Made in the shade

Third-grade differentiation

■ Reading and discussion tips:

- Read the article "Cool in summer, warm in winter" together in class. You might wish to elongate the scope of the lesson so you can spend ample time reading and discussing the article during class time.

- Place students into small groups. Allow the groups to complete the "Vocabulary match-up" worksheet together.

- Help students determine the main ideas and details of the article with a graphic organizer. Create a simple graphic organizer with a large box for the "main idea" and three arrows pointing to three smaller boxes for the "details." Study a specific section of the text, and show students how the main idea of the section is supported by detailed information.

■ Activity tips:

- Assign students to mixed-ability groups. Have groups of students work together to identify and research plant and tree information based on their leaf samples.

- Make sure to use plenty of examples when the students are analyzing purpose and audience. If possible, create a sample tip sheet beforehand that exemplifies the "Do's" and "Don'ts" concerning purpose and tone.

- When creating the class tip sheet, allow students to contribute information, drawings and diagrams.

■ Assessment tips:

- You may wish to create a short multiple-choice quiz based on the information acquired during the lesson in order to assess students' understanding of the concepts covered.

■ Optional extension tips:

- Create a template for the class proposal. Allow each student to contribute a sentence or drawing to the proposal.

Fifth-grade differentiation

■ Reading and discussion tips:

- During reading, ask students to summarize the major sections of the article.

- After reading the article, have students identify, using general terms, the types of trees and shrubs that would affect energy efficiency the most in the major regions of the United States (Northeast, Southeast, Midwest, Southwest and Northwest).

■ Activity tips:

- Have students gather the online and library resources regarding tree and plant identification and plant care on their own.

- Have students work in small groups to generate ideas for the tip sheet. Assign each group a specific aspect of the tip sheet, such as the introduction, a list of trees and plants that grow well in your region, or instructions on how to care for those plants. Then reconvene as a class in order to compile the groups' contributions. You may also wish to assign one group the task of designing the tip sheet. Have this group generate ideas on the organization of the information and the overall appearance of the tip sheet.

- Encourage students to send their tip sheets to multiple Habitat for Humanity affiliates in your region, if possible.

■ Assessment tips:

- Collect and assess the accuracy and completeness of plant and tree care information students compiled for the tip sheet.

■ Optional extension tips:

- Assign students to small groups. Have each group generate its own proposal to the principal. Ask groups to present their proposals to the class.
  Take a class vote to choose one proposal to deliver to the principal.

Made in the shade

Grade four

Objectives

Students will:
- Learn how trees cut energy costs.
- Complete a matching exercise based on their reading.
- Research trees and plants that grow in your area.
- Create a planting tip sheet for local Habitat for Humanity affiliates.

National content standards

Science
- Students develop understanding of organisms and environments.
- Students develop understanding of changes in environments.
- Students develop understanding of science and technology in local challenges.

Language arts
- Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language and genre to create, critique and discuss print and nonprint texts.

Scope

- Three class periods (30 to 45 minutes each).

Materials

- **Article:** "Cool in summer, warm in winter."
- **Worksheet:** "Vocabulary match-up."
- Online and library resources that identify trees and other plants that grow well in your region, as well as how to plant and care for them.
- Notebook paper.
- Tape.
- Computer, printer and printer paper.
- Clip art or other digital images to decorate tip sheet.

Lesson plan

In this lesson, students will learn how trees and landscaping can help cut housing costs. They will research and create a tree-planting tip sheet for local Habitat for Humanity builders and partner families to use when landscaping new homes.

■ Preparation:

Before beginning the lesson:
- Gather online and library resources about tree and plant identification, planting and care.
- Establish contact with your local Habitat for Humanity affiliate. Find contact information at **http://www.habitat.org/local.**
- Review the Department of Energy information about regional climate and microclimate at **http://www.energysavers.gov/your_home/landscaping/index.cfm/mytopic=11920**.
- Assign students to read "Cool in summer, warm in winter" for homework.

■ Procedure:

Day 1   **Introduce the topic of how trees help save energy.**

1. **Discuss the article "Cool in summer, warm in winter."**

Answer the questions within the article. In a discussion, be sure to cover the following main ideas:

- The cost of heating and cooling our homes can mean both literal cost, as in money, and the cost to the environment that sustains us.
- We can use trees and plants to help keep our homes cooler in summer and warmer in winter.
- Certain kinds of trees planted in specific locations will save the most energy.

2. **Have students complete the worksheet "Vocabulary match-up."**

Read the directions aloud and answer any questions the students might have. Students may use the article to help them.

3. Locate your regional climate and discuss microclimate.

Use the Department of Energy map and descriptions at **http://www.energysavers.gov/your_home/ landscaping/index.cfm/mytopic=11920** to identify your regional climate and to read about how to identify microclimate.

4. As homework, instruct students to collect leaf samples.

Direct students to bring in leaves from two different trees. If you have resources containing information on other shade plants, you might have students bring in a leaf from one tree and one shade plant, such as a shrub or bush. Have students look for trees they think would help a homeowner cut energy costs.

Day 2 Identify leaf samples students have collected.

1. Have students tape each leaf sample to a separate sheet of notebook paper.

Direct students to leave blank space on the paper to write information about each leaf.

2. Have students use online and library resources to gather information about their samples.

For each leaf, students should gather the following information:

- The name of the tree the leaf comes from.
- Two adjectives that describe the type of tree. (Any tree will be either a conifer or a broadleaf tree. Any tree will be either evergreen or deciduous. Most conifers are evergreen, and most broadleaf trees are deciduous.)
- The mature height and the lifespan of the tree (e.g., fast growing with a short lifespan or slow growing with a long lifespan).
- Steps for planting a tree.
- Instructions on how to care for the tree after planting.

3. Compile a master list of information.

Have students share their information with the class. Make a list of what they have learned. Your list should include:

- What kinds of trees grow in your region.
- Steps for planting a tree, including where to plant in relation to a house so that it will best help cut energy costs.
- Instructions on how to care for the tree after planting.

Day 3 Create a tree-planting tip sheet for your local Habitat for Humanity affiliate.

1. Introduce the tip sheet project.

Tell students that as a class you will be writing an information sheet to give to Habitat for Humanity. Explain that Habitat builds affordable, safe, healthy homes with people who might not otherwise be able to afford homes. Explain that with the right information, Habitat builders and new homeowners will be able to make their homes more energy efficient by planting trees.

2. Help students analyze purpose and audience.

Prompt students to analyze the rhetorical situation by asking questions such as:

- What are we hoping to do by creating this tip sheet? What is our purpose? (The tip sheet is both informative and persuasive. You will deliver information and try to persuade your audience to take your advice.)
- Is our audience willing to listen to what we have to say? (The audience is most likely open to your ideas, especially since they benefit from them by saving money. Your tip sheet might also remind them that they are helping the environment in their city by planting trees.)
- What kind of tone should we use when writing our tip sheet? (An enthusiastic or energetic tone will help persuade the audience to follow your advice.)
- What features can we give our tip sheet that will make it appealing, attractive and easy to read? (Features might include a catchy title, bold lettering and colorful illustrations.)

3. Create your class tip sheet.

Working as a class, create your tip sheet on the computer. Your tip sheet might include the following information:

- Introductory information explaining why planting trees is good for homeowners and for the community.

- Specific kinds of trees and other plants that grow well in your region.
- Characteristics of trees and shrubs that provide the most shade and the most insulation from wind.
- Specific locations for placing trees and other plants to help cut cooling and heating costs, considering regional climate.
- Information to help homeowners consider their microclimate when planning where to plant.
- Instructions on how to plant and maintain trees and other plants you have recommended.
- Digital artwork or clip art to make the tip sheet attractive and emphasize important information. (Alternatively, students might decorate one tip sheet each with their own drawings. These sheets can then be photocopied as many times as necessary.)

4. **Present your tip sheets to your local Habitat for Humanity affiliate.**

Send your tip sheets to your contact at the local office or choose a delegation of students to present them to the Habitat board at its next meeting.

■ Assessment:

- Check students' worksheets for accuracy.
  Answers: 1. e; 2. g; 3. b; 4. a; 5. h; 6. f; 7. d; 8. c
- Evaluate student participation in the creation of the tip sheet.

■ Optional extension:

Make your school greener.

Plan and implement a class project to make your school building more energy efficient by planting trees and other plants.

- Create a map of your school building and grounds on graph paper. Copy and distribute it to students.
- Take a walk around your school grounds. Have students use compasses to draw a compass legend on their maps. Then have them mark X's with pencil where trees and plants are already located.
- Based on the information in the article "Cool in summer, warm in winter," and on the research you have done to identify trees and plants that grow well in your region, have students identify places on their maps where they think trees and other plants would help make the school more energy efficient. Have students mark these places on their maps with green X's. Have them make notes about what specific plants might grow well there.
- Create a class proposal to present to the principal of the school. In the proposal, ask the principal to help implement your class's ideas. Offer to help implement the project by fundraising and doing the planting and maintenance yourselves.
- Choose a delegation of students to present the proposal to the principal.

Cool in summer, warm in winter

More people, fewer trees

More and more people in the world are moving from rural areas to cities. These people need housing. We have cut down more and more trees to make room for houses and apartment buildings. We have cut down trees to make room for stores and offices. We have cleared trees to make room for roads, sidewalks and parking lots. But a city without trees is a city with problems.

The main problem is that without trees, cities are hotter in summer and colder in winter. Without trees, it takes a lot of energy to keep people comfortable in all seasons. People run their air conditioners more in the summer. They run their furnaces more in the winter.

When people run their air conditioners, fans and heaters more, a city uses more energy. The energy company has to produce more electricity for air conditioners. The gas company has to send more gas for furnaces.

Trees help us save energy. First, they help cool the air in the summer. Trees that grow next to windows block or filter the sunlight. The shade keeps the rooms inside cool. People do not have to use their air conditioners as much.

Trees can also keep the public places in a city cool in the summer. They can shade roads, sidewalks and parking lots. Without trees to shade it, a blacktop parking lot absorbs sunlight. The heat caught in the blacktop then radiates into the air. The air gets hot. The temperature in the parking lot and in the surrounding area rises. The temperature can be up to 25° F (14° C) cooler in the shade than it is in a parking lot with no trees.

In the winter, trees can block cold wind from blowing into houses. Without trees, wind can blow through the cracks along windows and doors. The wind makes it colder inside. People turn up their thermostats to keep warm.

Trees and shrubs that keep their leaves all year—which are called *evergreens*—can slow that wind down. They can block it. Farmers often plant rows of evergreen trees to block the wind. These rows of trees are called *windbreaks*. Windbreaks keep the soil from blowing off the farmers' fields. In the city, people can plant rows of evergreens to block the winter wind.

Trees that lose their leaves in winter—which are called *deciduous* trees—can also lower energy costs in the winter. Their leaves fall off, allowing sunlight to come in through the windows. Sunlight warms the inside of the house, and people don't need to heat as much.

An organization called American Forests helped two cities plant trees to save energy. As a result, Houston, Texas, saved $26 million a year on energy costs. Atlanta, Georgia, lowered its energy costs by $2.8 million a year.

A man waters trees. He is helping grow the trees for Habitat for Humanity. The trees will later be planted near new Habitat houses.

What happens when a city cuts down many of its trees?

How can evergreen trees help cut a home's energy costs?

How can deciduous trees help cut a home's energy costs?

Trees also help keep the air in a city clean. A lot of electricity is produced by burning coal. Burning coal pollutes the air. When we use electricity from coal, we pollute the air. Furnaces often burn gas. Burning gas also pollutes the air. The more gas we use, the more we pollute the air.

One of the ingredients of air pollution is carbon dioxide. Too much carbon dioxide in the air makes it hard for people to breathe. But trees use carbon dioxide to make food. They take in carbon dioxide and release oxygen. Oxygen makes it easier for people to breathe. So trees help cut down on pollution in two ways. They lower energy bills, and they clean the air.

What and where to plant

Anyone can use trees and bushes to lower energy costs. First you have to identify your regional climate. The United States contains four main types of regional climate: temperate, hot-arid, hot-humid and cool.

Temperate regions are places where summers are hot and winters are cold. The upper Midwest is a temperate region. Deciduous trees grow in temperate regions. These trees can be planted to shade windows and roofs from the hot summer sun. Trees with long trunks and wide branches will shade a two-story home. They will also allow air to circulate under the tree. This moving air will keep the area cooler. Deciduous trees lose their leaves in the winter. The bare branches will allow sunlight into the home. The sunlight will help warm it. Evergreen bushes and trees can be planted as windbreaks to block winter winds.

Hot-arid regions are places where summers are hot and dry and winters are cool and dry. The southwestern United States is a hot-arid region. In these regions, the summer sun is very hot. Homes need shade. Trees and bushes can shade roofs. They can shade walls and windows. The summer wind can be hot, too. Houses in these regions might need windbreaks. Many deciduous and evergreen trees can grow in hot-arid regions. But these trees do not grow as tall as trees in other regions. There is not enough precipitation for them to grow tall. They are good for shading one-story homes.

Hot-humid regions are places where summers are hot and wet and winters are cool and wet. The southeastern United States is a hot-humid region. Deciduous trees with wide tops create good shade in these regions. Trees with tall trunks let cool air move around. They let cool breezes blow toward the home. Trees with tall trunks also allow more winter sunlight into a home.

Cool regions are places where the summers are cool and the winters are cold. Homes in cool regions may never need shade trees or air conditioners. But winter winds are cold there. Homes might need evergreen windbreaks. Such windbreaks can block cold winter winds. Windbreaks can be made of trees. They can be made of bushes. They can be made of trees and bushes together. Bushes block wind close to the ground. Trees block wind higher up. A good windbreak can lift a cold wind right over a home.

Windbreaks are planted farther away from the home than shade trees. They are planted farther away to stop the wind before it reaches the house. They are planted farther away in case the wind blows them over. If they are blown over, they won't land on the house. An evergreen tree that will grow 30 feet tall should be planted at least 60 feet away from the home.

Usually, windbreaks are planted on the north or northwest side of a home. The coldest winds usually come from the north and northwest. Windbreaks should not be planted on the south side of a home. Winter sun comes in on the south side. It can help warm the home in winter.

When planting shade trees, people should first check where and when the sun hits the home strongest during the day. The tree should be planted to block the sun in that position. In many areas, the west side of the home is the sunniest side. Some homes are sunniest on the south side. Trees planted for shade should be planted 15 to 20 feet from the house. The distance causes the biggest part of the tree's shadow to fall on the house. It also keeps the roots of the tree from growing under the house. Trees with wide branches and thick leaves create the most shade.

In any region with hot summers, trees or bushes can be planted to shade air conditioners. In the shade, an air conditioner does not have to work as hard to cool the house. This saves energy. Trees and bushes can also be planted to shade the ground, sidewalks and driveway. This shade will help cool the air around the home.

Deciduous bushes near the house will shade the windows. They will allow cool air to flow through. Evergreen bushes will insulate the house from the cold. They will keep the cold air away from the house.

A couple plants a tree in their yard in Immokalee, Florida.

In all regions, people should leave space between bushes and their homes. There should be at least one foot of space between full-grown bushes and the house. This space lets air circulate. If air cannot move around, water can get trapped against the house. That will make the home feel damp. Trapped water also causes mildew and mold. In hot-humid regions, the air stays wet most of the time. Plants that need a lot of water should not be planted near the house at all.

Before planting in any region, people have to think about their *microclimate*. A microclimate is the very small climate around a home. The microclimate can be different from the regional climate in important ways. For example, a home might be located in a cool region. But if it is on a sunny hill, the home might get hot in the summer. The owners of the home might decide to plant a tree or bushes to shade the house on the sunny side.

Trees and bushes can make your yard beautiful. It can be fun choosing from the many different types of trees and plants that grow in your region. Which kinds will keep your home cool in summer and warm in winter? Trees can also save energy. If they are planted in the right places, they will lower your electricity and gas bills. And the less energy we use, the cleaner the environment will be for all of us.

> **Where is the best place to plant shade trees? Explain your answer.**
>
> **Where is the best place to plant windbreaks? Explain your answer.**
>
> **What is a microclimate? Why is it important to understand your microclimate?**

Worksheet: Vocabulary match-up

Directions: Match the word in the left column with the definition in the right column.

_____ **1.** windbreaks	**a.** Trees and shrubs that lose their leaves in winter.
_____ **2.** evergreens	**b.** The small climate around a home.
_____ **3.** microclimate	**c.** Places where summers are cool and winters are cold.
_____ **4.** deciduous	**d.** Places where summers are hot and dry and winters are cool and dry.
_____ **5.** hot-humid region	**e.** Rows of trees that block wind.
_____ **6.** temperate region	**f.** Places where summers are hot and winters are cold.
_____ **7.** hot-arid region	**g.** Trees and shrubs that keep their leaves all year round.
_____ **8.** cool region	**h.** Places where summers are hot and wet and winters are cool and wet.