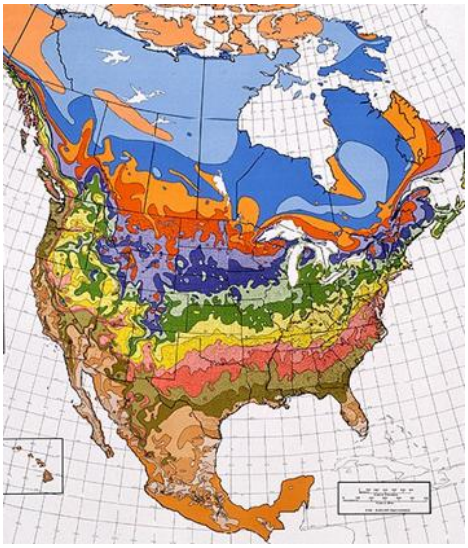


Lesson Title: In the Zone!

Grade: 4-6

Duration of Lesson: 2 - 50 minute classes

Brief: Students will investigate planting zones in Montana and will determine which plants are best suited for the area.

Materials:
Access to computer lab
Road map of Montana
Blank map of Montana
Colored Pencils
Edible landscape design (worksheet A) one copy for each student
Planting list (worksheet B) one copy for each student
Access to the following web sites:
http://www.plantmaps.com/interactive-montana-usda-plant-zone-hardiness-map.php
http://urbanext.illinois.edu/treeselector/search.cfm
http://www.jungseed.com/dc.asp?c=670
http://usagardener.com/how_to_grow_fruits/how_to_grow_raspberries.php

Key Terms: USDA, zone, climate, microclimate, producer, hardiness zone, annuals, perennials, fruits, berries, four season interest, frost free days, growing season, and edible landscape.

Standards/Objectives

Montana State Standards:
Science: Content Standard 1 - Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate results and reasonable conclusions of scientific investigations. Benchmarks 1.1,1.2,1.3; **Science Content Standard 3 -** Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact with each other and their environment.

Benchmark 3.1

Communication Arts: Benchmark 2.8 Students will recall and explain a series of events or the sequence of information.

Math: Content Standard 1 –Number sense and operation. Benchmark 1.5

Arts: Content Standard 1 - Students create, perform/exhibit, and respond in the Arts. Benchmarks 1.1, 1.3, 1.4 Content Standard 2 - Students apply and describe the concepts, structures, and processes in the Arts. Benchmarks 2.1, 2.2, 2.3 Content Standard 6 - Students make connections among the Arts, other subject areas, life, and work. Benchmark 6.4

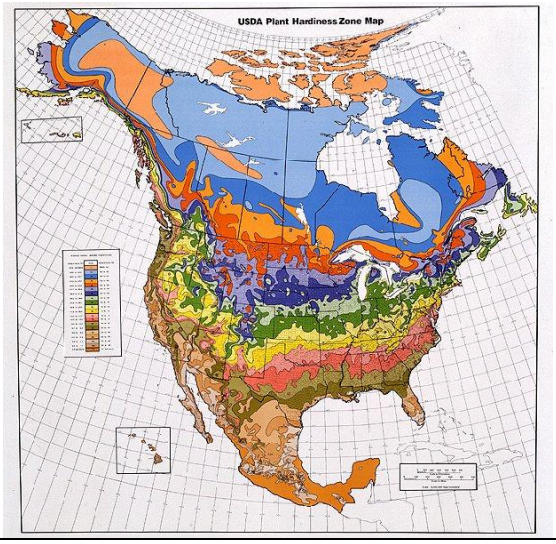
Understanding(s) /Big Ideas:	**Essential Question(s):**
Students will understand that the hardiness zone they are investigating in Montana will determine which plants are best suited for the area. Students will understand that USDA hardiness zones help farmers, gardeners, and landscapers to choose the best plants for their area.	What is a USDA hardiness zone? Why does a zone map help producers of agriculture products?
Students will know: Students will know that the USDA hardiness zone map is a guideline for choosing the best plant varieties for the planting area. Students will know that each state and county can be divided into many zones. Students will know that inside each zone microclimates can be identified.	**Students will be able to:** use research skills to find the appropriate internet sites to locate the zone for their area. Students will be able to divide geographical areas into USDA hardiness zones. Differentiate between planting zones.

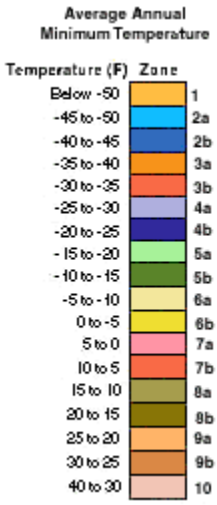
Performance / Observations

Performance Task(s):	**Other Evidence**
Students will use interactive internet pages to determine what USDA plant hardiness zone their assigned town is in, and what types of food producing plants can be grown there.	Students will explain and identify microclimates. Students will use the key terms in observation and discussion of hardiness zones.

Learning / Inquiry Activities

Introduction/Prep





A hardiness zone map supplies information based upon planting guidelines for perennials, trees, shrubs, and biennials. At stores and nurseries tags are attached to each plant with hardiness zone information. (See Appendix 1) By knowing your area's growing zone you can choose any of these plant types and be sure that they can survive typical winters in your area. Sometimes unusual climate variations can occur which damage or kill plants, yet the hardiness zone is the safest way to find plants for your area. When asked "Can I plant a banana tree in Montana" the answer is, "yes, you can plant a banana tree anywhere you want, but check the zone map to make sure it will survive more than one season!" Knowing your zone saves time and money!

Hardiness zones, also called planting zones, divide the United States, Mexico and Canada into 11 areas. Each of the gardening zones is based on a 10 degree Fahrenheit difference in the average annual minimum temperature. Planting Zones 1 and 2a, the coldest, represent Canada. The continental United States falls within zones 2 through 10. Hawaii and Mexico are represented by zone 11. States as large as Montana can have several different zones. Most of Montana is in zones 3 and 4, with a few small areas in zones 2 and 5. Take a look at the chart below. You'll see the lowest average temperature in Zone 2 is -50 to -40 degrees Fahrenheit, while the lowest average temperature in zone 10 is +30 to +40 degrees Fahrenheit. Plants are considered hardy up to the zone number of your area, for example if you are planting in zone 5a you could use plants hardy from zone 1 to zone 5

Zone	Fahrenheit	Celsius	Example Cities
1	Below -50	Below -45.6	Fairbanks, Alaska; Northwest Territories (Canada)
2a	-50 to -45	-42.8 to -45.5	Prudhoe Bay, Alaska; Flin Fon, Manitoba (Canada)
2b	-45 to -40	-40.0 to -42.7	Unalakleet, Alaska; Pinecreek Minnesota
3a	-40 to -35	-37.3 to -39.9	International Falls, Minnesota; St. Michael, Alaska
3b	-35 to -30	-34.5 to -37.2	Tomahawk, Wisconsin; Sidney, Montana
4a	-30 to -25	-31.7 to -34.4	St. Paul, Minnesota; Lewistown, Montana
4b	-25 to -20	-28.9 to -31.6	Northwood, Iowa; Nebraska
5a	-20 to -15	-26.2 to -28.8	Des Moines, Iowa; Illinois
5b	-15 to -10	-23.4 to -26.1	Columbia, Missouri; Mansfield, Pennsylvania
6a	-10 to -5	-20.6 to -23.3	St. Louis, Missouri; Lebanon, Pennsylvania
6b	-5 to 0	-17.8 to -20.5	McMinnville, Tennessee; Branson, Missouri
7a	0 to 5	-15.0 to -17.7	Oklahoma City, Oklahoma; South Boston, Virginia
7b	5 to 10	-12.3 to -14.9	Little Rock, Arkansas; Griffin, Georgia
8a	10 to 15	-9.5 to -12.2	Tifton, Georgia; Dallas, Texas
8b	15 to 20	-6.7 to -9.4	Austin, Texas; Gainesville, Florida
9a	20 to 25	-3.9 to -6.6	Houston, Texas; St. Augustine, Florida
9b	25 to 30	-1.2 to -3.8	Brownsville, Texas; Fort Pierce, Florida
10a	30 to 35	1.6 to -1.1	Naples, Florida; Victorville, California
10b	35 to 40	4.4 to 1.7	Miami, Florida; Coral Gables, Florida
11	Above 40	Above 4.5	Honolulu, Hawaii; Mazatlan, Mexico

Note: Hardiness zone information is not the same as growing season information. The growing season refers to the average number of frost free days and the dates of first and last freeze in your area. This information is helpful for determining a planting date and picking varieties when planting annuals (flowers or crops that grow for one season). The last freeze date in the spring is used as a guideline to know then you can transplant or plant most annual vegetables and flowers outside. Jack Frost can visit at any time and freeze tender annuals, these dates are based upon yearly averages and are not guaranteed dates! For a listing of growing season information for Montana visit: http://gardenguide.montana.edu/pdf/Climatological%20%20Data.pdf

For a listing of statistics on first and last frost dates per cities in Montana visit:http://www.northwest-gardening.com/resources/climate/data/MT.pdf

Other factors that can determine which trees, shrubs, biennials, and perennials best suit your area are humidity, wind, soil, drainage, and precipitation. Each area may also have a microclimate. A microclimate is the climate of a small area that is different from the area around it. It may be warmer or colder, wetter or drier, or more or less prone to frosts.

Microclimates may be quite small. They can be as simple as a protected courtyard next to a building which is warmer than an exposed open area nearby. A microclimate may also be extensive - a band extending several miles inland from a large body of water that moderates temperatures such as the shores of Flathead Lake which allow producers to have sweet cherry orchards. In windy areas a microclimate might exist alongside a tall fence which blocks the wind. For more on microclimates visit:
http://www.gardening.cornell.edu/weather/microcli.html

Information on microclimates supplied in part by Cornell University

Learning Activities

Introduce and explain to students hardiness zones and the key terms for the lesson from the introduction above. Inform students that they will be choosing which fruit trees and berry plants to plant in their ideal edible landscape. They will be using the internet for research and information to complete the assignment. Let them know that they will each be assigned a city in Montana in which they will design their dream edible landscape. They must pick plants from the list that will survive in their city based upon the United States Department of Agriculture (USDA) hardiness zone map.

1. Assign students one of the following Montana towns. Do not tell students which hardiness zone their town is in, they will be researching that as part of the assignment. Ask students to find their town on a Montana road map or by using the internet. They will have to know what region of Montana their town is in so they can find the town again on the hardiness zone map.

Plains 5b	Harlowton 4a	Coram 4b	Elmo 4b
Evaro 4a	Loma 3a	Apgar 4a	McLeod 4b
Martin City 4b	Naismith 3b	Libby 5b	Fort Shaw 3b
Conrad 3b	Radersburg 4b	Dutton 3b	Highwood 4a
White Sulphur Springs 4a	Cut Bank 3b	Judith Gap 4a	Clancy 4b
Harlem 3a	Winnett 4a	Heart Butte 4a	Hungry Horse 4b
Lodgepole 3a	Knife River 3b	Quebec 4a	Wye 4b
Kevin 3b	Ovando 3a	Antelope 3b	Froid 3b

2. After students have found their town on a road map and can locate it again by knowing the area of Montana the town is in, ask them to find the hardiness zone for their town. For this exercise they will need to have the terrain layer chosen at the link below to complete this assignment: http://www.plantmaps.com/interactive-montana-usda-plant-zone-hardiness-map.php Ask students to write down any major landmarks by their towns such as lakes, mountain ranges, rivers, etc. and save the information for later.

3. Check student answers for hardiness zones against the list above. Since many sources for hardiness vary slightly, it is ok for students to be one zone higher or lower.

4. Pass out copies of the edible landscape design (worksheet A) and planting worksheet B to each student.

5. Students will begin researching plants and trees which bear edible fruits and berries. Some of the landscape is already labeled with crops. These crops will grow in all of the hardiness zones in Montana. Students can find the information on trees and berry plants and their hardiness zones at the following website:

   Trees: http://urbanext.illinois.edu/treeselector/search.cfm
   To use this site, simply type in the type of fruit tree you want to plant and check your hardiness zone or any of the zones lower than your zone. Once students have chosen a tree click on the tree species and learn more about the size, growing needs, diseases, season colors, etc.

   Berry Plants: http://www.jungseed.com/dc.asp?c=670 If students have zone 3 or lower it may be hard to find berry plants, this website will help.
   http://usagardener.com/how_to_grow_fruits/how_to_grow_raspberries.php

6. Ask students to fill out worksheet B as they are doing their research. After the

worksheets have been filled out ask students to fill in the numbers 1-9 on their edible landscape (worksheet A) with the names of their trees and berry plants. They can also name their edible landscape and add structures, tunnels, or other drawings to their landscape, inform students to keep their work very neat as it will be the basis for their grade on this project.

7. Ask students to give a verbal report to the class about their town and what zone it was in. Prompt them to explain what difficulties they had in finding plants and trees for their landscape. Ask students who had hardiness zone 2 if they found it extremely difficult to find varieties of fruit. Ask students to consider Native Americans and what types of indigenous bushes and trees they might have gotten fruit from. Some examples of berries indigenous to Montana are: service berries (aka sarvas berries), chokecherries, huckleberries, wild strawberries, and thimbleberries (aka salmonberries).

8. Show students Appendix 1 and discuss which of their towns these perennials would be best suited for. These tags are available on most nursery plants and trees, and the zones are also listed in tree and plant catalogs. Once you are "in the zone" you will have the knowledge needed to understand how to choose plants and trees for your area. If this type of information interests your student(s), they might enjoy a career as a plant scientist, horticulturalist, botanist, or landscape designer.

Planting Worksheet B

Name _____ My edible landscape is in _____ which is in hardiness zone ☐
(assigned town) (#)

Major geographical landmarks near my town _____

Type of fruit bearing plant I chose and why. (Include full name of plant variety and hardiness zone)

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

Type of fruit bearing tree I chose and why. (Include full name of tree variety and hardiness zone)

7 _____

8 _____

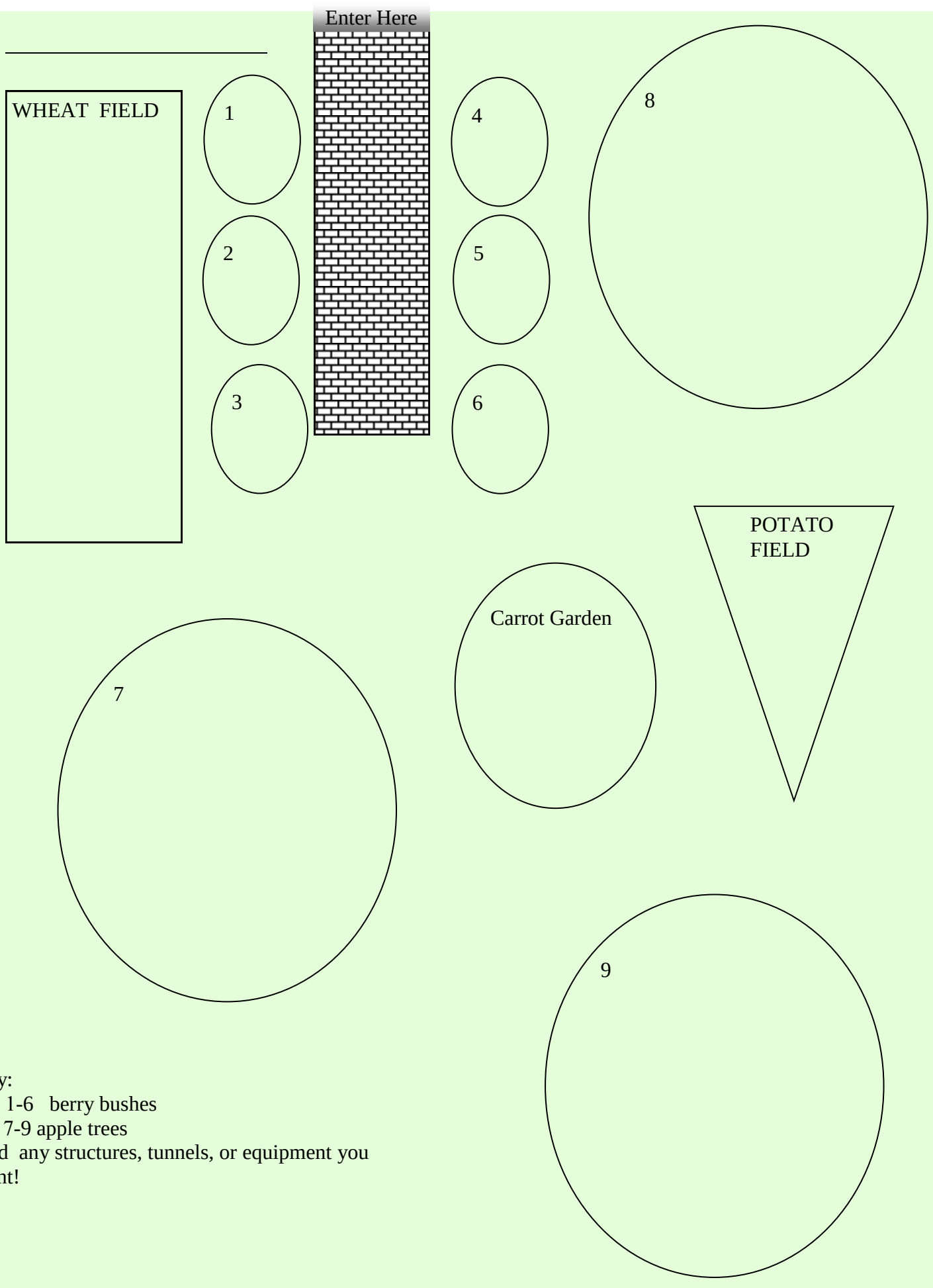
9 _____

What can you point out about the landmark near your town and did it determine any changes to the hardiness zone you were assigned?_____

Provide a name for your special edible garden: _____

Worksheet A

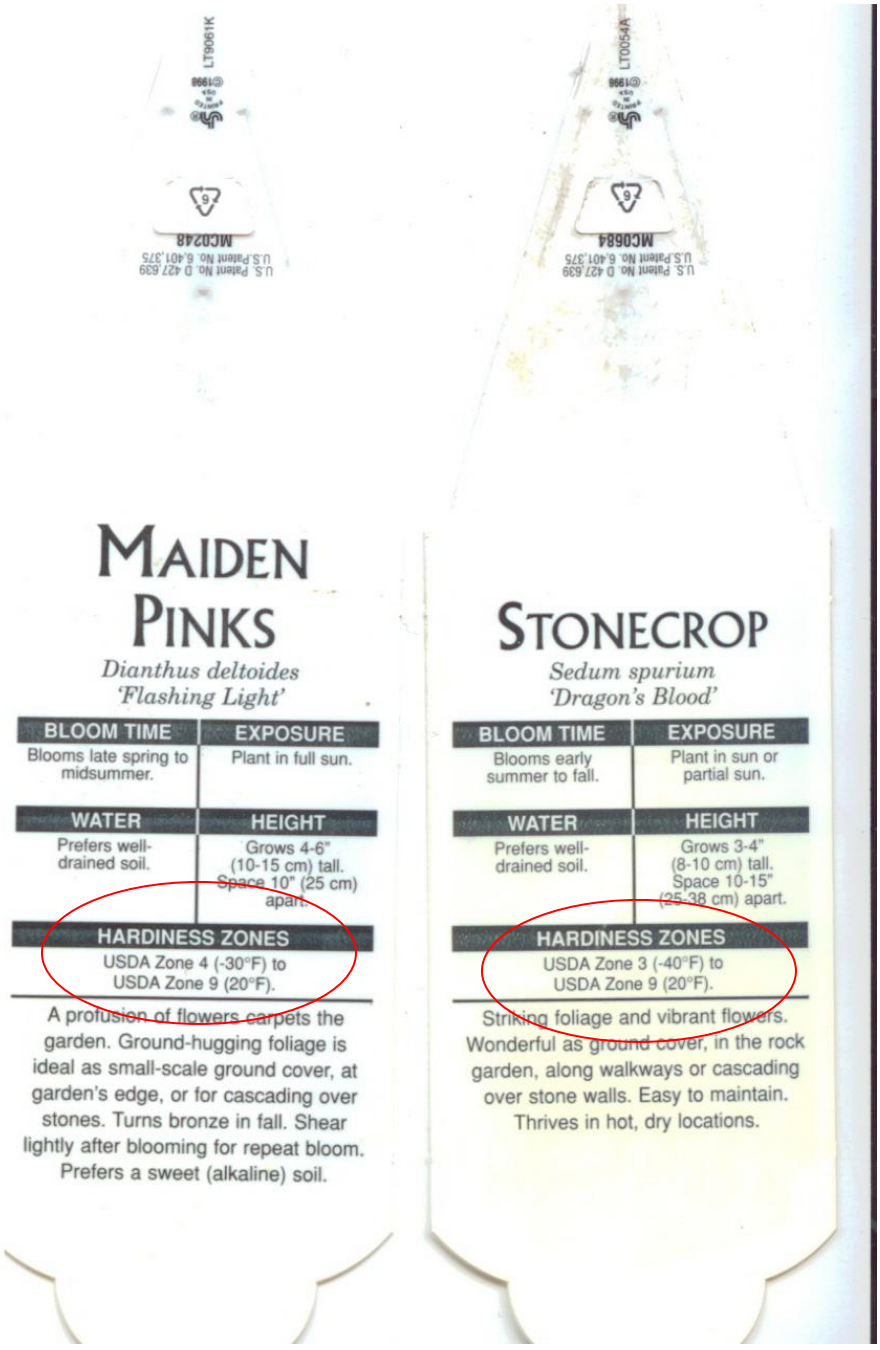
Name _____



Key:
#"s 1-6 berry bushes
#'s 7-9 apple trees
Add any structures, tunnels, or equipment you want!

Appendix 1

Sample of tags off of perennial flowers, ask students to compare the zones on these tags to their areas and see if they are a good choice as a perennial for their area?



MAIDEN PINKS

Dianthus deltoides
'Flashing Light'

BLOOM TIME	EXPOSURE
Blooms late spring to midsummer.	Plant in full sun.
WATER	**HEIGHT**
Prefers well-drained soil.	Grows 4-6" (10-15 cm) tall. Space 10" (25 cm) apart.

HARDINESS ZONES
USDA Zone 4 (-30°F) to USDA Zone 9 (20°F).

A profusion of flowers carpets the garden. Ground-hugging foliage is ideal as small-scale ground cover, at garden's edge, or for cascading over stones. Turns bronze in fall. Shear lightly after blooming for repeat bloom. Prefers a sweet (alkaline) soil.

STONECROP

Sedum spurium
'Dragon's Blood'

BLOOM TIME	EXPOSURE
Blooms early summer to fall.	Plant in sun or partial sun.
WATER	**HEIGHT**
Prefers well-drained soil.	Grows 3-4" (8-10 cm) tall. Space 10-15" (25-38 cm) apart.

HARDINESS ZONES
USDA Zone 3 (-40°F) to USDA Zone 9 (20°F).

Striking foliage and vibrant flowers. Wonderful as ground cover, in the rock garden, along walkways or cascading over stone walls. Easy to maintain. Thrives in hot, dry locations.