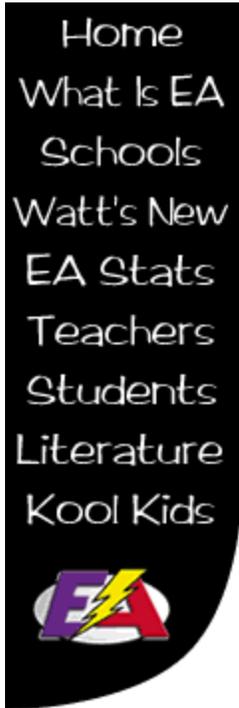


Lesson Four

(ELEMENTARY)



LANDSCAPING AND URBAN FORESTRY

Concept:

Trees and other landscaping plants can be used to reduce the urban heat island effect and its resultant health and environmental problems.

Lesson Four Goal:

Students will discover and understand how trees and landscaping can be used to improve air quality and help reduce the urban heat island effect.

Utah State Science Core Objectives:

5th grade: 3050-02

6th grade: 3060-0101

Intended Learning Outcomes:

1. Students will understand that trees directly and indirectly help reduce the urban heat island effect.
2. Students will know and understand the terms photosynthesis and transpiration and why these processes can help reduce CO₂ and ozone pollution.
3. Students will understand that trees provide shade to buildings, streets, parking lots, playgrounds, etc.
4. Students will understand the difference between deciduous and evergreen plants.
5. Students will observe various tree and leaf shapes and sizes.

Materials/Preparation:

1. Overhead of leaf diagram
2. Tree identification book for students
3. Small model homes (two for each class)
4. Websites on urban forestry

Vocabulary:

Landscaping, deciduous, evergreen, coniferous, windbreak, CO₂, transpiration, urban forestry, stomata, photosynthesis, simple, compound, needles

Background Information:

1. Photosynthesis:
 - a. CO₂ is absorbed through the stomata (holes in the leaf surface) and converted into sugars in the presence of light energy.
 - b. Sugars are used to produce flowers, seeds, leaves, stems, trunks, and roots
2. Transpiration:
 - a. As CO₂ is absorbed for photosynthesis, H₂O vapor is simultaneously lost through the stomata to the environment.
 - b. Transpiration cools the leaf through the process of evaporation.
 - c. If water loss through transpiration is greater than water uptake from the roots, plants wilt.
3. Plants and Energy:
 - a. Transpiration or the loss of water from leaves cool the surrounding air.
 - b. Shade from canopies of trees also cools the surrounding air.
 - c. When air temperatures are cooler, the need for air conditioning of buildings decreases.
 - d. Lower energy demands decreases the amount of electrical power generation.
4. Plants and Air Quality:
 - a. Because shade and transpiration cools the surrounding air
 - i. Lower air temperatures in the summer decrease energy demands

- ii. Decreases in energy use decreases the amount of CO_2 emissions resulting from the burning of fuels for power generation
- iii. Lower air temperatures slows the formation of ground-layer ozone
- b. Plants may also help reduce the amount of CO_2 emissions by taking up CO_2 for photosynthesis. The sugars produced
 - i. Used for daily growth
 - ii. "Stored" (buzz word is sequestered) in trees and shrubs as wood (plant biomass)

5. Plant Types and Forms:

- a. Deciduous: plants that lose their leaves during the dormant season e.g., maples and roses.
- b. Evergreen: plants that retain their leaves during the dormant season e.g., pines, junipers, and holly.
- c. Coniferous: plants that belong to the Conifer family (pine, yew, juniper, fir, spruce), which have needle- or scale-like leaves and cones or fleshy structures that enclose seeds. Most conifers are evergreens, however, there are some species that are deciduous e.g., Larch.
- d. Tree shapes include:
 - i. Columnar: tree canopy is much taller than it is wide
 - ii. Pyramidal: tree canopy is narrow at the top and wide at the bottom
 - iii. Globe: tree canopy is fairly rounded
- e. Leaf shapes/type include:
 - i. Simple: one leaf and one petiole (fleshy stem that attaches the leaf to the branch) e.g., maple, aspen, oak
 - ii. Compound: three or more leaflets form a whorl and are attached to a branch by a single petiole e.g., mimosa, horse chestnut,

Kentucky Coffee Tree, Golden
Raintree

- iii. Needles: a slender pointed leaf
- 6. Reasons to Plant Trees:
 - a. Shade
 - b. Block wind, sound, unsightly views
 - c. Stabilize soil especially on sloped sites
 - d. Beautify
 - e. Provide food and wildlife habitat
- 7. Tree Locations for Optimum Energy Conservation

Cool Communities Strategies

- a. Trees or shrubs should be planted to shade the central air conditioner unit. A shaded air conditioner requires less energy to cool a building.
- b. Deciduous trees should be planted on the south side of buildings and planted close enough to shade buildings from all-day sun during the summer. Vegetation cools local environments by shading and by transpiration. This cooling effect has been shown to decrease energy use by 17% and 30% in Phoenix and Sacramento, respectively.
- c. Evergreen trees should be planted on the north side of buildings to protect buildings from prevailing winds during the winter. Neighborhoods with canopy cover of more than 50% can decrease wind speed by half, therefore, decreasing winter energy consumption.
- 8. Factors to Consider When Selecting a Tree or Shrub
 - a. Primary intended function for the plant
 - b. Intended site for the tree e.g., avoid planting
 - i. "messy" trees near water features
 - ii. shallow, large-rooted trees near foundations, sidewalks, driveways, ponds, or pools

- iii. trees that keep their leaves well into the winter on the east, south, and west side of homes
- iv. Size, growth habit (form), growth rate
- v. Water, soil, and nutrient requirements
- vi. Cost
- vii. Maintenance e.g., pruning, fall cleaning
- viii. Pest susceptibility

Instructional Procedures:

1. Discuss reasons to plant trees, the best locations to plant trees for cooling, and factors to consider when selecting trees to plant.
2. On your own, take a walk in a nearby neighborhood and select a couple of homes for students to evaluate. With the class, ask the students to determine if the owners of the two homes have incorporated *Cool Community Strategies*. Consider:
 - a. types of trees e.g., deciduous or evergreen
 - b. location and number of the trees
 - c. location of the central air conditioner
 - i. Is the AC on the south side?
 - ii. Is the AC shaded?
 - d. color of hard surfaces including sidewalks, driveways, roofs,
3. Introduce the benefits of shade, and the processes of transpiration, and photosynthesis. Discuss the relationship between plants and the urban heat island. Also discuss how plants can help reduce certain air quality problems. The students could draw a tree and list the benefits gained from trees. They could also draw a leaf and diagram transpiration and photosynthesis.
4. The class could discuss the loss of 400 trees in Memory Grove Park as a result of the tornado that struck Salt Lake City in 1999. What will this loss mean to the park and the surrounding neighborhood?

5. Invite a local forester to speak to the class about urban forestry.

Assignment:

The class will plan and diagram a landscape design for their school campus. The students should consider strategically placing trees for maximum shading, cooling, and energy savings.

Homework Assignment:

You may want to have the students draw their home/apartment site including home orientation and existing landscape. Have the students name the trees or at least determine if the trees are evergreen or deciduous. Ask the students to redesign their home site to include *Cool Communities Strategies*.

Additional Activity:

Students could repeat the "Instructional procedure #2" from lesson 2 now that they have a better understanding of *Cool Community Strategies* and the relationships of plants and the urban heat island.