KANSAS CORN STEM

Kansas Corn:
World Wide Web

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KANSAS CORN COMMISSION

Kansas Corn: World Wide Web

Grade Level: 5th

Lesson 1: The Whole and the Parts (45 minutes)

Key Question

- What is an ecosystem?

Learning Objectives

- The children will make observations of an outdoor setting and a corn field (either directly or through media) and generate a list of living and nonliving things in that ecosystem.
- The children will analyze the relationship of the living and nonliving parts in an ecosystem.

Materials

- Science journal
- World Wide Web Discussion Questions (page S1)
- Pencils
- Setting: corn field or access to an outdoor area such as a field, woodland or stream area, school field or field trip to a natural area.

Guided Teaching

Procedures for Instruction

1. Introduce the subject and assess for prior understanding by leading a discussion.
   - "What do outdoor ecosystems in Kansas look like?"
     - (There should be a variety of responses- agricultural fields, playgrounds, yards, parking lots, streams, lakes, pasture, woodlands, parks, etc.)
   - "Using one area as an example, such as a meadow, what are all the parts that exist within that area?"
     - (Plants, animals, water, air, land, rocks, soil, concrete, sunlight, darkness, street lights, etc.)
   - "How are all the parts within the area related? Do any of them depend on each other?"
     - (Note that insects, worms, and other invertebrates will feed on plants and plant roots, which in turn provide food for many birds and mammals, etc.)
   - "We're going to take a look at an actual ecosystem."

2. Lead the children to an outdoor area to explore the whole and parts of the ecosystem. They should bring their science journals and pencils.
   - Whole, big-impressions
   - Have the children write or draw in their journals for 5 minutes (timed) their first impressions of the place. Suggest this might include such observations as: the sun is hidden behind clouds, the tree has many leaves on it, a robin is sitting on the fence, ants are crawling across the sidewalk.

- Detailed, specific observations.
- Then, instruct the children to observe the area for a specified time (15 minutes). Instruct the children to observe (see, hear, feel, smell) and list in their journals the details that belong in the ecosystem (living and nonliving).
- Encourage the children to close their eyes for a couple of minutes to hear or use a magnifying glass to see what is often hidden.

3. Return to your learning space for discussion to reflect on the system they observed with questions. Have the children record answers in their journal or distribute World Wide Web Discussion Questions such as:
   - "What are the parts of the ecosystem you observed?" (make a group list)
   - "Is there anything on this list you don't think belongs to the system? Why or why not?"
   - "Is there anything that belongs to this system that isn't listed?"
   - "How are the different parts related to each other?"
   - "Were you surprised by what you found?"
   - "Do the small parts contribute to the big picture? How?"
   - "Could the whole ecosystem exist without the small parts?"
   - "What does an ecosystem need to survive?"
     - Note: Plants combine sunlight, water and air in the process of photosynthesis to create living matter (the "stuff" that plants are made of). Therefore, these factors are absolutely necessary!
   - "Does an ecosystem consist of only things we can see?"
   - "What is an example of an ecosystem we can't see?"
     - (consider microorganisms in the soil, water, or gut and those of other animals)
4. Start to analyze relationships.
   - Instruct the children to start with one living part of the ecosystem they listed. On a new page, write and/or draw that organism.
   - Then add another organism (write and/or draw) on the same page that is connected in some way (one eats the other; one lives in the other; one relies on the other in some other way).
   - Draw a line between them and on the line, indicate how they are related.
   - Add additional organisms and relationships to create a food chain.
     - Example: a grasshopper eats grass. A snake eats a grasshopper. An owl will eat a snake.
5. Conclusion
   - "You have observed many things that belong to the ecosystem and you have started to analyze the ways they are related."
   - "The big-picture, whole system is what we call the ecosystem. Ecosystems are communities of organisms that are all the living and nonliving parts that belong to those communities."
   - "In our next lesson, we will go more in-depth. Be thinking about all the parts of the whole ecosystem and what roles they play in the system."

- I will leave you with two questions:
  - What is one thing all living things in any ecosystem depend on?
  - What does an ecosystem look like in a cornfield?" We will discuss those in our next lesson.

Early Elementary Activity

To learn more about ecosystems, check out this YouTube video: Ecosystems for kids
https://www.youtube.com/watch?v=SNF8b7KKJ2I

Science

- Let's talk about the ecosystem that is out in your backyard. Make a list of the living things that can be in your backyard. Then make a list of all the nonliving things that are located in your backyard. Are there a lot of things in your backyard ecosystem?

Art

- Draw a picture of your backyard ecosystem. Make sure to include the living and nonliving items you made in your list. Label your ecosystem.
  - Keep these for Lesson 2

Upper Elementary Activity

Science

- In the ecosystem video, pick one of the ecosystems that was discussed; dessert, tropical rainforest and deciduous forest. If you would like to do an ecosystem that takes place in the water; ponds, lakes, oceans, then do some further research.
- Make a list of the living things that can be found in this ecosystem. You might need to do some further research on your ecosystem. Then make a list of all the nonliving things, if there are any that are located in your ecosystem.

Art

- Draw a picture of your ecosystem that you chose above. Make sure to include those living and nonliving items you made in your list. Label your ecosystem.
  - Keep these for Lesson 2

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Lesson 2: The Community Players in a Cornfield

Key Question

- How are the parts of an ecosystem connected?

Learning Objectives

- The children will use reliable digital resources to gather and record information on a Kansas organism.
- The children will group and categorize organisms based on their characteristics.

Materials

- Student journal
- Pencils
- Kansas Corn Field Organism cards
- Large index cards
- Colored pencils
- Tablet or computer
- Binder clips or paper clips
- Roll of yarn

Guided Teaching

Procedures for Instruction

1. Activate prior learning with questions such as:
   - "What is an ecosystem?"
   - "What does an ecosystem need to survive?"
   - "How do the parts depend upon each other for survival?"
   - "How do the parts relate to the whole ecosystem?"
2. Introduce a new ecosystem: an agricultural cornfield. "Today we're going to think about a specific ecosystem: a cornfield." Ask students to observe and think about what belongs in a cornfield ecosystem as they watch one or more videos below. Also located at kansascornstem.com.
   - https://bit.ly/3DwvnfA
3. Gather ideas about "What We Know". Ask the children to list what we know to the best of our ability. Are there questions they wonder about? Consider the following prompts and record student responses:
   - "What did you observe that belongs to a cornfield?"
   - "What are the components that belong to the ecosystem?"
     - Example: the corn is tall, corn grows in rows, open, thick plant growth, straight rows of corn, shade from trees, noisy creek, windy and dusty, etc.

- "How is a cornfield ecosystem different from a more natural ecosystem, such as a natural grassland?"
  - Consider the roles the farmer plays in planting the seeds, adding nutrients to the soil, sometimes irrigation to provide water, harvesting the corn so humans and farm animals can eat it, preventing other plants from growing their herbicides, and preventing pests from eating the corn with pesticides.
- "What do all living things in any ecosystem depend on?"
  - Since photosynthesis is required for all producers, which are at the base of the food chain/web, guide the children to recognize the sun and plants as essential for all living things. Photosynthesis also requires water and carbon dioxide, so they might also say these.

4. Introduce the research activity. There are two options for this activity.
   - Option 1:
     - Tell the children they will be researching one organism of the cornfield ecosystem.
       - If you have two or fewer children then each child can pick 2-3 organisms of the cornfield ecosystem. If you have more than two children then make sure each picks a different organism.
     - Have the children select an organism, trying to avoid duplications. (If more than one child chooses the same organism, such as a hawk, suggest closely related hawks to give more variety, such as a Red-tailed Hawk and a Northern Harrier.)
   - Instruct the children to use internet resources to learn about their organism:
     - Features-physical appearance, behavior, seasonal differences
     - Location or range in which it lives
     - Habitat in which it lives (water, soil, woodland, open prairie, plowed field, etc.)
     - Food sources
     - How it reproduces and how many offspring
   - Have children create an index card with a drawing on one side and the organism's name and information on the other side.

   - Option 2:
     - Hand out the Kansas Corn Field Organism cards that have the following organisms listed on them: corn, invasive weeds, raccoon, hawk, snake, crow, groundhog, deer, field mouse, cricket, corn borer moth, grasshopper, fly, earthworm, sparrow, bacteria. Also distribute the sun, air, water and mineral cards.
     - Instruct the children to use the internet resources to learn about their organism:
       - Features-physical appearance, behavior, seasonal differences
       - Location or range in which it lives
       - Habitat in which it lives (water, soil, woodland, open prairie, plowed field, etc.)
       - Food sources
       - How it reproduces and how many offspring
     - Have children create an index card with a drawing on one side and the organism's name and information on the other side.

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Review safe internet practices and give the children plenty of time to conduct research and complete cards.

- Appropriate child-friendly websites for research include:
  - Plants and Animals: http://www.kidtopia.info
  - Plants and Animals: http://easyscienceforkids.com
  - Diverse species: http://www.biokids.umich.edu
  - Insects and other pests: https://pestworldforkids.org/
  - Soil organisms: https://www.blm.gov/nstc/soil/Kids/index.html

5. Create an ecosystem gallery
   - Secure a long string of yarn on a portion of a wall.
   - As the children finish, have them clip their card(s) to the yarn using paper clips or binder clips. The cards should have the picture facing out but should be easily turned to read the information on the back.
6. Conclude by sharing research and categorizing organisms:
   - Highlight some of the organisms that the children researched.
   - "Can we put these organisms into categories? What should be grouped with what?"
   - Allow the children to generate ideas.
   - Encourage them to think about groupings according to physical similarities (example: corn plant, birds, mammals, reptiles, insects, worms, flowering plants, grasses, weeds, soil organisms such as worms, bacteria, fungi).
   - "Are there other ways we could categorize these organisms?" Leave the children thinking about these questions without answering them.

Activities

Let's learn more about classifying organisms.

- Check out this video on YouTube: Feed Me: Classifying Organisms- Crash Course Kids #1.2
  - https://www.youtube.com/watch?v=AHCOzc143Ec

Let's learn more about food chains and food webs.

- Check out this video on YouTube: Food Chains Food Web Video for Kids
  - https://www.youtube.com/watch?v=FFIoV2J-eKI

Early Elementary Activity

Science

- Use the list you made from Lesson 1 about the ecosystem in your backyard. On your living things list, write next to each living thing if they are an; herbivore, carnivore or omnivore. Make sure to watch the video if you need further information about these words.
- Use your knowledge from the food chain/food web video. Make a food chain of an animal that is located

in your backyard ecosystem. You may need to do some further research to help you.

- Save this for Lesson 3

Upper Elementary Activity

Science

- Use the list you made from Lesson 1 about the ecosystem you chose. On your living things list, write next to each living thing if they are an; herbivore, carnivore or omnivore. If you need to do further research about the animals to find out, then do so. Make sure to watch the video if you need further information about these words.
- Use your knowledge from the food chain/food web video. Make a food chain of animals that is located in your backyard ecosystem. You may need to do some future research to help you.
- Save this for Lesson 3

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Lesson 3: Networking (60 minutes)

Key Questions

- How does matter and energy move through an ecosystem?
- What functions do organisms serve in an ecosystem?

Learning Objectives

- The children will model the ways matter and energy move through a cornfield ecosystem by creating food chains and food webs.
- The children will identify the roles of producers, herbivores, carnivores, omnivores, scavengers and decomposers.

Materials

- Student journal
- Kansas Cornfield Organism cards
- Pencils
- Colored pencils
- Binder clips or paper clips
- Roll of yarn
- Tablet or computer
- Producer, consumer, decomposer worksheet (pages S3)
- Sun, air, water and mineral cards

Guided Teaching

Procedures for Instruction

1. Assess prior learning and engage the children:
   - "What were the categories of organisms we identified in our ecosystem?"
   - "How else could we categorize these organisms? Did anyone have any ideas?"
   - "Encourage the idea that organisms together create their own food through photosynthesis?" "...that eat plants only?" ".... that eat only other animals?"
   - "Where does the energy come from for organisms to live?"
2. Propose food chains in science journals.
   - Instruct children to get out their journals, review the organisms they observed in the ecosystem or refer to Kansas Cornfield Organism cards.
     - Propose new food chains that contain at least 4 organisms. Indicate the relationship with arrows.
     - After 5-10 minutes, have the children share their food chains with others and compare.

3. Discussion to explore food webs with such questions as:
    - "How many of your food chains have common players or organisms?
        - Example: how many have grasshoppers, birds, plants?
    - "Do they play the same role in each food chain?"
    - "Are simple food chains the only way all these organisms relate to each other?"
    - "Let's see if we can model a corn field ecosystem!"

4. Play a game to create a model of an ecosystem food web using organism cards (if you use the Kansas Corn cards, make sure to add in the sun, air, water and minerals).
    - Tell the children you are going to create a model of an ecosystem in a corn field, with the yarn showing connections between organisms. Tell them they need to think about what organisms they could connect together.
    - Start the yarn and clip it to the sun card. Have the children help connect the sun card to the other cards that are provided in the deck. How long of a chain can you make?
        - Example: Sun, then clip the cornstalk to it (the corn gets their energy from the sun), grasshopper comes next (the grasshopper eats the corn stalk), hawk (will get its energy from eating the grasshopper) etc.
5. Connect vocabulary with concepts.
    - The children will get out their science notebook.
    - Ask the children if they understand the difference between a food chain and a food web and make notes as the discussion happens.
        - Food Chain: a model showing linear links of how matter moves in an ecosystem
        - Food Web: a model showing independent and overlapping links of how matter moves in an ecosystem
        - "Which is more complex?" "In what ways is it more complex?"
6. Lead into understanding the terms for the roles that organisms play in the ecosystem (see vocabulary list below).
    - Ask children to suggest names for the roles that organisms play in the ecosystem.
        - Example: plants can be considered "Food Creators" or "Sunlight Chemists" or "Producers", since they produce their own food through photosynthesis.
    - "What might you call the organisms that eat plants?" and so on. Give the children some time to generate names for the different roles in a food chain/web.
    - Guide discussion and make notes.
        - "If plants are called producers, what do you call the organisms that eat them?"
    - Share the different terms the child came up with. Encourage them to generate descriptive terms and definitions. Have fun with this. They will likely offer terms scientists use along with others. The goal is to have them construct the definitions of the concepts themselves, with you helping them to refine and restate their understanding.

- Producers: organisms that produce their own food by photosynthesis (mostly plants)
- Consumers: organisms that eat other organisms
- Herbivores: organisms that eat plants (grasshoppers, bees, rabbits, deer)
- Omnivores: organisms that eat both plants and animals (bears, coyotes, chickens)
- Carnivores: organisms that hunt and eat other animals (hawks, snakes, mountain lion, coyote)
- Scavengers: organisms that search for and eat dead animals (turkey vulture, crows, flies, cockroaches, raccoons, bears)
- Decomposers: organisms that transform dead and decaying organisms or waste into material usable by other organisms such as plants (fungi, bacteria, termites, earthworms)

- "You are thinking just like a scientist and in fact have come up with many of the same categories you have!"
- "Can one organism be in more than one category?" (yes) "Can you give an example?"
- "Which category would be the largest by mass?" (producers, because energy is lost at every level since organisms consume energy to live, grow and reproduce themselves- they pass on less energy)
- Another way scientists describe food webs is to indicate:
  - Producer (living things that makes its own food)
  - Primary consumer (eats producer)
  - Secondary Consumer (eats primary consumer)
  - Tertiary consumer (eats secondary consumer)
  - Decomposer (organisms that break down dead plants and animals for food)

7. Have the children record vocabulary terms and definitions in their science journal.
   - Create a corn field food web model with labels in the science journal.
   - Instruct children to draw a food web in their science journal and label each organism using the vocabulary terms.
     - Remind them to include the sun, air, and water as the starting point.
     - Give the children time to complete this
     - Or use technology such as:
       - MindMup:http://www.mindmup.com/
       - If the children complete the food web correctly, they can print a Food Web Certificate of Achievement with their names on it.
       - Scholastic: http://teacher.scholastic.com/activities/explorer/ecosystems/be_an_exploer/map/line_experiment14.swf
8. Conclude with this quote: When we try to pick out anything by itself, we find it hitched to everything else in the universe. -John Muir

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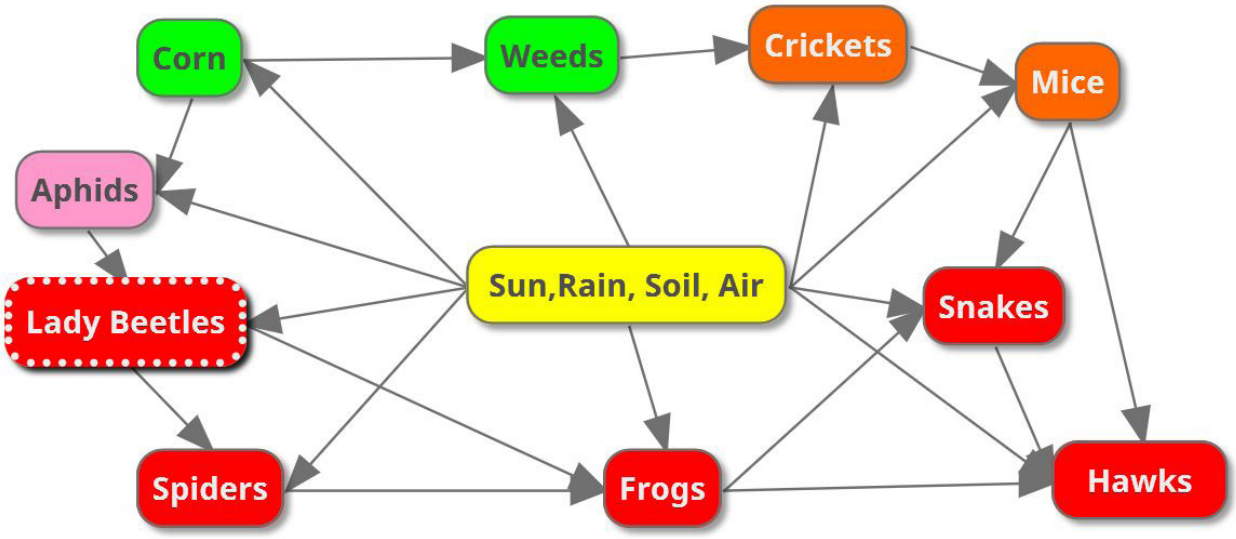
Information for Educators

- The children can access further information and examples of food chains, food webs, producers, consumers, and decomposers at the following website.
  - http://www.sheppardsoftware.com/content/animals/kidcorner/foodchain/foodchain.htm
  - http://teacher.scholastic.com/activities/explorer/ecosystem/be_an_explorer/map/line_experiment14.swf. If students complete the food web correctly, they can print a Food Web Certificate of Achievement with their names on it. Below is an example of a web completed correctly.



Early Elementary Activity

Science

- Use your food web or food chain from Lesson 2 for your backyard ecosystem. Using the words; producers, consumers, herbivores, omnivores, carnivores, scavengers or decomposers, add these words to your diagram.

Upper Elementary Activity

Science

- Use your food web or food chain from Lesson 2 for your ecosystem of your choice. Using the words; producers, consumers, herbivores, omnivores, carnivores, scavengers or decomposers, add these words to your diagram.

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Lesson 4: Agriculture Food Webs and STEM careers (1-5 days)

Key Questions

- How do humans impact food webs in a Kansas corn field?
- What do careers look like in agricultural STEM fields?

Learning Objectives

- The children will explain the roles of humans in managing a corn ecosystem.
- The children will explore and report on STEM careers in agriculture.

Materials

- Student journal
- Pencils
- Tablet or computer

Guided Teaching

Procedures for Instruction

1. Assess prior knowledge and engage the children in the human role in agricultural food webs with questions such as:
    - "Are humans part of food webs? How so?"
    - "Where do we get our food? How does our food get to the grocery store?"
    - "Are humans producers, herbivores, omnivores or carnivores?"
    - "How does a corn field food web differ from a natural food web?" Differences would include:
        - With one main producer (corn), less biological diversity throughout the web compared to a natural system (herbivores would only be those that eat corn, etc.)
        - Soil is fertilized and tilled by humans
        - Plants are planted by humans
        - Weeds and insect pests are managed by humans
        - Pollination and breeding is managed by seed producers
        - Corn is harvested and sold to feed humans and/or animals
    - "So, are birds helpful or harmful to a corn farmer?"
        - This would depend on what type of bird and what it eats. A hawk might eat rodents that would eat corn; a bird might eat insects that would harm the corn; starlings might eat the corn itself.
    - "Where does the water come from that the corn needs in order to grow?"
        - Many farmers irrigate fields if necessary

- "Where do the minerals come from that the corn needs to grow?"
  - Many farmers fertilize the soil in their fields).

2. Guide discussion to the many roles agronomists play in managing food webs so that humans and domesticated animals have ample sources of food.
   - "What does someone in an agriculture or STEM field do?"
   - Show a video:
     - Agronomist Career Video: https://youtu.be/Aap-6x8Cn3Q
     - Kansas State University- What is Agronomy? https://youtu.be/bCTS-BGgusY
     - Food Scientists and Technologists Career Videos: https://youtu.be/cWbaZEle7GQ
3. Focus discussion on careers in agriculture or STEM.
   - Ask the children, "Have you thought about what career you might like as an adult?"
   - Have the children record in their science journal what job they would like to hold in the future. Key points should include:
     - What kind of task would you have to perform?
     - Is the work to be performed inside or outside?
     - What skills would be important for that type of job?
     - Would you have to go to college and/or trade school?
     - What specialty classes would you have to enroll in to be successful?
     - How much money would you make a month/year?
   - "Why do we need more people who want to work in agriculture?"
   - "Why is agriculture so important in the world today? Tomorrow?"
   - "With a growing world population should we develop new and improved ways of feeding everyone?"
   - "How can the future leaders of the world (you) make a difference as the population of the world is expected to be over 8 billion people by 2030."
   - "What is sustainability?"
     - "How is your generation going to address hunger, loss of resources, pollution, extinction of species, loss of habitat, over population and housing?"
   - "You can make a difference and the career choice you make might have a positive effect on the lives of millions of people."
     - http://ionfuture.org/
     - https://www.bls.gov/ooh/a-z-index.htm
     - https://www.engineergirl.org/33.aspx
4. Allow the children to research careers using the websites.
   - Instruct the children to select a career that is agriculture or STEM related.
   - The children will take notes in their science journal on their career choice.
   - Items they should include in their note taking should include the following:
     - Summary of their career
     - What they do

- Work environment
- How to become the career of your choice and what high school and college courses would you need to take.
- Pay
- Job outlook
- Related careers

Early Elementary Activity

Writing

Continue to do research about a job in agriculture. Ideas on what to do with the information:

- A poster can be created with answers to the questions above.
- A paragraph can be written about the job.
- A drawing of the person can be made with information drawn around the person to share facts.

Upper Elementary:

Writing

Continue to do research about the job in agriculture. Ideas on what to do with the information:

- A poster board can be created with answers to the questions above.
- A 5 paragraph paper about the job can be written.
- A brochure about the career with facts and real pictures can be made.

Name: _____

World Wide Web Discussion Questions: Lesson 1

Complete the following questions based on what you observed and recorded in your Kansas Corn science journal. Provide answers with evidence found in the field.

1. What were the parts of the cornfield ecosystem you observed? (make a group list)

2. Is there anything on this list you don't think belongs to the system? Why or why not?

3. Is there anything that belongs to this system that isn't listed?

4. How are the different parts related to each other?

5. How would you compare your detailed observations to your whole first impression?

6. Were you surprised by what you found?

7. Do the small parts contribute to the big picture? How?

8. Could the whole exist without the parts?

9. What does an ecosystem need to survive?

10. Does an ecosystem consist of only things we can see?

11. What is an example of an ecosystem that we can't see? (consider micro-organisms in the soil, water, our gut and those of other animals

What's Living in the Cornfield?

Producers
are plants that make their own food from sunlight, air, water and soil.

Consumers
are living organisms that don't have the ability to make their own food. All animals are consumers.

Decomposers
break down dead plants and animals for their food.

Identify each of following living organisms as either a **producer, consumer** or **decomposer.**

1. Hawk:

2. Fungi:

3. Raccoon:

4. Deer:

5. Bacteria:

6. Worm:

7. Corn plant:

8. Weed:

9. Corn beetle:

10. Mushroom:

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2. Fungi: Decomposer
3. Raccoon: Consumer
4. Deer: Consumer
5. Bacteria: Decomposer
6. Worm: Decomposer
7. Corn plant: Producer
8. Weed: Producer
9. Corn beetle: Consumer
10. Mushroom: Decomposer