Life Cycle of the Tennessee Coneflower

Activity adapted from Mary V. Ball's ***Tennessee's Watchable Wildlife,*** 1994

OVERVIEW: The Tennessee coneflower is a highly specialized plant found only in cedar glades and limited to three Middle Tennessee counties. Although well adapted to its native habitat, the coneflower has not successfully migrated to neighboring areas, and was placed on the endangered species list by the U.S. Fish and Wildlife Service in 1979. Intensive efforts to not only protect but also restore the Tennessee coneflower populations has led to a significant increase in numbers; it appears successful recovery efforts with the Tennessee coneflower will change the status of the plant. By examining the structure and life cycle of the coneflower, students are able to determine the adaptations that allow the coneflower to survive in a sometimes harsh environment.

GRADE LEVEL: 5 – 8

SETTING: CLASSROOM

OBJECTIVE: Students will examine plant structure and life cycle of the Tennessee coneflower to understand how it survives the seasonally harsh conditions of the cedar glade habitat

LEARNING STANDARDS: GLE 0707.4.2; 0607.2.3; 0807.5.3

MATERIALS: photograph of the Tennessee coneflower (see appendix for Plant Flower Photograph); for an electronic copy of the Plant Flower Photographs, visit the center for Cedar Glade Studies website "Teaching from the Glades" link: www.mtsu.edu/~gladectr
Student handout with guiding questions

BACKGROUND: The Tennessee coneflower (*Echinacea tennesseensis*) is restricted to a few native populations in cedar glades in three Middle Tennessee counties. In 1968 Dr. Elsie Quarterman, professor at Vanderbilt University, was returning from field work in another cedar glade with a student, Barbara Turner, and took an alternate route. She noticed the fuchsia, daisy-like flowers growing in what is now known as Mount View glade (the property went up for sale and was purchased by the Nature Conservancy). Since the plant was thought to be extinct, and she did not have access to a herbarium specimen, an expert on coneflowers visited the site to determine that in fact this was the Tennessee coneflower; the plant was designated as an endangered species by the U.S. Fish and Wildlife Service in 1979. The plant is well adapted to the extreme environment in the glades (summer temperatures exceed 120 degrees) in several ways, (1) it has a long taproot that grows between the cracks in the rock, seeking water and, (2) the stem is covered with tiny translucent hairs that prevent excessive transpiration or water loss. The Tennessee coneflower grows well under cultivation and has

been successfully transplanted to other glades but it does not compete well with plants in other habitats and the seeds do not disperse easily. The Tennessee species is related to other coneflower species in the U.S. and Europe; it is in the Sunflower Family. Native Americans used the leaves, roots, and juices of the coneflower plant to treat a variety of ailments. Dried flower heads are very spiky and were used as combs. In West Germany today, over 240 pharmaceutical products contain coneflower plant extracts. The coneflower lifecycle begins with insect pollination during the summer. The 1/8 inch seeds are dispersed during the fall and winter months. In early March, the seeds germinate in mats of moss or moist decaying grass litter. The seedlings develop a long tap root and grow into ground-hugging juvenile plants (this adaptation conserves water). In May, or in later years, the mature plants produce flower heads on top of tall stems (Tennessee coneflowers can grow up to 3 feet tall but the average reported height is 18 inches).

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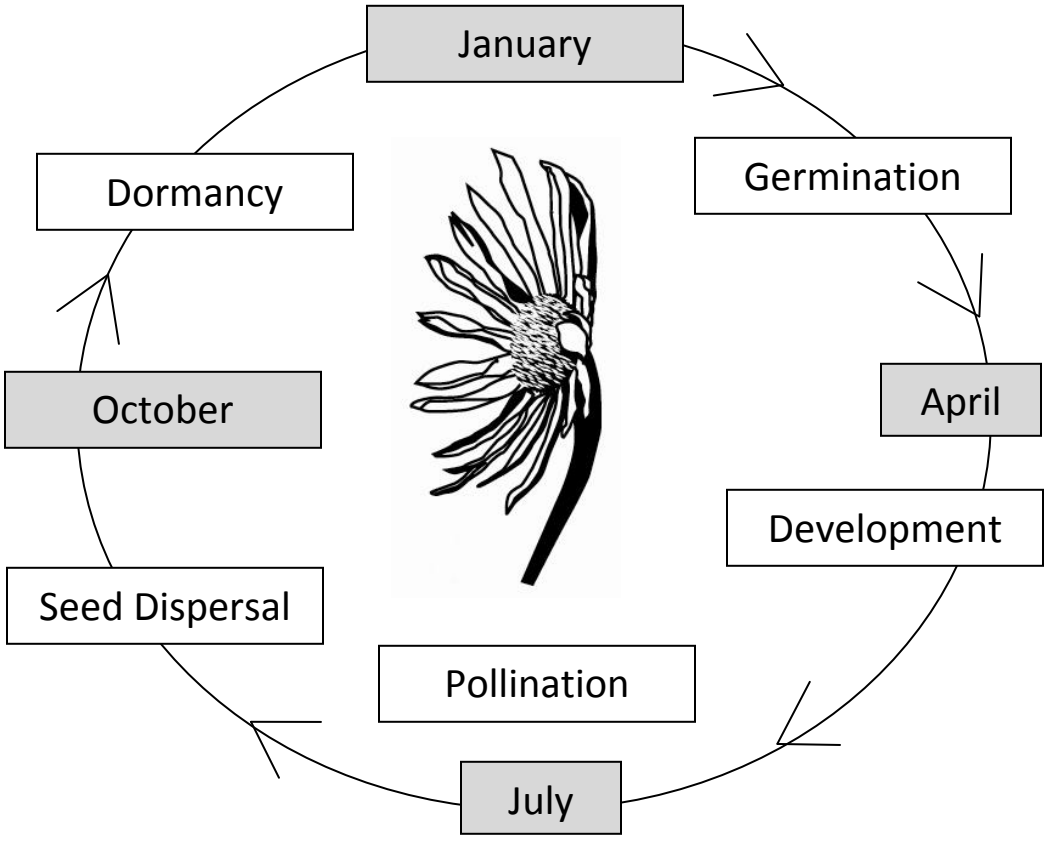

PROCEDURE:

1. Review and discuss the Tennessee coneflower *life cycle* with students.
   Students should understand these terms:

pollination	pollinators
cross-pollination	germination
seed dispersal	flowerhead
dormancy	seed dispersal

2. With their partner, students should read and answer the question sheet.

3. Review answers/discussion.

EXTENSION:

- Partner students at a computer station and have them research cedar glade conditions, type of soil, yearly rainfall, and other rare plants of the cedar glades
- Instruct students to log onto the U.S. Fish and Wildlife Services internet site at www.fws.gov/ and investigate the Tennessee coneflower listing and recovery plan
  *this site is useful for looking at other types of endangered plants and animals

Team Names: _____

With your partner, review the structure and life cycle of the coneflower and answer the following:

1. The Tennessee coneflower has a long root called a tap root. How does the tap root help the plant survive?

2. How does growing close to the ground help young plants survive?

3. What characteristics does the coneflower have that helps it attract pollinators?

4. Predict the possible consequences to the coneflower populations if the numbers of honeybees continue to decline?

5. Notice that coneflower seeds germinate in moss or moist grass litter. How does this help the seedlings survive?

6. Suggest ways that citizens can help protect the coneflower:

Suggested Answer Sheet for Teacher

1. The Tennessee coneflower has a long root called a tap root. How the tap root help the plant survive?

   Allows plant to reach moisture beneath sun-dried surface

2. How does growing close to the ground help young plants survive?
   Helps reduce moisture loss

3. What characteristics does the coneflower have that helps it attract pollinators?
   tall stems, colorful ray flowers, numerous disk flowers

4. Predict the possible consequences to the coneflower populations if the numbers of honeybees continue to decline?
   decline of honeybee population might result in less pollination/fewer coneflowers; although honeybees are not native to this country, there most likely would be other pollinators

5. Notice that coneflower seeds germinate in moss or moist grass litter. How does this help the seedlings survive?
   Moss and grass litter retains moisture

6. Suggest ways that citizens can help protect the coneflower:
   do not pick or dig up wildflowers; do not litter; do not ride off-road vehicles through cedar glades or other wild areas; make donations to preservation organizations, etc.