains a combination of size particles. The quantity of clay to silt to sand particles determines the quality and the "type" of soil. There are a variety of reasons people would want to know soil type of in a given area. Rangelands use the information to help them manage the land for growing plants and animals.

The whole mass of living organisms in soil is called microbial biomass. A handful of healthy soil contains millions of living organisms! The key nutrients in soil for plant growth are nitrogen, phosphorous and potassium. Measuring the amount of soil nutrients can tell what and how much plant life the soil can support. Ability to erode, compaction and chemical make-up are other important characteristics of soil. For Rangeland Managers to maintain their operations, they have to maintain the soil.

Procedure

Preparation

- Collect materials needed for activity
- Place blank mailing label on the lid of each jar

Discussion

- Ask students if they think that there are different types of soil? What makes soil types different from each other?
- Tell students they are going to investigate the make-up of soil and how different soil types have different sizes and amounts of soil particles.
- Show basketball, softball and golf ball to the students. Tell them that they each represent an example of a size of soil particle. Ask them to guess which ball represents sandy soil. And clay-like soil? And garden-like soil? Show the students examples of each soil type as you discuss. Basketball equals sand particles, softball is silt and the golf ball is like clay. Garden soil is a combination of the particle sizes.

Activity

1. Fill each jar to 2/3 full of water.
2. Have students collect a sample of soil into the jars. Assign each student group a specific location for their sample.
3. Collect a soil sample from the surface of the soil to several inches below the surface. Fill the jar until it is full of dirt and water. Put on the lid.
4. On the lid's label, write the location of the soil sample, name and date.
5. Shake the soil sample until it is like a "smooth" mudshake- until the soil is completely dissolved into the water.

6. After shaking, place the jar on a surface and watch the soil settle out of the water. Have students observe this process.
7. Ask students about what they are seeing, which particles are settling first? Which sized particle are the ones making the water look muddy? What do they think the settled soil will look like tomorrow? Will the soil and water separate?
8. Place jars where they can be seen, but not moved or bumped easily.
9. Wait 24 hours and then continue the observations and discussions.
10. Ask students what they now see. Can they see the layers of the different sized parts of the soil? Remind them of the comparisons to the sized balls from before. Why isn't the land where the soil was taken from layered like in the jar? Is the soil sample more like clay or more like sand or an equal combination of various sized particles?

Conclusion

Soil is a vital resource for all life on Earth. 55% of California is covered in rangelands and the health of its soil is very important. There are many different kinds of soil, composed of many different sized particles. The ability of the water to infiltrate through soil has to do with the combination of the various sized particles. Sand and sandy soils contain more, larger-sized particles than clay soils. Clay particles are small in comparison, containing little space between particles for water and air.

Variations

- Have students choose locations for soil samples.
- Keep jars covered with paper until they have settled, this can heighten the anticipation to see what the results are as well as encourage the group to predict the outcome.
- Have students sketch the layers of their soil sample.

Extensions

- Take more soil samples at different times in the year. Compare and see if there are differences in soil composition in one place, over time.
- Bring into the classroom separated soil types like clay, silt and sand. Have students experiment with making mudshakes of their own "recipes".

6. Racing to Run-off

Purpose

- Understand how water flows downhill and over the land
- Experience how different surface and soil types transport water
- Observe the process of water cycling- transportation, evaporation, infiltration
- Observe infiltration and erosion on soils with different amounts of plant coverage

Concepts/Content Standards Correlation

Grade 4

Life Sciences- 2a, 2b, 2c, 3a, 3b, 3d

Earth Sciences- 4a, 4b, 5a, b, c

Investigation and Experimentation- 6a - f

Grade 5

Life Sciences- 2e, 2f, 2g

Earth Sciences- 3a – e

Investigation and Experimentation- 6a, 6b, 6c, 6f, 6g, 6h, 6i

Grade 6

Shaping Earth's Surface- 2a, 2b, 2c, 2d

Heat- 3a

Ecology (Life Science) 5a-e

Resources- 6a, 6b, 6c

Investigation and Experimentation- 7a, 7b, 7e, 7h

Materials

- One set-up per student group:
  - Gallon plastic "milk" jug
  - Large, light colored cardboard or butcher paper
  - Racing to Run Off Worksheet 1

Time

Preparation: 15 minutes

Discussion and Activities: 1hour

Plants like grasses on rangelands support the animals that survive on the land. The plants need sun, soil water and air to survive and feed the animals and people. Different soil types support the growth of different types of plants. Also, different soil types and conditions can support different types of life. Erosion of soils is one basic process that helps to shape the land.

Vegetation holds soil in place and can help to prevent erosion (the movement of soil). Areas of bare soil that lack vegetation can erode due to wind, water or the movement of animals. Where there is fertile soil and water, grasses and other crops grow. Land needs to be functioning well on a basic ecological level to sustainably support activities like recreation, wildlife and grazing.

The soil supports the cycling of nutrients and water. Water has different rates of cycling over different surface types. Less compacted soils allow more water to infiltrate into ground water, but can more easily erode. Compacted soils can decrease the amount of water infiltration into ground water and increase the amount of surface run off (transportation of water) and evaporation. Healthy rangelands can support the healthy cycling of water, soil and nutrients. Since 55% of California is covered in rangelands, the health of these lands is crucial in providing plant covered, open space that supports the natural processes of infiltration, evaporation, transportation and erosion.

Procedure

Preparation

- Copy Racing to Run-off Worksheet 1 for each student
- Decide on where to do the four different surface run off tests

Discussion

- Tell students they will be forming an experiment about how water cycles and flows over different surface types.
- Ask students to name different types of surfaces on Earth.
- Ask students to think about the water cycle and how it flows over the Earth.
- Review the concepts of infiltration, transportation and evaporation.

Activity

1. Have students follow along the Racing to Run-off Worksheet 1 as you describe the activity.
2. Go to each of the 4 surface types listed on the Worksheet. Note, you pick the 4th surface type to experiment on.
3. Before the experimenting with flowing water, have students fill out their hypothesis on the worksheet. Have students use the words infiltration, evaporation, transportation and erosion in their hypothesis.
4. Have each student group visit one surface type at a time. Take the gallon jug or water and pour a full gallon in one spot over the surface. Place the cardboard or paper piece next to where the water is being poured so observations of soil transportation can be seen. The more soil being transported by the water, the more splashes of soil will appear on the paper. Have students observe how much of the water is infiltrating into the ground, how much is running over the surface and how much is soil is eroding.
5. Once students have completed the experiment with all 4 surface types. Have them draw their observation of water flowing over the surface types on the Worksheet. Students should draw and label the water infiltration, evaporation, transportation and erosion processes they observed.

6. Discuss how the different surfaces had different rates of soil and water infiltration, evaporation, transportation and erosion. Discuss the reason for these differences.
7. Review with students how 55% of California is covered in rangelands and what surface types could be there. Discuss how California's rangelands are important for the infiltration, evaporation, transportation and erosion of water and soil.

Conclusion

Water flows differently over different surface types. Vegetation holds soil in place and bare soil with no vegetation erodes its soil quickly. Since 55% of California is covered in rangelands, it is important that these lands support the healthy functioning of infiltration, evaporation, transportation and erosion. Erosion is a natural process that helps to shape the land, but erosion can also be increased when the vegetation is decreased. Less compacted soils allow more water to infiltrate into ground water, but can more easily erode. Compacted soils can decrease the amount of water infiltration into ground water and increase the amount of surface run off (transportation of water), evaporation and erosion downstream.

Variations

- Have whole class travel to each surface location together and perform the water flow experiments at one time.
- Try pouring the gallon of water at different rates (slow to fast).
- Before pouring the water, have students stand in a location where they believe their feet will be touched by the water flowing over the surface. They are guessing where downhill is from where the water will be poured out.

Extensions

- Have a local soil scientist visit the class and discuss their job.
- Visit a working farm and/or rangeland and observe the different surface types present.
- Visit a soil product and/or composting facility.

UNIT V

Range Management

The final section serves as a detailed look into range management and as a general conclusion. Included are activities for an appreciation of range products, managers and farmers as well as an activity that reviews the range and livestock information covered.

Activities include:

Home on the Range Management Game

Many Thanks to Give

1. Home on the Range Game

Purpose

- Experience managing rangeland and livestock
- Combine the different rangeland and livestock subjects learned by students

Materials

- Home on the Range Game Cards, copied and cut out (laminated optional)
- Home on the Range Game Worksheet 1

Time

Preparation: 10 minutes

Discussion and Activities: 30 minutes - 1 hour

The health of California rangelands and livestock is important to all Californians. Almost all of the state's surface water runs through these lands and we rely on animal products for food and other materials. Even if we are not rangeland owners or managers, the work that keeps rangelands and livestock thriving affects us all.

Raising animals and tending to the land is a difficult business with 365 days a year of work to do! Also, because of the inherent, fluctuating qualities of livestock and the environment, circumstances are always changing. Managing land requires balancing many objectives at the same time. Managers of rangelands and livestock are knowledgeable about ecology, biology, animals, economics, geography and much more.

In California, rangelands provide economic, ecologic and cultural benefits. Ranching families manage over 19 million acres of private and 22 million acres of publicly- owned rangelands. The state's characteristics rolling oak hills and associated wildlife habitat can be maintained and even enhanced through proper grazing practices. Ranching families and businesses manage our state's rangelands to provide an economic foundation for rural communities and an ecological foundation for our state's natural resources.

Procedure

Preparation

- Copy Home on the Range Game Cards onto cardstock, cut out each card and laminate.
- Put each set of cards into an envelope or folder. Label the envelope with the groups name (wildlife, soil, water, food or livestock).

Discussion

- Ask students if they think it is an easy job managing rangelands and livestock. Review with students how this is high energy work that happens year-round. Tell students that they will get a chance to see how they can manage rangelands and livestock.

Activity

1. Pass out worksheets to each student and explain how the game will be played.
2. Divide students evenly among the 5 groups. Have students stand in a single-file line.
3. The first student in line pulls a card from the top of the stack. They read the card and put it at the back of the pile. The card will either tell of a good or poor activity with their rangeland and livestock. Student records what happened on their worksheet for turn #1 (just put group name and place under correct column). Students then go to the next group that the card listed.
4. The student travels to that next group for turn #2 and stands in the back of the line until their turn to pick another card.
5. All students continue in line to pull cards, record what happened and then move onto the next group.
6. Keep playing the game until all students have pulled a card 12 times.
7. For discussion at the end, have students look at what happened with their rangeland and livestock. Ask students "Out of 12 turns, how many turns did something good happen? How many turns did something poor happen? Were there more times good or poor things happen you your herd? What was something good that happened to you? What was something poor that happened? Could you do something to fix the poor thing that happened?"

Conclusion

California's rangelands are important to the health of our state. Managing rangelands and livestock is a difficult job that requires year-round hard work. Because rangeland managers work with animals and nature, circumstances are always changing. It takes knowledge, skill and planning to successfully manage rangelands and livestock.

Variations

- Play the game on a large playing field, this will get students to spend energy traveling to the different groups in between their turns
- Have an adult volunteer at each group. Volunteers hold and hand out the cards.

Extensions

- From their worksheet, have students create a story or a picture about what happened during their twelve turns managing rangelands and livestock.
- Have students think about how to change the poor things that happened to their rangeland and livestock. Have students record those solutions on their game worksheet.

2. Many Thanks To Give

Purpose

- Express appreciation for rangelands, livestock and the associated animal products we consume and enjoy

Materials

- Pen and paper for each student
- Copy of sample letter for each student

Time

Preparation: 10 minutes

Discussion and Activities: 30 minutes - 1 hour

Grasslands, savannas and shrublands that are grazed by livestock are called rangelands. Over half of the state of California is covered by rangelands. These lands provide biologic, scenic, economic and recreational values and help shape California's environment. Managing rangeland and livestock operations is hard, energy intensive, year-round work. Those who manage rangelands care for the health of both the land and the animal products we consume.

It is special in California that we have access to a wide range of farm and livestock products. Rangeland and livestock operations provide us with products like butter, cheese, milk, lamb and beef. It is also special that we have over 40 million acres of land in California being cared for by ranching families. California's rangelands also support an amazing amount of plant and wildlife species. There are many reasons to be thankful for California's rangeland and livestock history, present and future. It is always beneficial to take a moment and say thank you for something you appreciate.

Procedure

Preparation

- Copy Many Thanks to Give Worksheet 1- Sample Letter for students to use

Discussion

- Remind students what they have learned about rangelands and livestock.
- Review the major themes they completed.
- Have students think of things they are thankful for concerning rangelands and livestock.

Activity

1. On a piece of paper, have students list off animal products they enjoy using and eating.
2. Students then circle their favorite thing on the list.
3. Ask students about their favorite animal product "Who can you thank for providing this animal resource to you?"
4. Have all the students think about whom they can thank for raising their favorite animal product.
5. Have all students write about how and why they are thankful for this animal product and the person/business that raised the animal.
6. Review copies of Many Thanks to Give Worksheet 1- Sample Letter.
7. Students draft a thank you letter to the person/business they have chosen.
8. After the teacher reviews a draft, students re-write a final letter. Students sign, address envelope and send out the letters.

Conclusion

It is important to be aware and thankful of the things that give you energy to keep you alive. It feels good to know about where your food comes from and to say thank you to someone who works hard to bring food to people. Rangelands and livestock are an important part of California's agricultural heritage and every one should know about their connection this rich inheritance.

Variations

- Place students into groups to write letters.
- Have students write more than one letter.
- Have students include a drawing or a copy of a rangeland and livestock activity.

Extensions

- Visit one or more of the places students wrote thank you notes to.
- Have students write thank you notes to all the people/business along the way of the life of the product they appreciate.

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