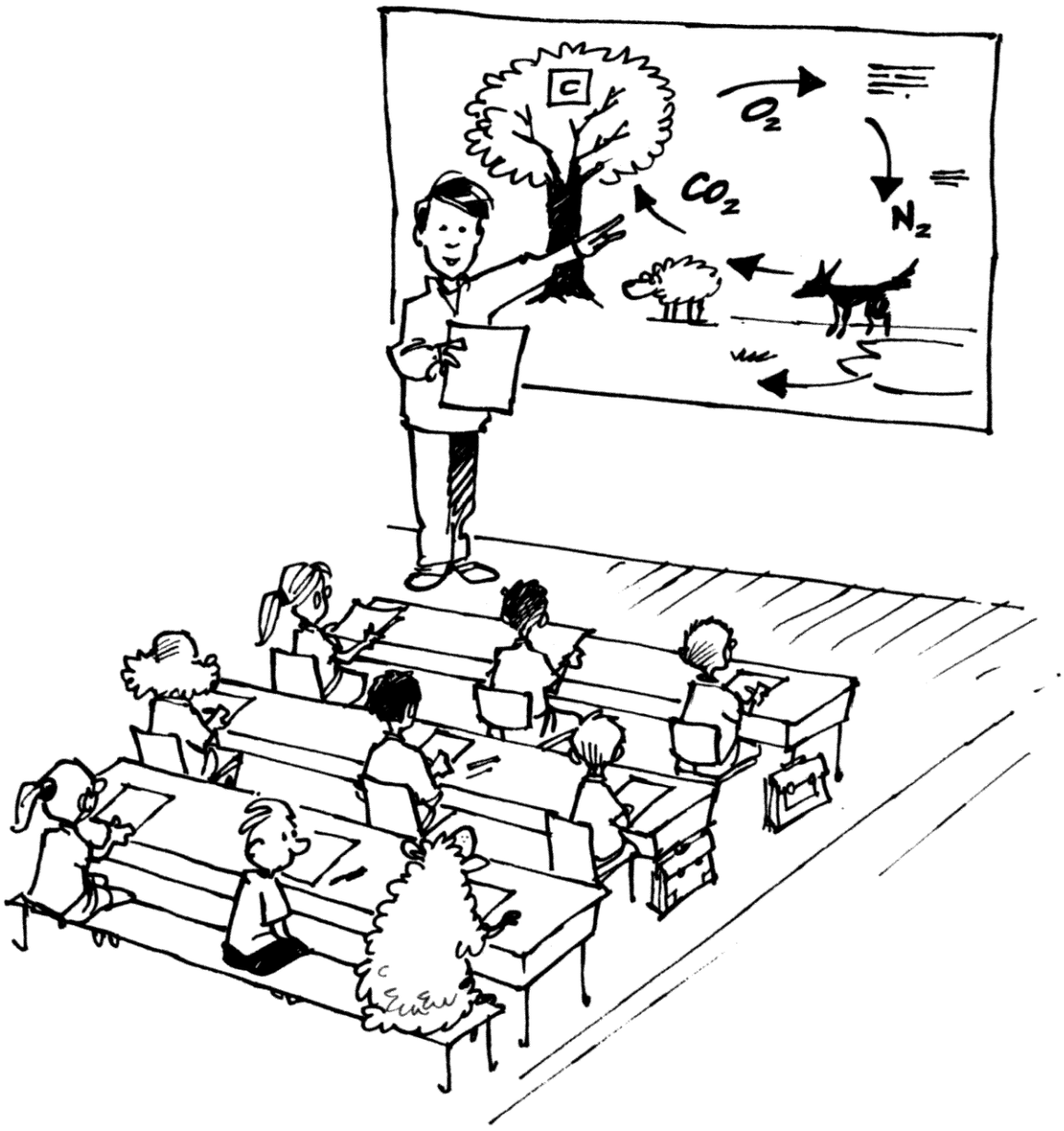
Biodiversity, food and farming for a healthy planet

Lesson plans



Convention on Biological Diversity

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Acknowledgements
Learning for a Sustainable Future

Convention on Biological Diversity

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Introduction

Welcome teachers!

Teaching students about biodiversity, or the variety of life on Earth, is a daunting yet exciting task. The Convention on Biological Diversity wants to support you in guiding students through a fascinating and exciting exploration of biodiversity issues.

For our first project, we've designed a module on biodiversity and agriculture – the 2008 theme for the International Day for Biological Diversity. It comprises of five lesson plans for teachers and an accompanying educational booklet. The resources are aimed at students in upper primary school (grades four to six), but could be adapted for other levels.

We invite you to introduce your students to biodiversity and agriculture issues. The following five lesson plans are designed as an integrated biodiversity unit. The lessons are suitable for diverse subjects: biology, environmental science, science, mathematics, nutrition, art, geography, agriculture and social studies. If your class completes multiple lessons, we recommend doing one KWL chart for the entire unit (e.g. complete columns K and W at before the first lesson, and column L after the final lesson). A KWL chart is a simple but effective tool for charting learning progression. (See appendix 1 for KWL chart instructions.)

To ensure the resources will meet the needs of teachers, they were evaluated by teachers and employees of Learning for a Sustainable Future, a Canadian non-governmental organization aiming to integrate education for sustainable development into school curricula. The resources have since been revised to better reflect classroom realities and education for sustainable development curriculum criteria. (For a full review of the resource, please visit the Resources For Rethinking website at r4r.ca and search "biodiversity".)

We recommend sending a letter home to parents informing them of the upcoming biodiversity unit. The parents may ask questions, encourage conversation and support the homework activities. It is also a way to extend the students' learning. (See sample letter in appendix 2.)

We hope you enjoy using these lesson plans, and that your students enjoy their exploration of biodiversity and agriculture.

Please write or email us with your stories, suggestions and critiques. We'd love to hear how you use the resources, and how your students respond.

Sincerely,
Christine Gibb and Leah Mohammed
(secretariat@cbd.int)

What is Biological diversity?

Lesson Plan 1

Grade levels: 4 to 6.

Subjects: Science, Biology, Environmental Education

Duration: 1 hour

Purpose: Students play a round of "musical chairs" using drawings of different species in a food web. The disappearance of "chairs" signals the extinction of that species. Students learn how the extinction of species affects others in the food web.

Learning Objectives: By the end of the activity, the students will be able to:

- Explain how plants and animals support each other in the food chain or food web;
- Identify human-caused species loss as one of the major current threats to biodiversity;
- Explain the species diversity level of biodiversity;
- Explain how the disappearance of one species affects other species.

Skills: Students will develop skills in the following areas:

- Organizing their knowledge into KWL charts.

Materials: blackboard, chalk, paper, drawing tools and source of music (teacher can sing).

Vocabulary: biodiversity, carnivore, decomposer, ecosystem, food chain, food web, herbivore, microorganism, omnivore, species.

Procedure

Part 1 – Understanding food webs (30 minutes).

1. As a class, create a KWL chart and fill in the K and W columns. This step will help students start reflecting on biodiversity, and is an opportunity to introduce new vocabulary. (See appendix 1(a).)
2. Explain learning objectives of this exercise. Have students read "What is biological diversity?" in *Biodiversity, food and farming for a healthy planet*. If reading in class, students can take turns reading out loud. Explain new vocabulary as the section is read in class or when the reading is assigned.
3. Have students create a word wall to put on the wall for the duration of the biodiversity module. (See appendix 1(b).)

4. In small groups (or as a class), have students brainstorm examples of food chains, identify the component microorganisms, plants and animals and explain the relationships among the components. (See sample below.)
5. Write the five typical levels of food chains on the black board ("plants/primary producers", "herbivores", "omnivores", "carnivores" and "decomposers"). Have students classify each species in their food chain according to these divisions. Have students write each species in its appropriate category on the board. There should be multiple organisms for each level of the food chain.
6. Draw lines connecting the various components of each food chain. Use a different coloured piece of chalk for each food chain. Students should recognize that one species can be part of multiple food chains. Explain that a food web is various food chains that are connected. Explain that the connections between species are why biodiversity is sometimes called "the web of life".
7. Ask students how humans, human activity and human inventions can affect food web(s) in both positive and negative ways. Students should consider the effects of various levels – for individual species, for a particular food chain, and for the entire food web (e.g. felling trees to build homes destroys plant and animal habitats and disrupts an entire food web; birds have less food to eat when farmers apply insecticides to kill insect pests). Before sharing their answers with the class, have students spend one minute sketching their answers.
8. Have students select one or more food chains for the game. Have students choose one species they want to draw (ensuring that there is at least one species per category). **Only one species per piece of paper.**
9. After students have completed their drawings, ask students to arrange the drawings in a web, according to the food chain.

Part 2. Game to understand biodiversity loss (30 minutes).

10. Explain that the rules of game (an adaptation of musical chairs):
    - The drawings are set up in a circle (one drawing per student).
    - The music is turned on and the students walk around the drawings.
    - The teacher sneaks in and takes one of the drawings out—representing the loss of a species.
    - When the music stops the students sit on the drawings.
    - The student left standing is taken out of the game.
    - The teacher shows the picture of the 'extinct species' and asks the students "what could have made this species go extinct?"
    - Students have 30 seconds to consult with the student sitting next to them. The teacher asks two or three groups to report their conclusions.
    - The students all stand again and the music is started again. Another drawing is removed.
    - This procedure is continued for several rounds.

- After several rounds have students compare the remaining species to the food webs on the board. Ask if and how any of the remaining species would be affected by the loss of removed species.
- Repeat previous steps until only one student remains.
- Ask what would happen to the species if it were the only species remaining.

11. Play the game.
12. Finish with a short discussion on species extinction and a brainstorming session on what students can to reduce and eliminate biodiversity loss.
13. As a class, complete the L column of the KWL chart.

Assessment:

- Active student participation in food web discussion.
- Active student participation in brainstorming session of what students can to reduce and eliminate biodiversity loss.
- See appendix 3(a) for a sample rubric for assessing participation and group work.

Internet resources
The 3-minute *2010 video* is visually appealing and contains good background information on biodiversity issues for teachers; however, the words change too quickly for young students to read.
cbd.int/videos/

Food webs:
bigelow.org/edhab/fitting_algae.html
arcytech.org/java/population/facts_foodchain.html
gould.edu.au/foodwebs/kids_web.htm (with a web activity to create a food web)

Possible modifications and extensions
Have students brainstorm causes of biodiversity loss (e.g. habitat destruction to construct new homes and businesses; habitat changes due to climate change) and ways to mitigate biodiversity loss (e.g. government creates new protected areas; citizens plant local species in private and community gardens). Have students draw each idea onto a card (one idea per card). Play the game with a modification: instead of always removing a species, the teacher can add or remove species. In each round, the teacher draws a card – if it is a cause of biodiversity loss, a species goes extinct; if it is a way to mitigate biodiversity loss, a species is added.

Have students write a letter to their government representative and/or the Minister of Environment informing him or her about how they feel about biodiversity, its relevance to their lives and their opinion on the role of the government in biodiversity issues.

Diagram 1. Sample food web illustrating the relationships among soil organisms, plants, organic matter, birds and mammals.

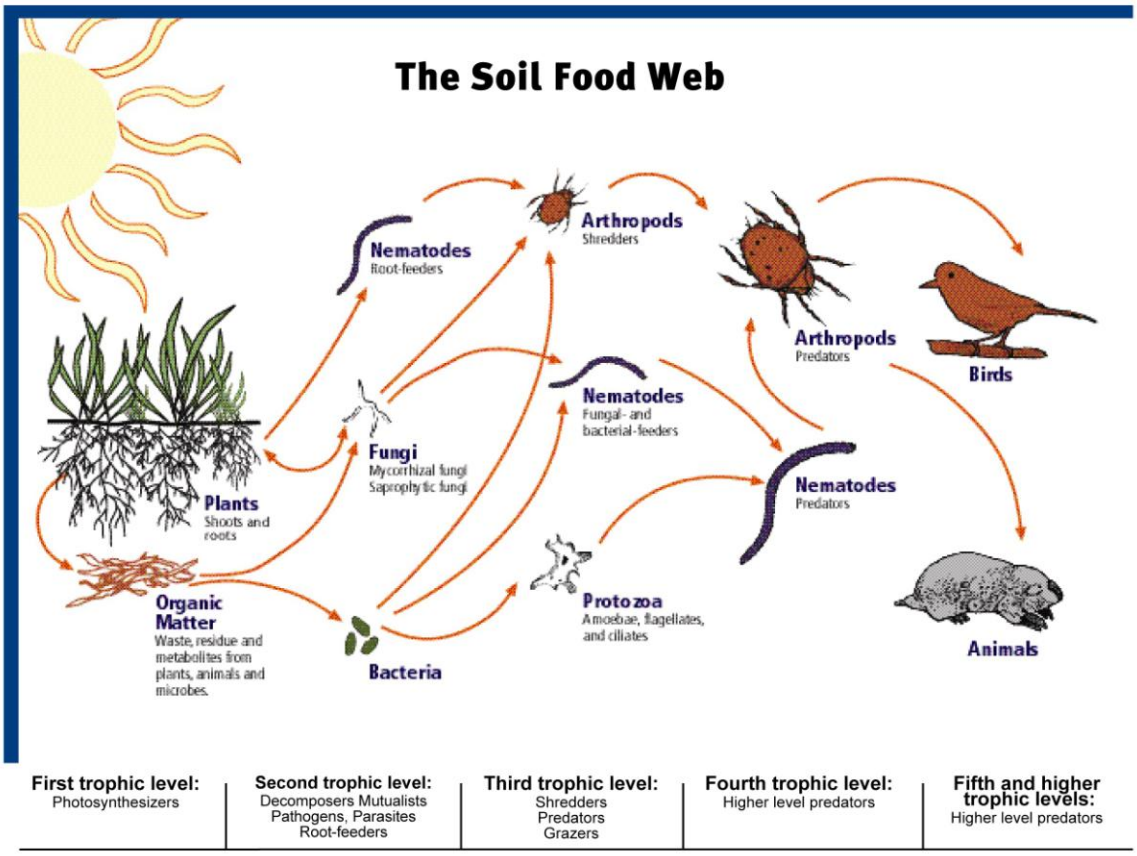


Image courtesy of USDA Natural Resources Conservation Service.
soils.usda.gov/sqi/concepts/soil_biology/images/A-3.jpg

Diagram 2. Simple food chain

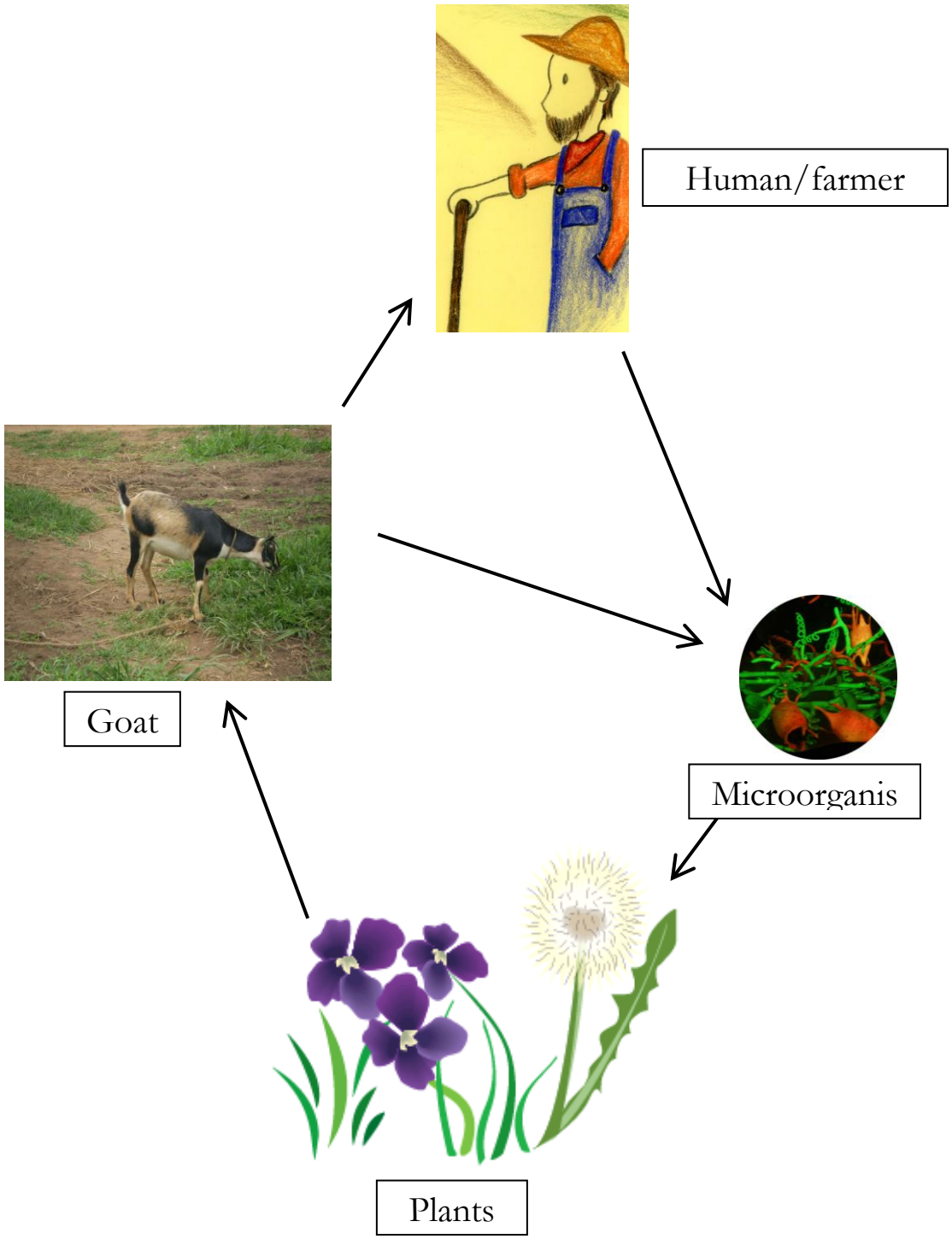


Image courtesy of Annie Webb

What does biodiversity have to do with the food we eat?

Lesson Plan 2

Grade levels: 4 to 6.

Subjects: Nutrition, Science, Mathematics

Duration: Two 1.5 hour sessions in the classroom + three 30 minute sessions at home

Description: Students keep a daily food log for three days. After, they investigate how their food consumption depends on genetic and species diversity.

Learning objectives: By the end of the activity, the students will be able to:

- Link the different foods they eat to biodiversity;
- Explain three reasons why genetic diversity is important for agriculture and for people;
- Explain three reasons why species diversity is important for agriculture and for people.

Skills: Students will develop skills in the following areas:

- Creating graphic organizers;
- Classifying and organizing data;
- Introduction to systems thinking.

Materials: Notebook or paper, pencil.

Vocabulary: biodiversity, climate change, gene, genetic diversity, species diversity.

Procedure:
In-class preparation (Monday, 1.5 hours)

1. Start activity with a KWL chart or word wall. (See appendix 1.)
2. Explain learning objectives and new vocabulary.
3. Have students read "What does biodiversity have to do with the food we eat?" in *Biodiversity, food and farming for a healthy planet*.
4. Ask students why they think both genetic and species diversity are important for farming and for food.
5. Introduce concept of a graphic organizer (e.g. table) as a tool for collecting, organizing information. Constructing the food log could be integrated as a mathematics lessons in

which the students determine (a) what data are important, (b) how often to record data, (c) the appropriate layout, number of rows and columns and column headings.

6. Have students create a food log in a notebook (see sample below), where they will record their food and drink intake for the next 4 days.

At home assignment (Tuesday, Wednesday, Thursday)

7. After every meal or snack (or other agreed upon time), fill in the food log.
8. Repeat for three days.

In-class follow-up (Friday, 1.5 hours)

9. Engage students in a class discussion on the results of their food logs. Use facilitation techniques to encourage participation of all students (e.g. small group discussions in which one student reports the group's ideas back to entire class; pair-and-share; one minute delay between asking questions and soliciting answers, during this time, students write or sketch possible answers). Possible starting points include:

    - Have students create categories using the data they have collected (e.g. breakfast/lunch/dinner; sweet/salty/bitter/sour fruit/vegetable/grain/meat/dairy; locally-produced/imported; organic/fair trade/conventional; food produced in N. America/S. America/Africa/Asia/Europe/Pacific; special occasion food/everyday food; food I cook/food mom cooks/food dad cooks; etc.) and then group their food. Write categories and food ingredients on the board.

    - Ask students what it would be like to eat only one food or only one category of food. Introduce importance of species diversity in agriculture and how it enriches human lives (by way of providing us with diverse foods). Have students identify other reasons why species diversity is important to agriculture (e.g. environmental, social and economic reasons).

    - Ask students what would happen if climate change affected the growing conditions of farms around the world. Have students identify other reasons why genetic diversity is important to agriculture.
      For example, if historically cool and wet potato-growing regions of Peru became warm and dry, what might happen to the potatoes? To the potato farmers? To potato consumers? What characteristics in other potato breeds might the potato farmers select if they want to continue growing potatoes? What other options do they have? Discuss the importance of genetic diversity in agriculture and how it enriches human lives (e.g. different varieties or breeds of a single species may be better suited to local tastes, cooking methods, nutritional needs, growing conditions, etc.).

10. If using the KWL chart, as a class, fill in the L column.

Assessment:

- Active student participation in class discussion.
- Submission of daily food log.
- See appendices 3(a) to assess participation and group work and 3(b) to assess the food log graphic organizer.

Internet resources
Interactive World Hunger Map from the United Nations World Food Programme:
wfp.org/country_brief/hunger_map/map/hungermap_popup/map_popup.html

Origins of Food: open2.net/everwonderedfood/origins.html
online.sfsu.edu/~patters/culinary/pages/croporigins.html

Graphic organizers: eduscapes.com/tap/topic73.htm

Modifications and extensions:
This activity could be extended to look at global inequity in a hunger map. Students could research and compare average daily caloric intake of children in different parts of the world. As student may be shocked by their findings, a class discussion of why the inequity occurs and what students can do about it should be included.

Sample food log

Tuesday – Meal one

Meal 1: Breakfast		Meal 2: Lunch		Meal 3: Dinner		Snacks		
Dish	Ingredients	Dish	Ingredients	Dish	Ingredients	Dish	Ingredients	
Porridge	Oats							
	Milk							
	Raspberries							
	Brown sugar							
Fruit salad	Orange							
	Apple							
	Watermelon							
Toast	Whole wheat bread							
	Peanut butter							
Water	Water							
…								

How do farmers grow food around the world?

Lesson Plan 3

Grade levels: 4 to 6.

Subjects: Science, Environmental Education, Geography

Duration: five 45-60 minutes sessions + individual research time + ongoing garden maintenance time + community celebration event time

Description: There is a dual focus for this activity: investigating the origin of and growing methods for a food, and growing a garden. Over the course of several weeks, you can introduce different methods used by farmers to grow food, why different methods are used in different parts of the world, and engage the students by having them test various growing methods.

Learning objectives: By the end of the activity, the students will be able to:

- Describe different basic farming methods used in different parts of the world, as examples of how human knowledge shapes and is shaped by biodiversity
- Explain why some growing practices are used in some areas but not in others, and for certain foods but not for others
- Grow food using different growing methods

Skills: Students will develop skills in the following areas:

- Scientific method;
- Oral presentations;
- Research techniques;
- Creating graphic organizers;
- Classifying and organizing data.

Materials: World map, indoor planting material (seeds, pots, soil, water, fertilizer, light source), outdoor planting material (seeds, trowel, soil)

Vocabulary: biodiversification, biodiversity, community-supported agriculture, greenhouse, industrial farming, monoculture, organic farming, pesticide, small-scale farming, sustainable farming.

Procedure:
Introduction to concepts (45-60 minutes)

1. Start activity with a KWL chart or word wall (see samples in lesson plan 1). Explain vocabulary and learning objectives.
2. Have students read "How do farmers grow food around the world?" in *Biodiversity, food and farming for a healthy planet*.
3. As a group, have students list the various foods they eat. Encourage them to identify which crops, fruits, vegetables and animals are used in their favourite dishes. Have students refer to their food logs from lesson 2.
4. Ask students where they think their food was grown or originated. Have students indicate the country on a world map.
5. Ask students to describe how any of listed foods are grown or raised. Explain there are many different ways that farmers grow different kinds of food around the world. Further explanation of agriculture terminology and various growing methods may be needed.
6. Explain the individual assignment:
    - Each student selects one food item, such as a fruit, vegetable, root or meat, for a research project.
    - Each student uses a worksheet to help guide his or her research. (See sample worksheet below.)
    - Each student prepares a two-minute presentation on his or her research.
7. Introduce or review research and investigation techniques: 1) identify a research question, 2) identify possible sources of information such as books, videos, internet encyclopedias, reliable websites, resource people in your community, 3) read or talk with information sources, 4) record your notes, 5) organize your notes, 6) summarize your main findings and conclusion.
8. Introduce or review oral presentation techniques. Divide students into groups of three. In each group, assign a timekeeper, note-taker and reporter. Ask half the groups to come up with a list of *good* oral presentation techniques (e.g. making eye contact with the audience). Ask the other half to come up with a list of *poor* oral presentation techniques (e.g. only looking at your feet). The groups have five minutes to brainstorm ideas. After, the reporter in each group summarizes the group's discussion for the rest of the class. The teacher may wish to post a list of good and poor presentation techniques in the classroom.

Presentation of research (45-60 minutes)

9. Have students present their research to the class.

Hands-on activity (45 minutes for instructions and skill-building + 45-60 minutes for each of the each indoor and outdoor planting sessions)

10. Introduce or review the scientific method. Explain that the class will use the scientific method to learn about growing food and comparing growing methods.
11. As a class, decide how you will measure plant growth (e.g. height of plant, number of leaves per plant) and variables that affect plant growth (e.g. hours of daily light exposure, amount of water per day or week, number and type of neighbouring plant(s)).

12. Select a fast-growing food plant (e.g. beans) that students can grow using various methods in the classroom and schoolyard.
13. Introduce concept of a graphic organizer (e.g. table) as a tool for collecting, organizing information. Constructing the plant growth and variables table could be integrated as a mathematics lessons in which the students determine (a) what data are important, (b) how often to record data, and (c) the appropriate layout, number of rows and columns and column headings.
14. Divide the students into teams of five. Groups should have students of mixed abilities. In each group, assign roles: someone to read the instructions aloud, someone to draw a graphic organizer, someone to collect planting material, someone to take notes and someone to ensure everyone is on task and participating.
15. Have each team plant bean (or other species) seeds according to a different growing method. For example, growing beans in individual pots in the classroom represents growing food in a greenhouse; growing *only* beans in the school garden represents a monoculture; intercropping beans with other plant species represents biodiversification; raising beans without pesticides represents organic farming. (See evergreen.ca/en/lg/patterns.pdf for specific steps.)
16. Have students nurture the seedlings.
17. Have students compare the various growing methods and prepare a short written or oral report.
18. If using the KWL chart, as a class, fill in the L column.
19. Host a garden/greenhouse celebration. Invite other classes, parents and community members to tour the garden and classroom greenhouse, and to listen to student presentations. During the celebration, ensure each student has a specific role (e.g. greeter, tour guide, presenter, etc.). Roles should be assigned before the celebration. (If the class is doing lesson 4 *Can farming affect biodiversity?* combine the garden celebration with the poster presentation.)

Assessment:

- Student research project on one type of food – where it originated or its history, where it is currently grown or raised, and why it grown in these locations; how it is grown or raised, and why it is grown or raised using such methods.
- The student will demonstrate their understanding of food production methods as an example of human contributions to the cultural aspects of biodiversity through an oral presentation of their research project.
- The student will demonstrate their practical awareness of growing food through active participation in the hands-on planting activity, culminating celebration and oral and written research reports.
- See appendices 3(a-d) for sample rubrics of participation and group work, graphic organizers, oral presentations and research reports.

Internet resources:

Steps to start and maintain a school garden (with curriculum links) evergreen.ca/en/lg/patterns.pdf

Interactive World Hunger Map from the United Nations World Food Programme: wfp.org/country_brief/hunger_map/map/hungermap_popup/map_popup.html

Origins of Food: open2.net/everwonderedfood/origins.html
online.sfsu.edu/~patters/culinary/pages/croporigins.html

Scientific method: sciencefairproject.virtualave.net/scientific_method.htm

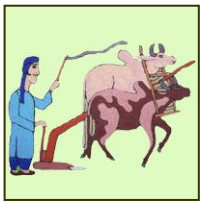
Graphic organizers: eduscapes.com/tap/topic73.htm

Sample research worksheet

Name:	
Food item:	
Overall research question:	
Useful information sources (write the title, author, website url, publication date, …)	1.
	2.
	3.
	4.
Notes on:	
• Where did your food item originate?	
• What are some interesting historical facts about your food item?	
• Where is your food item currently grown?	
• Why is it grown in this location/ these locations?	
• What farming methods are used to grow or raise your food item? Describe them.	
• Why are these particular methods used?	
• How is your food item prepared and eaten?	
• Any other interesting facts or questions	
Summary of main findings:	
Overall conclusion:	

Can farming affect biodiversity?

Lesson Plan 4



Grade levels: 4 to 6.

Subjects: Science, Biology, Agriculture, Environmental Education

Duration: Classroom time (45 min + 1.5 hours + 50 min) + 3.5 hour on-farm session

Description: Students play a detective mission game in which they visit a farm and surrounding area and observe differences in ecosystems and in plant and animal species to learn how farming practices can affect the environment and biodiversity. Students present their findings orally and through a poster presentation.

Learning objectives: By the end of the activity, the students will be able to:

- Collect biodiversity-related field data using simple observation techniques;
- Summarize and present research findings in written and oral forms;
- Analyze and interpret data to arrive at a conclusion based on various sources.

Skills: Students will develop skills in the following areas:

- Field data collection;
- Poster presentation.

Materials: Notebook, pencil, detective mission, measuring instruments (ruler, tape measure), observation materials (tape recorder, digital camera, magnifying glass), drawing/painting materials, flip chart paper or other large sheets of paper.

Vocabulary: agroecosystem, biodiversity, ecosystem, indicator.

Procedure:
Initial preparation:

1. Select a farm with various ecosystems where students can walk around to observe how farming practices have affected the environment. Depending on the farm, different ecosystems may include a grain field, a vegetable garden, an orchard, a fish or duck pond, a forest, a lawn or a hedgerow. Obtain permission to use the farm and invite the host farmer(s) to join in the activity and answer students' questions. Ask the farmer how agriculture has affected the landscape and biodiversity on and around the farm. This information should be shared with the adult chaperones so that they can answer students' questions.
2. Prepare a detective's mission with clues specific to the chosen area. (See sample below.)

Classroom preparation: (45 minutes)

3. Start activity with a KWL chart or word wall to explain key vocabulary. (See appendix 1.) Explain learning objectives.
4. Have students read "Can farming affect biodiversity?" in *Biodiversity, food and farming for a healthy planet* before going to the farm.
5. Introduce concept of an indicator in the context of biodiversity and agriculture. For example, *"What happens when you go to a farm and ask 'how does agriculture affect biodiversity?' out loud? Probably nothing because the plants, animals, trees and soil won't answer in a human language. Instead, you need to look for clues to find the answer. In biology and in other sciences, these clues are called indicators. An indicator is a sign of something else. One indicator you might find is a fallen tree on the edge of a field. When trees are felled to create space for planting crops, the remaining trees are more exposed to the elements. The remaining trees may not be used to the strong winds. They are more vulnerable and more likely to fall. So, cutting down trees for farming can stress the remaining trees and eventually reduce biodiversity. A fallen tree is a clue, or an indicator, of how agriculture affects biodiversity."*

At the farm: (3 hours)

6. At the farm, set ground rules on safe and appropriate outdoor behaviour. Verify with the farmer areas that children should not enter (e.g. because it is too dangerous)
7. If the farmer chooses, he or she can give a short tour of the farm before the game so the students will know what crops are grown and which animals are raised. Encourage the students to ask questions.
8. After the tour of the farm, if possible, explain the rules of the game.
    - Divide students into teams of five, each accompanied by an adult. Assign a role to each student (e.g. someone to take notes, someone to read the detective mission aloud, someone to keep track of the time, someone to report findings to the class, someone to monitor to energy level of the group). Students may rotate roles throughout the activity.
    - Students must follow the ground rules.
    - Each team receives a biodiversity inspection kit comprising of detective mission, notebook, pencil, crayons, ruler, magnifying glass, digital camera, tape measure and tape recorder.
    - Each team is responsible for completing detective work for a given area.
    - Each team has 1.5 hours to complete the detective mission and return to the main base.
    - Throughout the activity, the adults in each group should help the students identify the appropriate vocabulary and ensure that all students participate. The adults should ask probing questions in steps 1 and 2 of the detective mission to ensure students recognize linkages between biodiversity and agriculture.

9. Have student teams complete the detective mission, then write or draw a summary of their results on a large sheet of paper. (1.5hour)
10. After the activity, have the class share their observations and compare the differences among groups observing different ecosystems. Encourage the students to describe their observations. Help students to identify appropriate vocabulary from their descriptions of their observations.

Classroom follow-up: 1.5 hours

11. Explain the characteristics of a good poster (artistic elements such as colour, layout and use of graphics, and information elements such as important sections and appropriate poster language). See internet resources for more ideas.
12. In their groups, have students create a poster illustrating two ways – one positive, one negative – of how agriculture affects biodiversity.
13. If using a KWL chart, have the class complete the L column.

Poster event: 45 minutes

14. Host a poster presentation event. Invite other students, parents and teachers to read and enjoy the group posters. One member of the group should remain with the poster to answer questions. Each group member should stay with the poster for ten minutes. (If the class is doing lesson 3 *How do farmers grow food around the world?* combine poster presentation with the garden celebration.)

Assessment:

- Each team submits a notebook with the completed detective mission sheet.
- Active student participation in class discussion about each team's observations and analysis on how farming changes an ecosystem, and in poster presentation event.
- Artistic and content quality of group posters.
- See appendices 3(a) and 3(e) for sample rubrics to assess participation, group work and posters.

Internet resources:

Peyton, B, H. Campa III, S.R. Winterstein, M.D. Peyton and J.V. Peyton. Biological Diversity for Secondary Education. Environmental Education Module. UNESCO-UNEP. IEEP. Available online at unesdoc.unesco.org/images/0011/001113/111306eo.pdf

Poster guidelines: lemanic-neuroscience.ch/AnnualMeeting/2007/files/poster%20guidelines.pdf

Sample detective mission. Detective missions can be written in a number of ways, for example as a checklist, worksheet, poem or series of clues. You may wish to adapt this sample mission.

Top Priority Mission

The Global Environmental Council (GEC) is urgently requesting your assistance. GEC has hired your class to conduct a local assessment of how farming in your area is affecting the natural environment Each team is responsible for observing and recording important information in one ecosystem. At the end, each team must report their findings to the class. Together, the class must draw five key conclusions on how farming in your area is affecting the natural environment. Report your findings to you teacher, who will then transmit the information.

Step 1. Investigating the big picture – practicing observation techniques

Go to the edge of the area. Slowly scan the environment from one side to the other, first scanning close to where you are sitting, then scanning in the distance. Pay special attention to the sensory elements of the landscape. (The *scanning* technique is useful for making sure you notice important details.)

After discussing with your group members about the different observations, complete the scanning checklist and record your observations in the notebook. In the area you just scanned…

Are the colours mainly:	Warm or cool; one or many; in orderly patterns or in random patterns
Are the lines:	Straight or curved; parallel or perpendicular; smooth or jagged
Are the shapes:	Large or small; regular or irregular; square or round; common or unusual
Is the texture:	Smooth or rough; lush or sparse; shiny or dull; warm or cold
Are the spaces:	Small or large; open or closed; consistent or inconsistent

Sketch the area, keeping in mind the elements of your scanning checklist.

Close your eyes. Focus on what you hear and what you smell. After five minutes open your eyes and share your observations with the rest of your team. Record your observations in the notebook (you may wish to tape record some of the sounds).

Step 2. Exploring the details – looking for connections between farming and biodiversity.

Now go into the area. Re-examine it and observe and answer the following.

Patterns of plant growth	What kinds of plants grow on high parts of the area? In low or wet areas? Near the edge? In the middle? Is one plant more common than others? Are there many trees?
Animals or animal signs	Which species of mammals, birds, insects, reptiles, amphibians or fish do you observe? How did you know it was these species (e.g. by sight, by sound, by tracks)? Where is each animal located (e.g. under leaves, in the sky)?
Non-living (abiotic) things	What are some of the abiotic things in the area (e.g. rock, stream, soil)? How do they interact with the living (biotic) things?
Evidence of change	Can you see change in the environment (such as fire, fallen trees, erosion, etc.)?
Unique traits of the area	Is there anything unique about this area that makes it different from other natural area you have seen, read about or visited (such as the presence of a river, large geological features, old trees, rare plants or animals)?

Record your answers in the notebook with words, sketches, photographs and/or tape recordings. Repeat for three sites within the same ecosystem.

Step 3. Bringing it together.

Return to the meeting place with the other teams. Share your findings. As a class, determine the five most important distinguishing features between agroecosystems (farm ecosystems) and other nearby ecosystems. You may wish to involve a farming expert (e.g. farmer) in your class discussion. The expert can use his or her farming experience and wisdom to help your class produce valid conclusions. Report the class conclusions to your teacher.

So what do you think and feel?

Lesson Plan 5

Grade levels: 4 to 6.

Subjects: Art, Social Studies, Environmental Studies

Duration: 2 hours (can be reduced if students complete the *so what?* diagram as homework)

Description: Students create a *so what?* diagram in which they organize their personal reflection on the relationship between biodiversity and agriculture, and how it relates to things they care about.

Learning objectives: By the end of the activity, the students will be able to:

- Articulate the relationship between biodiversity and agriculture, and how it affects other things;
- Organize their ideas in a *"So what?"* poster.

Skills: Students will develop skills in the following areas:

- Poster presentation;
- Oral presentation;
- Developing a concept map.

Materials: drawing materials (paper, coloured pencils, crayons, old magazines).

Vocabulary: biodiversity, fair trade, sustainable agricultural production.

Procedure:

1. Sensitize students to biodiversity and agriculture issues (e.g. by working on other activities in this module).
2. Start activity with a KWL chart or word wall to ensure students are familiar with appropriate vocabulary. (See appendix 1.)
3. Have students read "So what?" in *Biodiversity, food and farming for a healthy planet.*
4. Divide students into of three. In each group, assign a timekeeper, note-taker and reporter. Ask half the groups to come up with a list of good oral presentation techniques. Ask the other half to come up with a list of poor oral presentation techniques. The groups have five minutes to brainstorm ideas. After, the reporter in each group summarizes the group's discussion for the rest of the class. The teacher may wish to post a list of good and poor presentation techniques in the classroom.

5. Ask students to develop a *personal* response to one question, either "**biodiversity is important for agriculture - so what?**" or "**agriculture affects biodiversity - so what?**". Student responses should take the form of a *so what?* diagram. Students can create their *so what?* diagram on paper (Bristol board works well) or, if they like working on the computer, they can create a flow chart using PowerPoint or similar software.
6. Have students follow the steps for creating a *so what?* diagram:
    - Write the phrase "**biodiversity is important for agriculture**" or "**agriculture affects biodiversity"** in a small box in the center of the large piece of paper.
    - From the center box, draw a small line in any direction. Write the phrase *'so what?'* on top of the line. Draw a second box at the end of the line. In the box, sketch ***your own personal answer to this question.*** For example, if a student selected agriculture affects biodiversity, they may write *'forests in the Amazon are chopped down to create pastures for raising livestock'*.
    - From the **second** box, draw another line in any direction. Write *'so what?'* on top of the **second** line. Draw a new, **third** box. In the third box, sketch a response to the previous answer. (E.g. the *'so what?'* of *forests in the Amazon are chopped down to create pastures for raising livestock* could be, *'deforestation is threatening the habitat of tropical rainforests and wild animals like monkeys and jaguars'*.)
    - Continue adding to this 'line of thought' until no more connections can be made. Then start a new line from the center box and repeat the process.
    - Note: The lines of thought in the *so what?* diagram can be both positive and negative. For example, you may appreciate that we're making an effort to curb greenhouse gas emissions but regret that you now have more work to do.

    Some ground rules for your *so what?* diagrams:

    - Make it personal. This chart is about your own personal reaction to **biodiversity and agriculture issues**, not the 'right' reaction.
    - Use pictures more than words (sketch pictures or cut and paste pictures from old magazines).
    - Think big and broad. Think about all living things, near and far, now and in the future.
    - The last box in each line of thought should be very personal - it should include an 'I' statement (e.g. I believe ...., I wish, ... I am ..., I would feel better if .... I like ....)
7. Have each student present their *so what?* diagram to the rest of the class. Use the presentations as a starting point to discuss what concrete actions students can take.
8. If using a KWL chart, have students complete the L column.

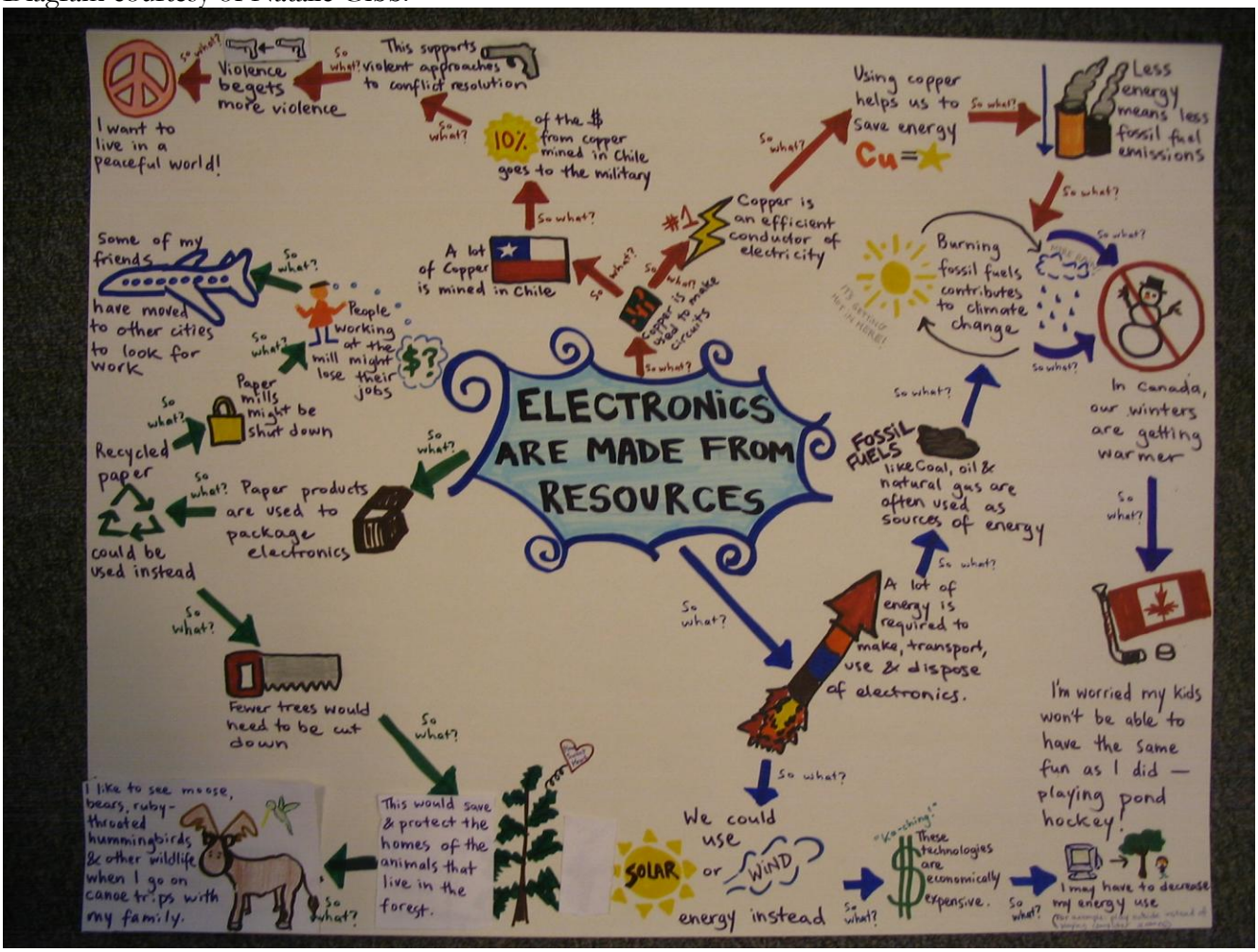
Assessment:

- Students present their *so what?* diagrams to the class.
- See appendices 3(a), 3(c) and 3(f) for sample rubrics of participation and group work, oral presentations and concept maps, resectively.

Internet resources:
Poster guidelines: lemanic-neuroscience.ch/AnnualMeeting/2007/files/poster%20guidelines.pdf

Other references:
Activity based on "So-what?" activity of Teri Burgess, Learning For a Sustainable Future 2007.

Sample *so what?* diagram reflecting on the question "electronics are made from resources, so what?". Diagram courtesy of Natalie Gibb.



Appendices

Appendix 1. Tools for charting learning progression and for learning new vocabulary.

(a) A KWL chart is a simple but effective tool for charting learning progression. One student, a small group of students or an entire class can complete it.

The three steps are simple. Before delving into a lesson, ask students what they **know** (**K**) about the topic. Write their answers in the K column. Next, ask students what the **want** (**W**) to learn about the topic. Write their answers in the W column. Now is a good time to explain the learning objectives of the lesson. The teacher may wish to revise the learning objectives and activity somewhat to address the W column. After the lesson activities are completed, ask students to reflect on what they have **learned** (**L**). Write their answers in the L column. This last step helps students summarize and remember the key points from the lesson. It also helps the teacher assess if the learning objectives were met.

Sample KWL chart template

K. What do we **know** about biodiversity and food webs?	W. What do we **want** to know about biodiversity and food webs?	L. What have we **learned** about biodiversity and food webs?
• • • •	• • • •	• • • •

(b) A word wall is a visual dictionary of important terminology related to a topic. For example, to make a word wall for the "What is Biodiversity?" activity, have students read the section and then list **all** new or unfamiliar vocabulary. Their list may include "biodiversity", "genes", "species", "ecosystems", "microorganism", "ecosystem services", "resources" and "food web" The teacher might add the vocabulary words listed in the accompanying lesson plan. Assign a word to each student. Students write the word on a piece of paper and draw a picture explaining it. All the words and drawings are posted together on the wall.

Appendix 2. Sample letter to parents.

Dear parents and guardians,

During the next *[insert number]* weeks, we will explore the relationship between biodiversity and agriculture. We will focus on the importance of biodiversity – or the variety of life on Earth – to our lives, in particular to the food we eat and to farming. We will investigate food webs, farming impacts on biodiversity, origins of different foods and various farming methods around the world. I encourage you to ask your child about what he or she is learning about biodiversity, and to share with them whatever experiences you have on these themes.

This unit will consist of conducting research, growing a school garden, participating in a field trip to a local farm, writing, developing oral and poster presentations, tracking food consumption and creating personal reflections. We will host a final wrap-up celebration showcasing the students' projects on *[insert date]* at *[insert time]*. We hope you can attend.

If you are available to assist with any of the activities, please contact me at *[insert phone number and/or email address]*.

For more information about this unit visit (cbd.int/ibd/2008/youth/) and about biodiversity in general, please visit the Convention on Biological Diversity website (cbd.int).

Sincerely,

[insert your name]

Appendix 3. Sample rubrics for assessment.

(a) Rubric for participation and group work. It is also suitable for self-assessment and peer feedback.

	Criteria				Points
	4	**3**	**2**	**1**	
Level of engagement in class	Student proactively contributes to class by offering ideas and asking questions more than once per class.	Student proactively contributes to class by offering ideas and asking questions once per class.	Student rarely contributes to class by offering ideas and asking questions.	Student never contributes to class by offering ideas and asking questions.	
Listening, questioning and discussing	Respectfully listens, discusses and asks questions and helps direct the group in solving problems.	Respectfully listens, discusses and asks questions.	Has trouble listening with respect, and takes over discussions without letting other people have a turn.	Does not listen with respect, argues with teammates, and does not consider other ideas, Blocks group from reaching agreements.	
Behavior	Student almost never displays disruptive behavior during class discussions and group activities.	Student rarely displays disruptive behavior during class discussions and group activities.	Student occasionally displays disruptive behavior during class discussions and group activities.	Student almost always displays disruptive behavior during class discussions and group activities.	
Preparation	Student is almost always prepared with assignments and required class materials.	Student is usually prepared with assignments and required class materials.	Student is rarely prepared with assignments and required class materials.	Student is almost never prepared with assignments and required class materials.	
Problem-solving	Actively seeks and suggests solutions to problems.	Improves on solutions suggested by other group members.	Does not offer solutions, but is willing to try solutions suggested by other group members.	Does not try to solve problems or help others solve problems.	
Group/partner teamwork	Works to complete all group goals. Always has a positive attitude about the tasks and work of others. All team members contribute equally. Performed all duties of assigned team role.	Usually helps to complete group goals. Usually has a positive attitude about the tasks and work of others. Assisted team members in the finished project. Performed nearly all duties of assigned team role.	Occasionally helps to complete group goals. Sometimes makes fun of the group tasks and work of others. Finished individual task but did not assist team members. Performed some duties of assigned team role.	Does not work well with others and shows no interest in completing group goals. Often makes fun of the work of others and has a negative attitude. Contributed little to group effort. Did not perform duties of assigned team role.	
				Total	

Adapted and used with permission from Karen Franker; original at: uwstout.edu/soe/profdev/elemteamworkrubric.html
Adapted and used with permission from Teach-nology; original at: teach-nology.com

(b) Rubric for graphic organizer.

	Criteria				Points
	4	**3**	**2**	**1**	
Explanation	A complete response with a detailed explanation.	Good solid response with clear explanation.	Explanation is unclear.	Misses key points.	
Demonstrated knowledge	Shows complete understanding of the questions, mathematical ideas, and processes.	Shows substantial understanding of the problem, ideas, and processes.	Response shows some understanding of the problem.	Response shows a complete lack of understanding for the problem.	
Requirements	Goes beyond the requirements of the problem.	Meets the requirements of the problem.	Hardly meets the requirements of the problem.	Does not meet the requirements of the problem.	
				Total	

Used with permission from Teach-nology
Original at: teach-nology.com

(c) Rubric for oral presentation

	Criteria				Points
	4	**3**	**2**	**1**	
Body language	Movements seemed fluid and helped the audience visualize.	Made movements or gestures that enhanced articulation.	Very little movement or descriptive gestures.	No movement or descriptive gestures.	
Eye contact	Holds attention of entire audience with the use of direct eye contact.	Consistent use of direct eye contact with audience.	Displayed minimal eye contact with audience.	No eye contact with audience.	
Introduction and closure	Student delivers open and closing remarks that capture the attention of the audience and set the mood.	Student displays clear introductory or closing remarks.	Student clearly uses either an introductory or closing remark, but not both.	Student does not display clear introductory or closing remarks.	
Pacing	Good use of drama and student meets apportioned time interval.	Delivery is patterned, but does not meet apportioned time interval.	Delivery is in bursts and does not meet apportioned time interval.	Delivery is either too quick or too slow to meet apportioned time interval.	
Poise	Student displays relaxed, self-confident nature about self, with no mistakes.	Makes minor mistakes, but quickly recovers from them; displays little or no tension.	Displays mild tension; has trouble recovering from mistakes.	Tension and nervousness is obvious; has trouble recovering from mistakes.	
Voice	Use of fluid speech and inflection maintains the interest of the audience.	Satisfactory use of inflection, but does not consistently use fluid speech.	Displays some level of inflection throughout delivery.	Consistently uses a monotone voice.	
				Total	

Used with permission from Teach-nology
Original at: teach-nology.com

(d) Rubric for research reports

	Criteria				Points
	4	3	2	1	
Introduction/ topic	Student properly generates questions and or problems around a topic.	Student generates questions and or problems.	Student requires prompts to generate questions and or problems.	Questions or problems are teacher generated.	
Conclusions reached	Numerous detailed conclusions are reached from the evidence offered.	Several detailed conclusions are reached from the evidence offered.	Some detailed conclusions are reached from the evidence offered.	A conclusion is made from the evidence offered.	
Information gathering	Information is gathered from multiple electronic and non-electronic sources and cited properly.	Information is gathered from multiple electronic and non-electronic sources.	Information is gathered from limited electronic and non-electronic sources.	Information is gathered from non-electronic or electronic sources only.	
Summary paragraph	Well organized, demonstrates logical sequencing and sentence structure.	Well organized, but demonstrates illogical sequencing or sentence structure.	Well organized, but demonstrates illogical sequencing and sentence structure.	Weakly organized.	
Grammar and spelling	Punctuation and capitalization are correct.	There is one error in punctuation and/or capitalization.	There are two or three errors in punctuation and/or capitalization.	There are four or more errors in punctuation and/or capitalization.	
				Total	

Used with permission from Teach-nology
Original at: teach-nology.com

(e) Rubric for posters.

	Criteria			Points
	3	2	1	
Colors and patterns	Enhance readability.	Support readability.	Detract from readability.	
Layout	Creatively enhances information.	Balanced, uncluttered, adequate white space.	Not balanced, cluttered, insufficient white space.	
Graphics/photos	All graphics are engaging, enhance text.	Graphics enhance text.	Graphics do not enhance text.	
Titles and subtitles	All titles and subtitles are clear, enhance readability	Most titles and subtitles are clear, enhance readability	Few or no titles or subtitles to clarify text	
Text size and color	All text is clear and readable; a few changes in size and color enhance understanding.	Text is clear and readable; changes in size and color enhance understanding.	Some text is clear and readable; frequent changes in size and color do not enhance understanding.	
Writing	Well written and organized, clear, easy to follow.	Adequately written and organized, clear, reasonably easy to follow.	Poorly written and organized, unclear, hard to follow.	
Quality of information	Product description is clear, complete and concise.	Product description is mostly clear, could be a little more concise.	Product description is unclear, incomplete and not concise.	
Grammar and spelling	No grammar or spelling errors.	One grammar or spelling error.	Many grammar and spelling errors.	
			Total	

From Anthony Salcedo
Original at teachnet-lab.org/motthallschool/asalcedo/marketing/Poster%20Rubric.htm

(f) Rubric for concept maps.

	Criteria			Points
	3	2	1	
Relationships between concepts	Clear relationship between concepts. Hierarchical organization from components to sub-components.	Relationship between concepts evident. Components and sub-components present.	Unclear relationship between concepts. Components and sub-components unorganized.	
Cross-linkages	Logical linkages. Clear and thorough explanation of links. Information is clear, accurate and precise.	Logical linkages. Explanation of links unclear. Information is accurate.	Linkages do not make sense and are not explained. Information is inaccurate.	
Presentation	Presentation is orderly and visually appealing. Demonstrates effective use of the elements of graphic design.	Presentation is orderly and effective	Presentation is not orderly.	
			Total	

Adapted and used with permission from Joyce Tugel
Original at: edmall.gsfc.nasa.gov/WebQuest/sysmaprub.htm

Glossary

Ancestor: an organism from which later individuals or species has evolved.

Aquaculture: the science, art and business of cultivating aquatic species, especially fish, shellfish and seaweed in natural or controlled marine and freshwater environments.

Archeologist: a person who studies the history of people and their culture.

Biodiversification: the process by which the diversity of plants or animals develops or is increased within a particular region or group of organisms.

Biodiversity: the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic systems and the ecological complexes of which they are part of; this includes diversity within species (genetic), between species and of ecosystems.

Breed: a grouping of animals of the same species having a common ancestor and the same set of characteristics. Farmers use selective mating to produce offspring (a breed) with the desired characteristics.

Carnivore: a species that primarily eats protein. Carnivorous animals include dogs, cats, wolves, seals and sharks. Also, insectivorous plants are considered carnivores.

Cell: a usually microscopic structure surrounded by a membrane or cell wall in plants and consisting of one or more nuclei, cytoplasm, and various organelles. It is the basic building block of all organisms. A single-celled organism is capable of independent functioning, whereas a multi-cellular organism, such as plants and animals, are composed of tissues with different types of cells.

Community: a group of associated individuals of any size sharing a space or locality.

Community supported agriculture: strategy of connecting local farmers with local consumers; developing a regional food supply and local economy; maintaining a sense of community; encouraging land stewardship; and honoring the knowledge and experience of growers and producers working with small to medium farms. (localharvest.org/csa.jsp)

Compost: a mixture of decaying organic matter, as in leaves and manure, used to provide nutrients to crops and improve soil structure.

Crop: a cultivated plant or the yield of cultivated plant for a given season or harvest.

Crop pest: insect, fungus, microorganism or animal that eats or damages crops, trees and garden plants.

Domesticated: species trained or adapted by humans, especially through generations of breeding. All domesticated species originated from wild ancestors.

Ecosystem: A dynamic complexity of plant, animal, and microorganism communities and their non-living environment interacting as a functional unit.

Ecosystem service: The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual and recreational benefits; and supporting services such as nutrient cycling that maintain the conditions for life on Earth. The concept "ecosystem goods and services" is synonymous with ecosystem services.

Ecology: the branch of biology dealing with the relations and interactions between organisms and their environment, including other organisms.

Endangered species: a species at risk of extinction because of environmental changes such as from human activity or climate change.

Environment: the circumstances or set of conditions—land, organisms and climate—that surrounds where one lives or where a group of organisms or a community lives.

Epiphyte: a plant, such as a moss, that grows directly on another plant for support but not food. Epiphytes get moisture and nutrients from the air or from small pools of water that can collect on the host plant, such as a tree.

Fertilization: the second step in plant reproduction that unites the male and female gametes to form a zygote, which will develop into a seed. In a flower the pollen travels down the stigma and joins with the ovary; the genes of both are combined in the zygote.

Fertilizer: Any of a large number of natural and synthetic materials, including manure and nitrogen, phosphorus, and potassium compounds, spread on or worked into soil to increase its capacity to support plant growth.

Food chain: The sequence of the transfer of food energy from one organism to another in an ecological community. A food chain begins with a **producer**, usually a green plant or alga that creates its own food through photosynthesis. In the typical predatory food chain, producers are eaten by **primary consumers** (herbivores), which are eaten by **secondary consumers** (carnivores), some of which may in turn be eaten by **tertiary consumers** (the top carnivore in the chain).

Food web: The complex system of interrelated food chains in an environment**.**

Fungus: any of a diverse group of organisms ranging from a single cell to a mass of branched filamentous hyphae (looks like the roots of a plant), such as molds, mildews, smuts, rusts, and yeasts, that live by decomposing and absorbing the organic material in which they grow. Fungi lack chlorophyll and vascular tissue and produce specialized fruiting bodies, such as mushrooms.

Genes: the variation of genes for all individuals within a species; it determines the uniqueness of each individual within the species, or a population. The expression of DNA into traits, such as the ability to tolerate drought or frost, facilitates adaptation to changing conditions.

Grain: a small, hard seed, esp. the seed of a food plant such as wheat, corn, rye, oats, rice, or millet.

Herbivore: an animal that feeds mainly or only on plants. In a food chain, herbivores are primary consumers.

Indicator: a plant, animal, or species that is a sign of — by its presence in a given area — the existence of certain environmental conditions.

Industrial farming: form of farming that mass-produces products using machines and other resources that must be bought.

Livelihood: a means of supporting one's existence, either through a paying job or by growing, producing and/or gathering everything you need to survive.

Macroorganism: a small creature that can be seen with the naked eye.

Microorganism: An organism of microscopic or submicroscopic size, especially a bacterium.

Mixed farming system: type of farming that combines farming with another type of activity, such as herding, fishing or forestry.

Nutrient cycling: the reusing of nitrogen, carbon and other nutrients in ecosystems.

Omnivore: a kind of animal that eats either other animals or plants.

Organic or ecological farming: type of sustainable farming where on-farm renewable resources are used as much as possible.

Organism: a living individual, such as a maize plant, a bird, a fish or a human.

Pasture: an area covered with grass or other plants, usually surrounded by a fence, used or suitable for the grazing of livestock; grassland

Pollination: the completion of the sexual phase of reproduction in some plants by the transportation of pollen. In the context of ecosystem services, pollination generally refers to animal assisted pollination, such as that done by bees, rather then wind pollination.

Pollinator: insect or animal that fertilizes a flower.

Recycle: to treat or process used or waste materials so as to make suitable for reuse: *recycling paper to save trees.*

Reduce: to bring down to a smaller extent, size, amount, number, etc. For example, buying goods with less packaging or buying fewer goods.

Renewable resource: any natural resource that can replenish itself naturally over time, as wood or solar energy; also called natural renewable resources.

Resource: a source of supply (e.g. natural resources), support (e.g. financial resources), or aid (e.g. manual labour), esp. one that can be readily drawn upon when needed.

Rethink: the act of reconsidering.

Reuse: to use again, especially after salvaging or special treatment or processing.

Small-scale farming: farmers grow food for themselves, their family and sometimes the local market on a small piece of land with limited resources. Often, these farmers do not have the money to buy resources they need.

Species: a species is a group of morphologically similar organisms that are able to interbreed and produce fertile offspring.

Sustainability: a characteristic or state whereby the needs of the present and local population can be meet without compromising the ability of future generations or populations in other locations to meet their needs.

Sustainable farming: type of farming that can make use of nature's goods and services while producing a sufficient yield in an economically, environmentally, and socially rewarding way, preserving resources for future generations.

Traditional (or local) knowledge: information and learning processes developed over many years and passed down from one generation to the next. Traditional knowledge is not static; it evolves or changes over time.

Definitions compiled from:

- Dictionary.com
- Millennium Ecosystem Assessment. *Ecosystem Health and Well-being: A Framework for Assessment*. Washington: Island Press, 2003.

Web pages to visit:
cbd.int/youth and cbd.int
unep.org/tunza
cyberschoolbus.un.org
ecoliteracy.org

Convention on Biological Diversity