MIDDLE SCHOOL
LESSON GUIDE

Into the Outdoors

COMPARING FISH LIFE CYCLES

educational partners

Great Lakes RESTORATION

Life Science

GRADE LEVELS
Middle School - Grades 6-8

CONTENT AREA
Life Science and Math

UNIT THEME
Life Cycles and Ecosystems

TOPICS
life cycles, animals, plants, birth, growth, sexual maturity, ecosystem

TIME REQUIRED
75 minutes

OVERVIEW

Students should have already viewed the video, *Comparing Fish Life Cycles*, that introduces students to comparing life cycles of two species living in the same environment. Topics discussed in the video included similarities and differences in animal species' physical traits, sexual maturity age, number of eggs laid, and comparisons. In this lesson, students will apply concepts learned in the video when they first compare two animal species' life cycles. They will then demonstrate their understanding of life cycles when they apply their knowledge while organizing animal species life cycles and explaining the ecosystem's influence on the animal's life. Finally, students will be assessed on their understanding of the influence ecosystems and species' life cycles have on each other when they choose a plant to grow on a fictitious farm.

CONCEPT

Students will be able to compare and contrast various animal and plant species that inhabit the same ecosystem after analyzing provided data.

ENDURING UNDERSTANDING:

Students will learn that life cycles help people understand how a species (whether it is a plant or an animal) and its ecosystem mutually influence each other.

PROCESS OBJECTIVES:

1. Students will explain to their peers how their model (using a slinky) represents a cycle.

2. Students will compare and contrast plant and animal life cycles.

3. Students will organize a series of pictures to demonstrate their understanding of animal/ insect's life cycles. They will then use their prior knowledge of the living thing's habitats and explain how the animal influences the environment and vice versa.

4. Students will analyze given information about two plant species to decide which plant species to plant on their fictitious farm. During this exercise, students will also apply math skills related to proportions, ratios, and rational number computation.

MATERIALS NEEDED

Slinky (one for each group of three to four students)

Appendix A and B for each student

LEARNER OBJECTIVES:

1. Students will learn how an energy wave is similar to a life cycle as both are a series of events repeatedly occurring in a specific order. The last event in the cycle leads to the first event occurring again.

2. Students will know that animals have life cycles which include inception, birth, growth, and sexual maturity. This life cycle then repeats itself, which enables a species to continually exist.

3. Students will learn that a plant's life cycle stages are seed germination, plant growth, flower development, flower producing fruit, fruit releasing seeds, and plant death.

4. Students will learn that an ecosystem is a community of organisms (plant or animals) that inhabit the same environment.

5. Students will learn that living things and ecosystems mutually influence each other.

PROCEDURES

Introduction of a Cycle

Prior to instruction, ask students: "What is a cycle? Where have you heard the word before?" Responses may include: "A cycle is something that goes around and around again and again;" "I've heard the word used in bicycle and tricycle;" "I learned about the word in the video about life cycles."

Next, divide the class into groups of three or four students. Give each student a slinky and ask them to use the slinky to create a model of a cycle. Some students may put the slinky in a circle; others may move it up and down to create an energy wave pattern. Have each group explain to the class how their model represents a cycle. This activity will serve as a preassessment to determine the students' understanding of a cycle.

After each group has shared their cycle, instruct the students that a cycle is a series of events repeatedly occurring in a specific order. The last event in the cycle leads to the first event occurring again. Demonstrate for students how to use the slinky to create a wave pattern. This can be accomplished by holding one end of the slinky and moving it successively in an up and down motion. Point out to the learners the wave's starting point, high point, midpoint, low point, and end point, being sure to show them how the high, mid, and low points are repeated throughout the wave over and over, and in the same order. Tell students that the wave would continue if the slinky was longer and there were no external forces acting on the slinky, such as gravity and friction.

Animal Life Cycle

With students still in their small groups, give each group a set of four animal photos (Appendix A). Each set has a picture of the species pre-birth and at the young, midlife, and mature life stages. Have the students organize the pictures in the correct order and discuss with their group members what life events occurred in the specie's life that took it to the next life stage. Ask groups to share their specie's life cycle aloud with the class, discussing the various life events and stages. Life events and stages students may share include: birth, baby, growing up, getting bigger, young adult, maturing, mature, adult, reproduction.

After volunteers have shared their life cycles, instruct the students that similar to the waves stages (start, low, mid, high, and end points), animals have life cycles which include inception, birth, growth, and sexual maturity. This life cycle then repeats itself which enables a species to continually exist.

Next, give each student the worksheet entitled Living Things: Life Cycles and Ecosystems. Have students work in small groups to complete all questions. Once complete, have the students come together as a whole group and review their responses. Remind students that both living and nonliving things live in an ecosystem and that they mutually influence each other.

PROCEDURES (continued)

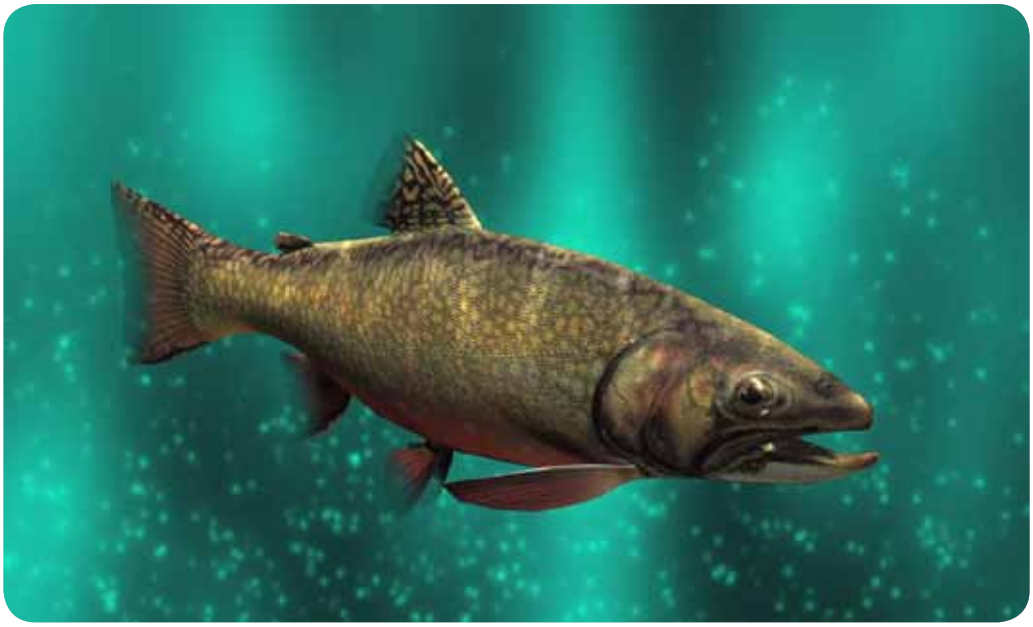
Plant Life Cycle

Tell the students that all living things, including animals and plants, have life cycles. Draw a T-chart similar to the chart below comparing and contrasting animal and plant life cycles.

Next, give students the worksheet entitled Plants and Ecosystems (Appendix B). Complete part I as a class. During this portion of the lesson, students will learn the stages of a plant's life cycle. The stages are as follows: seed germination, plant growth, flower development, flower producing fruit, fruit releasing seeds, and plant death.

Afterwards, have students independently complete part II of Appendix B which requires students to analyze temperature and precipitation levels and combine it with learned information about specific plant species to choose an appropriate location for the plant species to be grown. Once students complete part II, review the answers as a whole group. Discuss with the students how the environment influences where certain plants can grow and that plants have specific adaptations so that they can grow in their environment. For example, a cactus has deep roots so that it can store water in the desert.

For the last portion of this activity, students will work with a partner on part III of Appendix B. At this time, students will evaluate given information about pea and peanut plants to decide which plant species they ought to plant on their fictitious farm. Learners will apply their understanding of life cycles and ecosystems, as well as demonstrate their ability to apply mathematical concepts (ratios, proportions, and multiplication) to a real-life math story problem. There is no correct or incorrect answer for part III. Students need to provide justification for their reasoning. This will serve as a formal assessment on the students understanding of the ecosystems' and species' mutual influence on each other.



ASSESSMENT

Students will be informally assessed on their understanding of plant and animal life cycles through their small and whole group discussions during the lesson. Students will also be formally assessed on their ability to apply their understanding of life cycles' and ecosystems' mutual influence on each other from their responses on Worksheet B.

EXTENSION ACTIVITIES

Plant Life Cycle Observation

Materials:

- 1 to 2 seeds of two different plant species (suggested plant species: bean plant and Wisconsin Fast Plant) (More information about the Wisconsin Fast plant can be found online at http://www.fastplants.org/life_cycle/)
- 2 Styrofoam cups
- Soil - enough to fill each cup ¾ with soil
- Water
- Paper to record observations on

SPECIAL CONSIDERATIONS:

For students to be successful at this lesson, consider these modifications:

Organize the living things cards and orally describe to a peer or group members the living things' life cycle. This can serve as an assessment of the students' understanding of life cycles.

Label the parts of the plant life cycle and describe aloud what plants need to survive and why specific plants grow in different environments.

EXTENSION ACTIVITIES (continued)

Students can plant two different plant species in the same ecosystem. While the plants are growing, the students can collect data on their plants so that they can compare and contrast the growth rates and life cycle milestones of each species.

This can be accomplished by first choosing two plant species such as a bean plant and Wisconsin Fast plant. Using soil in two Styrofoam cups, the students can plant one to two seeds of the plant species in each cup. The cup should be filled approximately three-quarters with soil and the student should plant only one plant species in the cup. The student can then care for the plant as it grows, being sure to care for each plant exactly the same (water each plant at the exact same time and the same amount; placing it in the sun at the same time for the same duration, etc.) While the plant is growing, students can record their observations. After several weeks, students can compare and contrast their observations, drawing conclusions about changes in plant life cycles.

RESOURCES

- Bradtke, B. (2013). Growing bananas. Retrieved from http://www.tropicalpermaculture.com/growing-bananas.html
- Oregon State University. (2003, January 03). Peas for processing: Eastern oregon. Retrieved from http://nwrec.hort.oregonstate.edu/pea-e.html
- The Old Farmer's Almanac. (2013). Potatoes. Retrieved from http://www.almanac.com/plant/potatoes
- The Old Farmer's Almanac. (2013). Sunflowers. Retrieved from http://www.almanac.com/plant/sunflowers
- United States Department of Agriculture. (2013, June 4). Crop explorer. Retrieved from http://www.pecad.fas.usda.gov/cropexplorer/continentview.aspx?regionid=namerica&ftypeid=23&fattributeid=1&startdate=1/1/2012&enddate=12/31/2012&season=2012 Calendar Year (Jan - Dec)&stypeid=23&sattributeid=2
- University of Wisconsin-Extension, University of Minnesota - Center for Alternative Plant and Animal Products. (1991, July). Alternative field crops manual. Retrieved from http://www.hort.purdue.edu/newcrop/afcm/index.html

ADDITIONAL RESOURCES

- Maryland Public Television. (Producer). (2013). Changing climate/changing habitats [Web Video]. Retrieved from http://changingthebalance.thinkport.org/changing_climate_changing_habitats.html
- United States Environmental Protection Agency. (2013, April 22). Ecosystems impacts and adaptation. Retrieved from http://www.epa.gov/climatechange/impacts-adaptation/ecosystems.html
- WGBH Educational Foundation. (2007). Life cycle of a seed plant. Retrieved from http://wimedialab.pbslearningmedia.org/resource/lsps07.sci.life.stru.seedplant/life-cycle-of-a-seed-plant/

The following **Student Proficiency Standards** can be met by teaching COMPARING FISH LIFE CYCLES:

WISCONSIN MATHEMATICS COMMON CORE STATE STANDARDS

Grade 6:

6.3 RP Understand ratio concepts and use ratio reasoning to solve problems. Use ratio and rate reasoning to solve real-world and mathematical problems

6.NS Compute fluently with multi-digit numbers and find common factors and multiples. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation

Grade 7:

7.RP Analyze proportional relationships and use them to solve real-world and mathematical problems. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units. Recognize and represent proportional relationships between quantities. Use proportional relationships to solve multistep ratio and percent problems

7.NS Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. Solve real-world and mathematical problems involving the four operations with rational numbers.

The following **National Common Core Standards** can be met teaching COMPARING FISH LIFE CYCLES:

NATIONAL COMMON CORE STANDARDS

MS. Matter and Energy in Organisms and Ecosystems

MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem

MS. Growth, Development, and Reproduction of Organisms

MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms

The following **Wisconsin Teacher Standards** may be met teaching COMPARING FISH LIFE CYCLES:

Standard 1: **Subject matter**

This curriculum provides information not readily available in other forms.
A teacher using this material will be well-informed about the subject matter.

Standard 2: **Broad range of ability**
This curriculum provides instruction that supports their intellectual, social, and personal development.

Standard 3: **Adapt instruction**

This curriculum provides suggestions for learners with a variety of intelligences and levels of ability.

Standard 4: **Instructional strategies**

This curriculum includes the use of technology to gain information and suggestions for using research in extending learning.

Standard 5: **Individual and group motivation**

Both prior knowledge and carefully designed group projects promote motivation for students to learn.

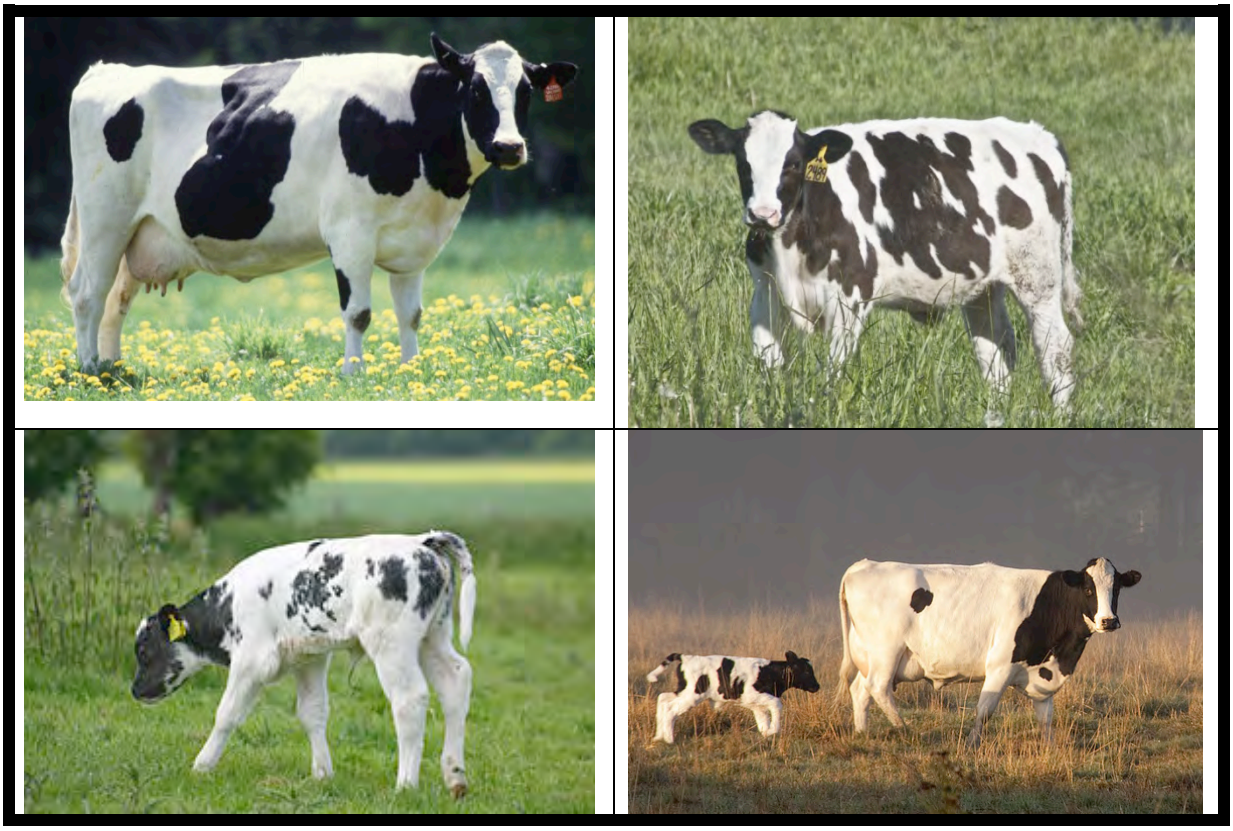
Standard 6: **Verbal and nonverbal communications**

Instructional media and technology that promotes active learning are key parts of this curriculum.

Standard 7: **Organizes and plans systematic instruction**

This curriculum is organized to support teacher knowledge, to draw on and motivate students to engage in active learning, and promotes active inquiry, collaboration, and supportive interaction in the classroom.

Appendix A



Appendix A

Appendix A

Living Things: Life Cycles and Ecosystems

An ecosystem is a community of living and nonliving things, such as animals, plants, water, and air.

Think about the ecosystem of the living thing featured on your set of cards and answer the following questions:

1. **What type of environment does this living thing need to survive (i.e. ocean, desert, forest, plain, etc.)?**

2. **What features in this environment enables it to survive? (fresh water, type of food, shelter, etc.)**

3. **Would this living thing survive in the desert? Why or why not?**

4. **Would it survive in the rain forest? Why or why not?**

5. **Would it survive in Wisconsin? Why or why not?**

6. **How does this living thing's life cycle influence the environment?** *For example, birds eat plants and seeds. Seeds often remain whole even after they are eaten because they are hard to digest in the bird. Therefore, when a bird defecates, seeds are often spread from place to place, enabling plant species to spread to new places.*

7. **Choose another living thing. Name its environment. What in its environment helps it survive? How does this living thing influence its living environment?**

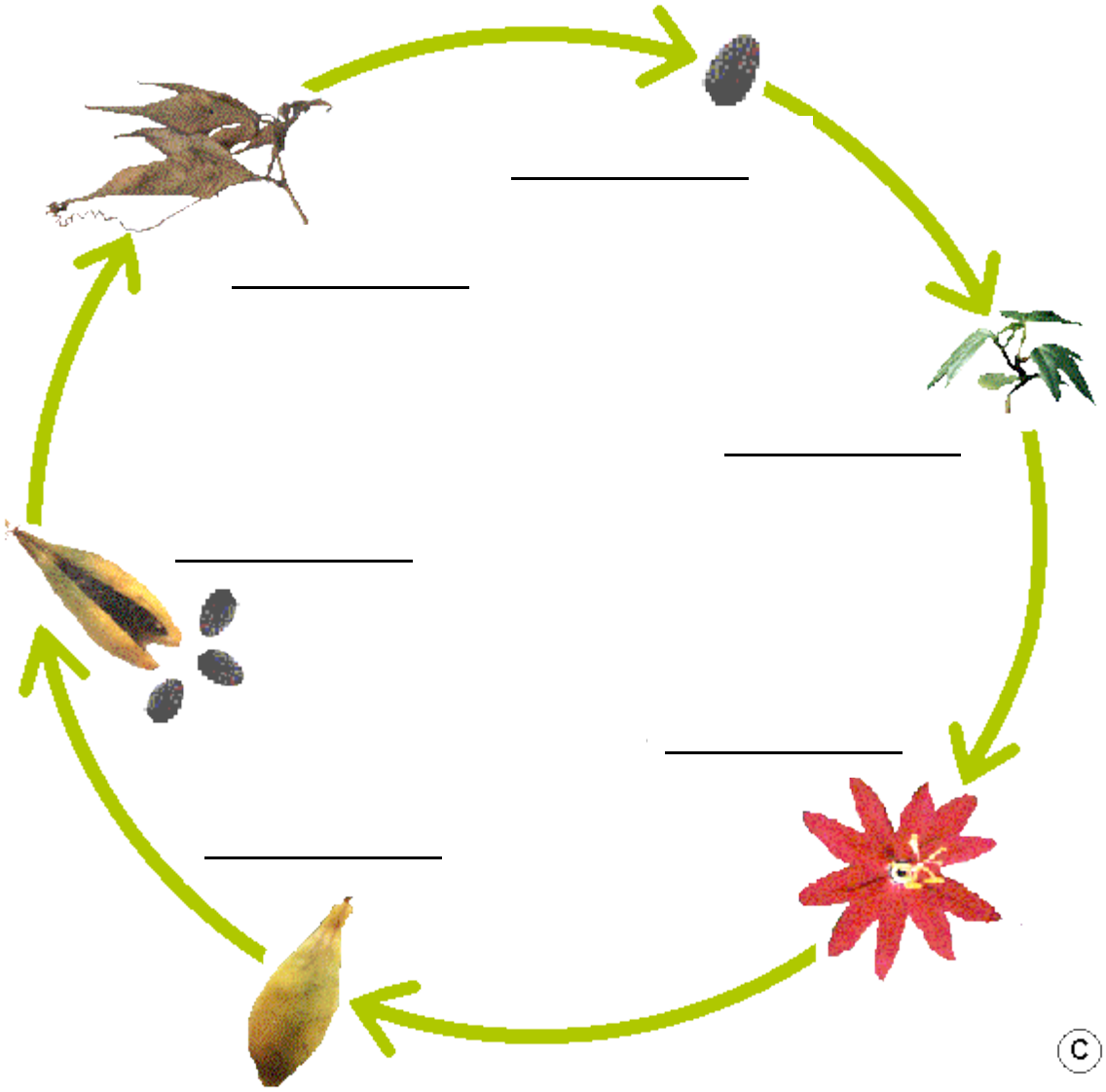
Appendix B

Name: _____

Plants and Ecosystems

Part I:

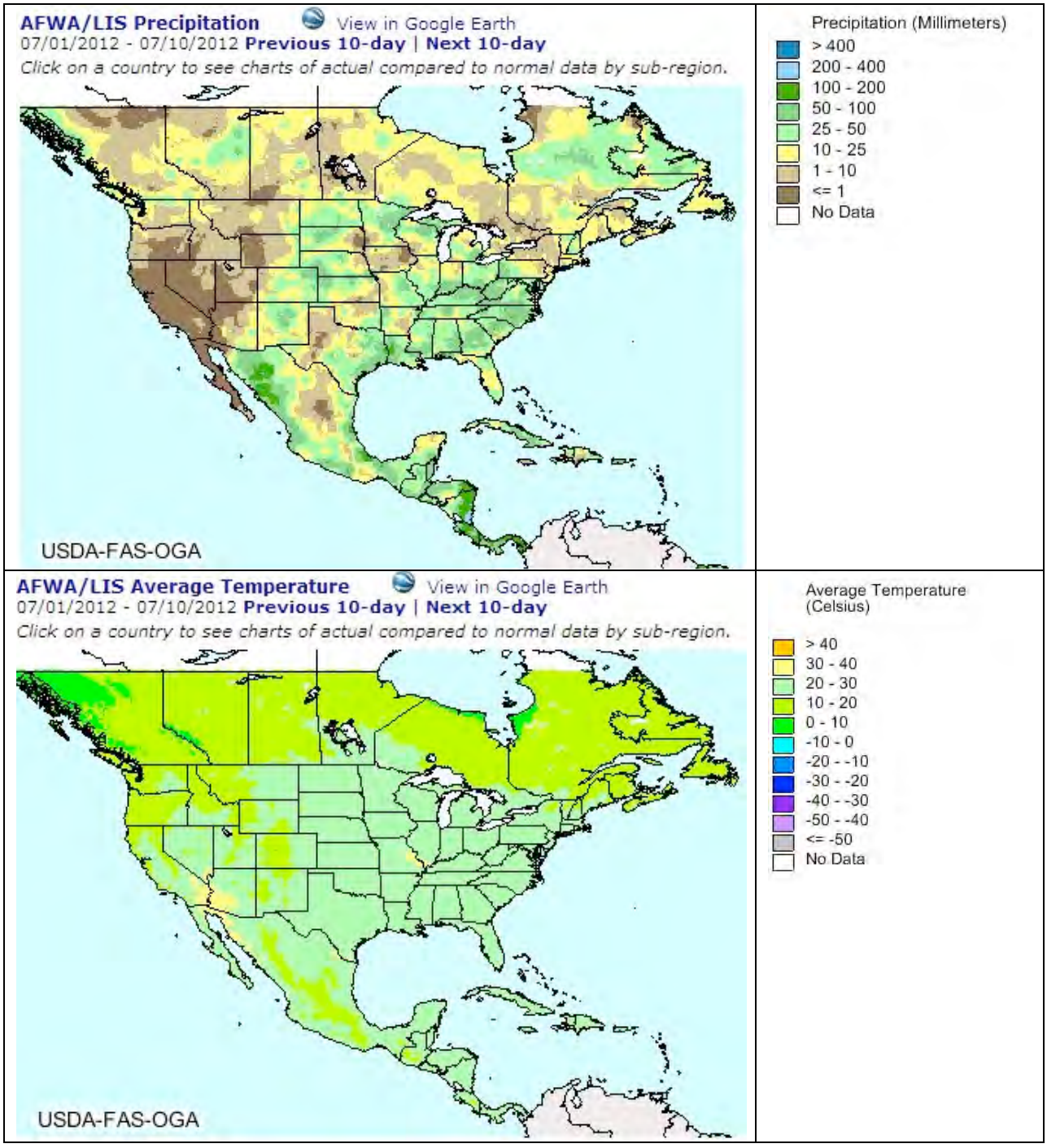
Like animals, plants have life cycles too. Using the diagram below, label the parts of the plant's life cycle:



Part II:

Like animals, plants have adaptations that enable them to survive in their ecosystem. For example, cactus can live in the desert because they have roots that go deep into the ground and they have a water system inside them that helps them store water. On the other hand, tulips cannot survive in the desert because they do not have the same physical characteristics that enable cactus to survive.

Use the maps to choose an environment where the given plant can survive.



Remember:
°C x 9/5 + 32 = °F
(°F - 32) x 5/9 = °C

Sunflowers grow best in 70 to 78 degree Fahrenheit weather and require full sun exposure. Do not water sunflowers too much. If you do, their roots will not grow very deep.

Sunflowers would grow well in _____ because _____
_____.

Potatoes need full sun exposure, and grow best in 65 to 70 degrees Fahrenheit temperatures. They also need regular watering.

Potatoes would grow well in _____ because _____
_____.

Temperatures between 78 and 86 degrees Fahrenheit are best for bananas to grow in. They also require a lot of water as the plants have large leaves that a lot of water evaporates from.

Bananas would grow well in _____ because _____
_____.

***Possible answers:*
Sunflowers would grow well in Iowa; Potatoes would grow well in northern Minnesota; Bananas would grow well in Georgia.

Part III

Your turn!

Situation: You are a farmer, and you are trying to decide what to plant on your fields – peas or peanuts. This is what you know about your farms and its ecosystem:

- You have 60 acres of land to plant.

- The ground is snow covered from mid-November to mid-April. The ground first freezes around October 1st, and the ground is thawed and ready to plant around May 1st.

- The average precipitation is as follows:

Month	**Precipitation (inches)**
January	1.25
February	1.28
March	2.50
April	3.61
May	3.55
June	4.13
July	2.94
August	4.64
September	3.08
October	2.43
November	2.35
December	1.66

- The average temperature is as follows:

Month	**Temperature (degrees Fahrenheit)**
January	21
February	19
March	36
April	46
May	61
June	70
July	79
August	85
September	76
October	62
November	45
December	29

You researched peas and peanut crops and found the below information. Use the information to decide which plant species you should grow so that you get the largest return for your investment.

Peas:

- Plant four to six weeks before the last spring frost
- Ideal planting temperature is 45 degrees Fahrenheit
- Grow best when the air temperature is approximately 60 degrees Fahrenheit; will stop growing if temperature rises above 85 degrees Fahrenheit
- Handle cool weather well
- Too much water or soil that is wet for too long will cause the seeds to rot and not germinate or the roots to rot and the plant will die
- Do not let plants dry out otherwise pods will not be produced
- Grow in most soil but best in silt loams, sandy loams, or clay loams
- Reach maturity after 60 days
- Plant seeds in a row with approximately 2 inches between each seed and 7 inches between each row.
- Yield is approximately 2000 pounds per acre
- Earn: $27.10 cwt (per hundredweight)

Peanuts:

- Grow best in sandy soil that is high in organic matter; have difficulty growing in clay
- Plant 1 to 3 inches deep and space plants 6 to 8 inches apart; rows need to be at least 20 inches apart
- Ideal time to plant is mid-May, but only if the weather is not cold or wet. If it is, delay planting.
- Need to keep soil moist until plants begin to flower (40 days) then water less
- Peanuts matures underground
- Blind (empty) pods result from too much rain at flowering time
- Not very tolerant of cold temperatures, but can withstand a spring frost better than beans
- Life cycle: 135 days (mature)
- Germinates in temperatures between 68 and 95 degrees Fahrenheit
- Emerge from ground after five to ten days
- Earn: $0.35 per pound
- Average yield is 3000 pound per acre

1. If conditions were ideal, how much money could you earn growing each crop?

   Peas: _____ Peanuts: _____

2. If you were to plant peas:

   Pros:

   Cons:

3. If you were to plant peanuts:

   Pros:

   Cons:

4. Which plant do you want to grow and why? *Remember to use facts from your research about the plant species to support your justification.*

***Answers to Number One: Under ideal growing conditions, peas will earn you $32,520.00 and peanuts will earn you $63,000.00.*