## Grade Level: 5

## Title: Interdependence (Feb. - Mar.)

This lesson is designed to be taught after the lessons titled "Producing Plants" and "Global Markets."

## Purpose:

The purpose of this lesson is for students to develop an understanding of the interdependence among plants and animals in various ecosystems.

## Subject Area(s) Addressed:

Science, Social Studies

## Common Core/Essential Standards:

**Science:**

5.L.2.1 Compare the characteristics of several common ecosystems, including estuaries and salt marshes, oceans, lakes and ponds, forests, and grasslands.

5.L.2.2 Classify the organisms within an ecosystem according to the function they serve: producers, consumers, or decomposers (biotic factors).

5.L.2.3 Infer the effects that may result from the interconnected relationship of plants and animals to their ecosystem.

**Social Studies:**

5.G.1.3 Exemplify how technological advances (communication, transportation and agriculture) have allowed people to overcome geographic limitations.

## Vocabulary:

Adaptation
Adapted
beneficial
ecosystem
harmful
interdependence
variety

## Materials Needed:

journal
Internet access

## Teaching Strategy:

**Part 1:**

Using research and the map from the lessons "Producing Plants" and "Global Markets," have students determine the top five strawberry producing states. Compare the varieties of strawberries grown in each state. What varieties are grown in these states, and why? Check the website

http://strawberryplants.org/2010/10/strawberry-varieties-by-state/ (Note that varieties grown by commercial growers may differ considerably from those grown by home gardeners; this source lists many more varieties than are commonly used.) Students might also consult the websites below, as well as Cooperative Extension Service recommendations for those states.

- California: www.californiastrawberries.com/about_strawberries
- Florida: http://flastrawberry.com/
- North Carolina: www.ncstrawberry.com/docs/StrawberryIndustry.htm
- Oregon: http://www.oregon-strawberries.org/index.html
- Washington:very similar to Oregon
- Pennsylvania: www.pafarm.com/pdf/Commodity/Strawberries.pdf
- New York: www.fruit.cornell.edu/berry/production/strawberryproduction.htm

Students will conduct research to learn why these varieties are best suited for their area and record their findings in their journals. Students should determine climate and soil quality as two of their reasons. Compare and contrast the ecosystems in the each of these states, specifically the areas where strawberries are grown. For example, California's climate and land varies greatly from end of the state to the other. Ask students to determine what characteristics these states have in common that make them suitable for growing strawberries. Consider all aspects of what makes an ecosystem when analyzing each state. Look at how the strawberry plants may have adapted to survive in a specific area. What adaptations might be necessary for a strawberry to grow in other ecosystems? For example, would strawberries grow well in the tundra? desert? rainforest? Students will record the information in their journals.

**Part 2:**

Give students the following list of creatures and ask them to create a chart and categorize them as helpful or harmful: earthworms, spiders, rabbits, beetles, butterflies, frogs, deer, bees, aphids, ladybugs. Warn students to consider all stages of the lifecycle, especially insects, such as butterflies. The butterfly itself is not harmful, however, the caterpillars are. After students have made their predictions, have them work in cooperative groups to research the creatures' relationships with strawberries. Use the graphic organizer at the following website to record the interdependence between the strawberries or strawberry plants and the creatures. Follow the directions from the webpage http://www.fcps.edu/islandcreekes/ecology/lesson2___three_degrees.htm. The organism at the top should be the strawberry. The following website defines the types of relationships: mutualism, parasitism, commensalism, and neutralism. http://www.fcps.edu/islandcreekes/ecology/relationships_page.htm

Next, determine if the same creatures are found in each of the top five strawberry states. Are there creatures that are exclusive to certain areas?

**Part 3:**

Most people think of strawberries growing only in fields on farms. However, there are strawberries that grow wild. Have students compare and contrast wild strawberries and cultivated strawberries. What is the relationship between the two? Students will record their findings in a Venn diagram. The following websites provide information about wild strawberries. http://www.fcps.edu/islandcreekes/ecology/wild_strawberry.htm and http://garden.lovetoknow.com/wiki/Wild_Strawberries

Next, have students determine where wild strawberries grow and compare those findings with the top five strawberry producing states. Is there a correlation between the two? Have students record this information in their journals.\

**Extension Activity:**

Research other countries that produce a large amount of strawberries--Spain, Canada, and Australia, for example. Compare the ecosystems in these countries to the United States. Are the plants grown in open ground or in tunnels and greenhouses? Why would protective structures be used?

**Background Information:**

**Part 1:**

Strawberries like a well-drained, reasonably fertile soil with a pH of 6.0-6.5. They are grown in a variety of climates and soil conditions around the world, with farmers manipulating the growing conditions (with fertilizer, irrigation, protection from weather, etc.) to get as close to ideal conditions as they can.

Choice of strawberry variety is important part of a growers' strategy. They can choose between plant types: day-neutral or everbearing plants fruit over a long period of time, and are mostly responsive to temperature as to when they set fruit. June-bearing or "short-day" varieties have a shorter season; they initiate flower formation when days are short (fall, winter, and early spring) and then bear fruit in spring/summer. Within each type, there are many varieties, some suitable to a narrow climate range, others, more broadly adapted. For example, the varieties most often used by NC commercial growers were developed in California (Chandler and Camarosa) and Florida (Sweet Charlie). New varieties developed in other regions are often tested (by University researchers and by growers) for suitability to their own growing conditions. Key factors for growers include yield, flavor, disease resistance, and harvest season.

**Part 2**:

Insect/arthropod pests of strawberries differ somewhat for growers who raise them in a perennial system (matted row) or as an annual (plasticulture), as ground-dwelling pests, in particular, have less time to get established in the annual system. Therefore, bear in mind that there are some pests described in materials from other states that do not relate to Southeastern plasticulture. The chief pest of NC plasticulture strawberries is the **twospotted spider mite.** *This*

*pest is particularly interesting ecologically as one of the control methods is use of predatory mites that eat the twospotted spider mites.* Other less important pests may include leafrollers, strawberry clippers, thrips, and aphids.

Deer are a major problem, especially in fall and winter, when they eat the foliage. Strawberry plants continue to grow all winter, making them a tasty meal for deer when not many other food plants are available. Deer also punch holes in the plastic and damage irrigation as they roam the fields. Many growers use electric fencing to keep deer out of their fields.

Squirrels, raccoons, and opossums harvest ripe fruit, especially when fields are located near wooded areas. Their predations are mostly limited to those field edges, however. Schools growing strawberry gardens may find that humans are similar pests when gardens are located near to well-traveled walkways.

**Part 3**:
The cultivated strawberry *Fragaria x ananassa* is an accidental hybrid between *F. chiloensis,* which grows along the western seaboard of North and South America as far south as Chile, and *F. virginiana* which is a woodland species mostly found in eastern North America. Both were eaten by indigenous peoples there before they were brought to Europe in the mid-16th century, where they were cultivated separately. Their fruits were larger than native European species which made them desirable, but the key event in modern strawberry history was a chance cross-pollination between these two species when they were grown together in France. The offspring was the even larger fruited *F. x ananassa.*

Strawberry breeders collect wild strawberries (some of which may have originally been cultivated strawberries which have "gone wild") in search of genetic traits that they may want to breed into new cultivars, such as disease resistance or exceptional hardiness to adverse environments.

http://www.fcps.edu/islandcreekes/ecology/wild_strawberry.htm
http://garden.lovetoknow.com/wiki/Wild_Strawberries

## Additional Resources:

Mite management in strawberries in NC:
http://www.ncstrawberry.com/docs/Mite%20ID%20and%20Management.pdf

University of Minnesota Field Guide for Identification of Pest Insects, Diseases, and Beneficial Organisms in Minnesota Strawberry Fields. This digital guide contains links at the bottom of the page to research beneficial insects such as the ladybeetle. A useful resource, even though it is from Minnesota.
www.mda.state.mn.us/en/plants/pestmanagement/ipm/strawberry-guide.aspx

Strawberry pest and disease information from Illinois; only information on mites, clippers, thrips, sap beetles, and grey mold are relevant to our region.
http://urbanext.illinois.edu/strawberries/insects.cfm

General production recommendations for our region:
www.clemson.edu/extension/hgic/plants/vegetables/small_fruits/hgic1405.html

Strawberry pest management form Virginia Tech Extension; a bit more technical but information is relevant to NC:
http://www.virginiafruit.ento.vt.edu/StrawMaster.html

Cornell's Berry Diagnostic Tool is great for pest/disease detective work:
http://www.fruit.cornell.edu/berrytool/

## Assessment:

**Part 1:**
Journal

**Part 2:**
Graphic Organizer

**Part 3:**
Venn Diagram
Journal

**Culminating Activity:**
Create a food web showing the interdependence of strawberries/strawberry plants and animals.


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