# Reflection Section Answer Guide

The follow section provides a guide to possible answers to the reflection questions found in each section of the articles. Reflection Sections are meant to stimulate critical thinking about the article, not to test knowledge. Use the answers below as a guide to stimulate critical thinking and discussion in your classroom.

***What You See Is Not What You Get: Visible Sunlight and Ultraviolet Radiation in Urban Forests***

## Introduction

- **What question did the scientists want to answer?** The question was—Does the shade under urban trees protect people from the sun's UVB radiation?
- **Why is this question important?** Because getting too much UVB radiation causes a lot of human health problems. If you think you are being shaded from UVB radiation but are not, then you might be unknowingly exposing yourself to danger from UVB radiation.

## Method

- **Name two reasons why is it important to find out what is already known about something before doing an experiment or collecting your own information about it.** (1) You might conduct an experiment that discovers something that is already known, wasting your time and money. (2) If you know as much about something as possible, you will design a better experiment or research method. Your students may come up with many other reasons.
- **From your own observation, would you say that leaves allow the sun's visible radiation to pass through them? Why or why not?** Leaves allow a little bit of the sun's visible radiation to pass through them. You can tell this by looking up at the undersides of the leaves and seeing the light green color of the leaves that are in the sunlight. The light green color is caused by some of the sunlight penetrating the leaf's surface. Leaves that are shaded are a darker green color when viewed from underneath.

## Findings

- **Look at table 1 and read the paragraph below it. Put the scientists' findings in your own words.** This could be done many ways. Essentially, the findings show that when you think you are protected from UVB radiation because you are in the shade, you are actually not as protected as you think. It also means that when you are under a tree, you are receiving some protection from UVB radiation, even if you are in a sunny area under the tree.
- **What do you think these findings mean for protecting yourself from harmful UVB radiation?** If you are under a tree canopy and you can see around the tree canopy to part of the sky, you are not as protected from harmful UVB radiation as you think you are. You might want to take additional actions to protect yourself from UVB, such as use sun protection lotion.

## Implications

- **In urban areas, some UVB radiation can be reflected off of buildings, sidewalks, streets, and fountains. Should you consider this source of UVB radiation when trying to protect yourself from the sun? Why or why not?** Yes, because UVB radiation is the same, regardless of whether it is reflected from buildings and other objects in an urban area.
- **Reread the last sentence in the last paragraph above. Why do you think that you receive less UVB radiation when standing in the sun next to a tree than when standing in the sun away from a tree?** When you are close to a tree, the tree's crown blocks part

of the sky from which the UVB radiation comes. When you are farther from the tree, less of the sky is blocked and you receive more UVB radiation.

### *I've Got You Covered: The Amount of Pavement Covered by Street Trees*

## Introduction

- **What were the scientists trying to do in this study?** They were trying to take an inventory of the amount of sidewalks and streets covered by street tree canopies.
- **Can you think of two other items that you took an inventory of this past week? What were they?** Examples of items that students could have taken an inventory of include—homework assignments; how many clean socks they had for the week; the number of CDs they have; and frozen foods in the kitchen freezer; which friends they were meeting after school. Your students should be able to think of many examples of taking inventories.

## Method

- **What do you think the numbers 10.7 meters and 35 feet represent?** They represent the average width of the streets in that community.
- **Do you think that the amount of tree canopy area covering streets and sidewalks was equal to the total amount of area that street tree canopies covered? Why or why not?** No, because the trees also covered front yards and median strips, and may have covered other things like planter boxes and even small buildings.

## Findings

- **Why do you think a greater percentage of sidewalk area than street area was covered by tree canopies?** Because street trees are planted closer to sidewalks, and the area of street pavement is much greater than the area of sidewalk pavement.
- **Did this tell the scientists how many benefits people were receiving from street trees? Why or why not?** No, all the scientists know now is how much of the sidewalks and streets are covered by street tree canopies. They will have to do more research to estimate how much people benefit from this amount of tree canopy coverage.

## Implications

- **What is one reason it is important to know how much paved area street trees cover?** In communities, people need to know how many trees to plant to achieve the amount of benefit that they hope to receive from urban forests. If you do not know how many trees or how much of the ground and pavement is now covered in trees, it is impossible to say whether you need more or not. Doing this inventory provides a starting point, or baseline, for understanding. This is an important point to make to your students, since in many situations, you must understand the baseline before you can discover more about the topic.
- **Do you think it might be important to also estimate the amount of grassed areas that street trees cover? Why or why not?** Yes, because street trees do more than keep areas cool. They also hold the soil in place and their roots absorb rainwater. They help to clean the air and provide homes for wildlife. The amount of area covered by tree canopies is a good measure of the total amount of trees growing in an area. If you know how much total area street trees cover, including grassed areas, you will have a more complete idea of the benefits being provided by urban trees.

### *Social Groupies: How Different Groups Use Urban Park*

## Introduction

- **What is the question that the scientist wanted to answer?** He wanted to know what kind of activities people of different ethnic backgrounds do when they visit an urban park.
- **If you were the scientist, how would you learn what kind of activities people of different ethnic backgrounds do when they visit a park?** Watch people when they visit a park and record what they do and what you think their ethnic background is. Talk to people of different ethnic backgrounds while they were visiting a park. Call people at their homes and ask them about their park activities. Students may come up with other ideas.

## Method

- **Why do you think that it was important to ask all of the visitors the same questions?** Because if the visitors were asked different questions or the questions were asked in different ways, the answers could not be compared with each other.
- **Based on your own experience, do you think that people from different ethnic backgrounds like to do the same things or different things when visiting an urban park?** This is a personal question and has to be based on each student's own experience. It provides an opportunity to discuss similarities and differences between ethnic groups, and misconceptions people can have about other groups of people.

## Findings

- **Are you surprised by the similarities and differences between the groups? Why or why not? Discuss with your class about whether you have observed the same things in your local parks. If your observations are different, how are they different? Why do you think that they are different?** The answer to these questions will be based on the experiences and perceptions of your students. These questions should stimulate discussion about observation and about the differences and similarities between people of different ethnic backgrounds.
- **When you visit a local park with others, how would you describe your group? Do you go with your family? With friends? What kind of things do you do when you visit a park?** The answer to this question will be based on the individual experiences of your students. These questions can stimulate a discussion about the students' use of local parks.

## Implications

- **Why is it important to think about all of the users of urban parks?** Because urban parks are managed for the use of all Americans, not just one ethnic group. This question provides a good opportunity to discuss the provision of public goods for all ethnic groups on an equal basis, including things like police protection, public schools, and any other public good or service.

### *Balancing Act: Urban Trees and the Carbon Cycle*

## Introduction

- **Think about how a part of the carbon cycle is illustrated by urban trees and urban tree maintenance. With that in mind, what is the question that the scientists were trying to answer?** Urban trees are a part of the carbon cycle because they absorb $CO^2$ from the air. Urban tree maintenance is a part of the carbon cycle because the engines emit $CO^2$ from the burning of fossil fuels. The scientists wanted to discover which trees absorbed the most $CO^2$ over the longest period of time. They wanted to find the point at which the engines used to plant and care for the tree emit more $CO^2$ than the tree is able to absorb.
- **Why do you think the scientists wanted to know which tree species absorb the most $CO^2$**

**over time?** Because these tree species will be the most beneficial to plant and maintain. They will cause less $CO^2$ to be emitted over time.

## Method

- **What did the two sets of numbers represent?** They represented (1) the amount of carbon in the tree and (2) the amount of $CO^2$ that was emitted from engines used to plant and care for the tree.
- **Why do you think each tree was maintained exactly alike?** So that the scientists could compare the amount of carbon in each tree every year with the same amount of $CO^2$ being emitted by the machinery used to maintain each tree. If the amount of $CO^2$ being emitted by machinery was different for each tree, the comparisons would be meaningless.

## Findings

- **This study looked at how much $CO^2$ was emitted by engines used to plant and maintain urban trees. What is one way that $CO^2$ emissions could be reduced without changing the type of tree species being planted?** Trees could be planted and maintained without using machines, or the use of machines could be reduced. Also, more energy efficient engines could be used.
- **This study examined the advantages and disadvantages of planting and maintaining different urban tree species for balancing $CO^2$. What might be some other advantages and disadvantages of different tree species?** One thing to consider is whether there are nuts that could fall from trees. Another thing might be whether the tree is more or less likely to get a disease. Another thing to consider is how much water the tree needs or how much space it needs to grow.

## Implications

- **This research identified the amount of carbon dioxide emitted by equipment that was used to maintain urban trees. What might happen in the future to the design of the equipment used to maintain urban trees? How could that change affect the scientists' research?** We could have more energy-efficient machines that either emit less $CO^2$ or use renewable sources of energy, such as hydrogen or solar power. If our equipment is more energy-efficient and emits less or no $CO^2$, you would not have to think as much about the balance of $CO^2$ absorbed by trees compared to the amount emitted by equipment. The scientists might not need to do this kind of research anymore.
- **If people want to increase the amount of $CO^2$ that is absorbed in urban areas, should they plant more or fewer urban trees?** They should plant more trees.
- **Of the tree species characteristics in figure 4, which kind of species should they plant?** They should plant trees that live a long time and grow fast or moderately fast.

### *Good to the Last Drip: How Urban Trees Help To Reduce Pollution*

## Introduction

- **What is the question that the scientists were trying to answer?** The question was—How much rainfall is intercepted by trees growing in an urban county in California?
- **Do you think that the amount of rainfall being intercepted by trees is different in urban areas than rural areas? Why or why not?** Yes, because in a rural area, there usually are many more trees to intercept the rain. The trees grow differently in rural areas because they are not pruned. They are able to grow taller and closer together.

## Method

- **How did the equations help the scientists to answer their question?** The equations helped the scientists to identify what they needed to measure by defining exactly what is involved in rainfall interception, as well as what is not involved in rainfall interception.
- **Why did the scientists need to know which tree species were growing in the county?** Because different kinds of trees have different shapes and sizes, different sized leaves, and different kinds and amounts of leaves. All of these differences will influence how much rainwater is intercepted by trees.

## Findings

- **Why do you think it is important to calculate the amount of rain intercepted over the entire county, and not just where trees were growing?** The important thing is how much rainwater is going into stormdrains and into creeks and rivers. The rain falling all over the county has a potential to run into the drains and creeks, not just the rain falling over the trees.
- **Why do you think that deciduous trees intercepted less rain than evergreen trees? (Hint: The scientists collected information for an entire year.)** Because deciduous trees lose their leaves in the winter, and evergreen trees keep their leaves and needles all year.

## Implications

- **We need to have a certain amount of rain hitting the ground, but how can too much rain hitting the ground at one time be a bad thing?** Too much rain at one time washes pollutants and soil into streams and rivers.
- **What is one way that people living in urban areas can reduce the impact of rainfall on soil erosion?** They can plant and care for a larger number of urban trees.

### *Don't Be So Fuel-ish! How Much Fuel Is Saved When Cars Are Parked in the Shade?*

## Introduction

- **Why do you think hotter temperatures cause more gases to be emitted from parked cars?** When the temperature is hotter, more evaporation will occur. Evaporation can come from improperly connected hoses; from gas caps that are not sealed properly or have been lost; and from permeable, easily punctured, or deteriorating materials.
- **What is the question that the scientists were trying to answer?** Is there a difference in the amount of gases coming from cars parked in the shade vs. cars parked in the sun?

## Method

- **Why do you think that the scientists used identical cars?** So that any differences they found in the car's surface temperature, inside temperature, and gas tank temperature could be attributed to the air temperature and/or amount of solar radiation, not the type or color of the car.
- **Why do you think that the scientists collected their information when the climate was hot?** (1) If the temperature was cool, there would be less difference between the temperature in the sun and the shade, making it harder to identify any differences in measurement. (2) The amount of solar radiation would be different coming through trees in the summer than in the winter.

## Findings

- **From the information in Table 1, would you say that the amount of sunlight reaching a parked car has an impact on its inside temperature?** Yes, because the inside temperature was 15 degrees higher in the car parked in the sun than the one in the shade (in Fahrenheit, the temperature difference was 122° to 149°).

- **Do you think that a 2-percent difference is a very big difference in the amount of gas evaporating from a car? Why or why not?** Although 2 percent is not a very large amount, over the millions of cars parked every day, it could add up to a large amount of wasted and dangerous fuel being emitted into the air.

## Implications

- **Which would you prefer–a parking lot with trees or one without trees? Why?** This question can be used as a basis for discussion over the costs and benefits of urban trees.
- **Do you think that evaporation from cars will continue to be a problem in the future? Why or why not?** As cars become more fuel efficient and new fuel technologies are developed, evaporation from parked cars will probably become less of a concern. On the other hand, the millions of cars still being driven every day are getting older and, therefore, are more likely to have evaporation problems.

***Yard Sale!***
***How Trees Affect the Selling Price of Houses***

## Introduction

- **What questions were the scientists trying to answer?** (1) Are yard trees valued by people buying a new house? (2) How much money are those benefits worth to people buying a new house?
- **If you were the scientist, how would you determine how much money trees are worth to people buying a new house?** Talk to different people who are buying a house and ask them how much more they would be willing to pay for a house with trees. Do some research about the price of similar houses with different amounts of trees growing in their yards. Your students may come up with other ideas. This is a good opportunity to brainstorm ways that your students might try to answer the scientists' questions.
- **The first paragraph of the "Introduction" section lists some benefits that are provided by trees surrounding a house. Name two other possible benefits.** (1) Trees can be places for tree houses. (2) Trees can hold swings. (3) Trees might provide nuts or fruits that can be eaten. (4) Trees provide shady places to have picnics or just to sit and relax. (5) Trees can make the neighborhood quieter by absorbing sound. Your students may come up with other benefits. You can list them on the board and discuss the value of trees surrounding houses (and schools!).

## Method

- **Why do you think that the scientists collected information about the number of rooms, the amount of heated space, and other things for each house they studied?** The price may have also been affected by these other things.
- **Do you think that the percentage of tree cover on a lot affected the price of the houses? Why or why not?** This is an individual question. It would depend on each student's own assessment of the value of trees surrounding a house. This question could be used to stimulate discussion regarding how and why different people might or might not value trees.

## Findings

- **Why do you think that most of the trees were growing on the border of the lots or in the backyard?** This is a question for which we do not have a definite answer, but some reasonable guesses are—(1) Trees are planted on the border of the property and in the backyard to provide privacy from next-door neighbors. (2) Trees are planted in the backyard for picnics, relaxing, tree houses, and other recreation. (3) Leaving the front yard open allows the house to be seen from the street. This

question can give you an opportunity to challenge students to think about why people who own houses plant trees where they do.

- **Athens-Clarke County is located in the Southeastern United States, where there is plenty of rain. Do you think that the amount of tree cover would affect the selling price of houses in other areas of the United States? Why or why not?** This question will allow you to discuss whether people buying houses in dry areas of the United States, such as New Mexico and Arizona, would spend more money on a new house if there were trees on the lot. It would also allow you to examine the practices and preferences of house buyers in the community where you live.
- **Look at figure 6. What is the relationship between tree size and the value of a tree?** As a tree gets larger, its value goes up.

## Implications

- **Think about how you feel about trees. Now pretend that you are getting ready to buy a house. Do you think that you would be willing to spend more money to buy a house that had more trees growing in its yard? Why or why not?** This is an individual question and every student will have a different answer. This question will give you an opportunity to discuss the findings and compare what the scientists found with your students' own experiences and preferences.