



Growing Native is a program aimed at restoring the rivers and streams of the Potomac River watershed by engaging volunteers in collecting native tree seeds and planting trees.



GROWING NATIVE

***Growing Native* is a project of the Potomac Watershed Partnership and is managed by Potomac Conservancy.**



Potomac Conservancy

The mission of Potomac Conservancy is to protect the health, beauty, and enjoyment of the Potomac River and its tributaries. Widely recognized as “the voice of the river,” the Conservancy safeguards water quality, conserves scenic landscapes, expands recreational opportunities, and builds an informed and engaged constituency.



Potomac Watershed Partnership

The Potomac Watershed Partnership is a collaborative effort among federal, state, and local partners to restore the health of the land and waters of the Potomac River watershed, thereby enhancing the quality of life and overall health of the Chesapeake Bay.

***Growing Native* is made possible thanks to the generous support of its sponsors:**



© 2007 by Potomac Conservancy. All rights reserved.

Potomac Conservancy

8601 Georgia Avenue, Suite 612 • Silver Spring, Maryland 20910 • 301.608.1188 • www.potomac.org

Acknowledgements

Colleen Langan, *Growing Native* Project Director

Jennifer Schill, Senior Editor

Kim Roberts, Designer

Anne Sundermann, Communications Director

Contributing Writers

Lisa Alexander, Richard Bailey, Sandy Burk, Edward T. Dix, Catherine Estes, John Ezzell, Mark Granger, Caitlin Greeley, Andy Jackson, Grace Manubay, Hayden Mathews, Marcia Moore, Heather Montgomery, Ellen Powell, Jennifer Schill, Carrie Seltzer, Jessica Sprajcar

Editors

Sandy Burk, John Ezzell, Tim Williamson

Research Assistants

Eliza Cava, Bridget Chapin, Ashley Steele

Reviewers

Joyce Bailey, Rebecca Bell, Shawn Belt, Sally Claggett, Gerald Crowell, Jim Cummins, Curtis Dalpra, Jon DeVier-Scott, Edward T. Dix, Cris Fleming, Sandra Geddes, Cheryl E. Hayes, Daniel Kirwan, Pamela Kogan, Karyn Molines, Stephanie Nelson, Judy Okay, Pam Rowe, Kathleen Sheridan, Jessica Sprajcar, James Standefer, Timothy Williamson

Illustrators

Hans Baumann, Meghan Bolton, Claire Buchanan, Chris Dotson, Eileen Doughty, Heather Montgomery, Trudy Nicholson, Tim Williamson, Jennifer Willoughby

Photographers

Don Chernoff, Douglas Graham (WLP, Inc.); Anthony Hathaway, Ed Neville (edneville.com), Jennifer Schill, Emmy Truckenmiller

Map Designers

Eliza Cava, Seth Coffman

Special thanks to the following organizations for their assistance with this project

American Forests, Anacostia Watershed Alliance, Chesapeake Bay Program, Coalition for Smarter Growth, Environmental Concerns, GreenKids Audubon Naturalist Society, Harrisonburg School District, Interstate Commission on the Potomac River Basin, Izaak Walton League, Lathrop E. Smith Environmental Education Center, Montgomery County Department of Environmental Protection, Pennsylvania Department of Conservation and Natural Resources, Potomac Overlook Regional Park, Potomac Watershed Partnership, Project Learning Tree, State Arboretum of Virginia Blandy Experimental Farm, United States Department of Agriculture Forest Service, United States Department of Agriculture Natural Resources Conservation Service, Virginia Department of Forestry, Virginia Tech

Growing Native Education Guide

Table of Contents

| | |
|-----------------------------|-----|
| Partners and Sponsors | I |
| Acknowledgments | II |
| Introduction | VI |
| Lesson Format | VII |



Section 1 • Our Potomac River Watershed

Students develop a sense of place by exploring the Potomac River watershed’s unique ecosystem, rich historical heritage, diverse resources, and recreational opportunities. Students will learn how humans influence—and are influenced by—the Potomac River, its tributaries, and their surrounding lands.

Lesson 1.1 • Watershed 101 I-1

Students identify the major physiographic regions and major sub-watersheds in the Potomac River watershed through creation of a three dimensional map.

Lesson 1.2 • Drawing Potomac River Watershed Boundaries I-21

Students investigate the relationship between natural and political boundaries by comparing and analyzing different maps.

Lesson 1.3 • Natural Resource & the Economy I-37

Students use research and presentation skills to learn about the various natural resources in the Potomac River watershed. Students understand how these resources are used by businesses and industries for a variety of purposes.

Lesson 1.4 • Balancing Recreation & Natural Resources I-46

Through an interactive mock public meeting, students use research and debate skills to identify recreational opportunities available in the Potomac River watershed.

Lesson 1.5 • Historical Snapshot of the Potomac River I-57

Students research historical sites in the Potomac River watershed, as well as the role of the economy, politics, and the area’s social makeup in shaping the region.



Section 2 • Understanding Our Forests

Students learn about trees, how to identify them, and their role in the larger Potomac River watershed ecosystem. Special attention is given to the benefits of streamside forests, especially about how these important areas help promote water quality.

Lesson 2.1 • Trees Inside-Out2-1

Students participate in an interactive game to investigate the basic anatomy of trees and the role that trees play in the ecosystem. Students learn to use dendrology terms to identify parts of a tree.

Lesson 2.2 • Tree Characteristics2-10

Students use a hands-on approach to identify and recognize native tree species by using real trees and a tree identification key. They discover science-related careers that involve dendrology.

Lesson 2.3 • Healthy Trees, Healthy Forests2-29

Students complete a tree inventory and learn about environmental factors that impact tree health. They use forest survey field tools to assess the health of trees in their community.

Lesson 2.4 • Streamside Forests Link Land & Water2-45

Students learn about streamside forests by physically demonstrating a riparian zone with and without vegetation. They also make the connection of the importance of riparian forest buffers to the water quality of our rivers and streams.

Lesson 2.5 • Restoring Our Native Forests2-59

Students learn the importance of a balanced ecosystem and the problems associated with invasive species. By developing a mock restoration plan to establish a riparian forest buffer, students assess what tree species are best suited for a streamside area.



Section 3 • Improving Our Potomac's Water Quality

This section teaches students about the importance of clean water, major threats to water quality, and strategies for protecting and restoring our rivers and streams. Special attention is given to Best Management Practices that reduce urban and rural runoff.

Lesson 3.1 • Water Is Life3-1

Students investigate the importance of fresh water to humans and their personal consumption of water. They research factors that threaten water quality in the Potomac River watershed, including nutrient and toxic pollution, sedimentation, and dissolved oxygen levels.

Lesson 3.2 • We All Live Downstream 3-14

Students investigate point source and non-point source pollutants and where there are evidences of such pollutants in their community.

Lesson 3.3 • Restoring the River 3-25

Students investigate the effects of water pollution and dams on fish and other animals of the ecosystem of the Potomac River and learn types of restoration practices that can help stop that pollution.

Lesson 3.4 • Cleaning Up Our Act 3-41

Students discover specific Best Management Practices (BMPs) that reduce water pollution. Students think creatively about strategies for implementing BMPs at their school and in their community.

Students Lesson 3.5 • Planning for a Healthy Potomac 3-71

Students represent stakeholders in a mock river partnership working to resolve a water quality problem in their watershed. They act as watershed managers to propose solutions to restore the river.



Section 4 • Being Stewards of Our Environment

This section provides supplemental hands-on projects to help students further investigate the importance of streamside forests, and to realize their ability to positively affect the Potomac River watershed.

Activity 1 • Growing Native Seed Collection 4-1

Lead your class, or entire school, in an organized *Growing Native* seed collection and/or encourage students to collect seeds on their own or as part of a publicly organized seed collection event.

Activity 2 • Establishing a Grow-out Station 4-8

You can involve your students in creating a nursery using seeds collected during their *Growing Native* seed collection by establishing a Grow-out Station—a nursery of native trees and/or shrubs—at your school.

Activity 3 • Plant-A-Seed 4-16

Plant-A-Seed is an educational project that integrates classroom and field activities with the goal of providing students with relevant experiences related to their watershed.

NAAEE Guidelines for Learning XI

Glossary XV

Growing Native Education Guide

“The creation of a thousand forests is in one acorn.” – Ralph Waldo Emerson

Growing Native

Growing Native is a program aimed at restoring the rivers and streams of the Potomac River watershed by engaging volunteers in collecting native tree seeds and planting trees. The program meets two goals. First, it provides native tree stock to regional nurseries for streamside restoration projects. Second, it builds public awareness of the important connection between healthy lands and clean waters—and of the impact our daily actions have on these vital resources. *Growing Native* is a program of the Potomac Watershed Partnership, and is managed by Potomac Conservancy.

This innovative program supports comprehensive environmental education that engages large numbers of students and other community members in outdoor experiences. Since its inception in 2001, *Growing Native* has gained recognition throughout the Potomac River watershed. The program’s seed collection and tree planting activities engage students in hands-on outdoor experiences that strengthen their knowledge about the Potomac River, the Chesapeake Bay into which it flows, and the role of streamside forests in protecting water quality. Students can experience the full cycle of *Growing Native*—seeds to trees to clean water—by collecting seeds and planting trees (using seedlings grown from *Growing Native* seeds) on sensitive river- and stream-side lands to restore degraded waterways.

Rivers and streams are the Potomac River watershed’s lifelines, providing habitat for hundreds of rare, threatened, and endangered species; recreation for tens of thousands of outdoor enthusiasts; and drinking water to nearly 75 percent of residents in the Washington, D.C., region. Volunteers of all ages and backgrounds come together to restore their local rivers and streams by participating in *Growing Native*. Volunteers include public and private schools, Boy and Girl Scout troops, community groups, and other residents throughout the Potomac River watershed.

The Growing Native Education Guide

The *Growing Native Education Guide: Experience the Potomac River Watershed* has been developed to expand the education experience of *Growing Native* to schools within the Potomac River watershed. The *Education Guide* provides educators with meaningful watershed Lesson plans; detailed guides to stewardship activities; and local resources to increase the value of students’ environmental education experience. The *Education Guide* assists school administrators and educators in integrating watershed education projects aligned with student achievement academic standards into their curricula. The Lessons are intended for students from fourth to eighth grade.

The *Education Guide* was developed through a collaborative effort with educators, state education administrators, foresters, local artists, and professional environmental educators across the Potomac River watershed. All of the Lessons are correlated to the North American Association for Environmental Education (NAAEE) Guidelines for Learning and state standards throughout the watershed.

What sets this *Education Guide* apart from other environmental curricula is that it is specific to the Potomac River watershed—addressing the issues, problems, and resources in this particular region. The *Education Guide* closely follows the focus of the *Growing Native* program by concentrating on the connection between land use and water quality.

The *Growing Native Education Guide* consists of four sections. The first section focuses on the Potomac River watershed and includes Lessons on the watershed’s geography, boundaries, natural resources, scenic areas, and history. The second section covers trees, featuring Lessons about tree anatomy and identification; factors affecting tree health; and the roles of trees in forested ecosystems. This section focuses particularly on the importance of streamside forests to water quality. The third section addresses water quality issues specific to the Potomac River watershed, and includes Lessons on best management practices and strategies that students can adopt to improve water quality in their local community. The fourth and final section offers established stewardship projects that you can implement at your school. These Activities include a *Growing Native* seed collection; a *Growing Native* Grow-out Station (a small-scale tree nursery); and a Plant-A-Seed project that engages students in hands-on projects to assess water quality and investigate riparian forests.

The *Growing Native Education Guide* provides issue-based learning experiences; promotes hands-on, field-based learning; and develops awareness and understanding of local river conservation issues. With the implementation of this *Education Guide* by dedicated educators like you, students will be inspired to protect and restore the Potomac River watershed, its tributaries, and the Chesapeake Bay.

Lesson Format

The Lessons in *The Growing Native Education Guide* are formatted so that educators like you can easily use and follow them. Each Lesson is clearly and concisely presented, and most materials (including additional student and teacher documents) that are required to complete the Lesson are provided within the *Education Guide*.

The Lessons are multi-disciplinary with an emphasis on science topics. Many Lessons combine hands-on classroom activities with outdoor components to augment students' understanding of the subject matter within the context of their local environment.

The format of the Lessons is consistent throughout the *Education Guide*, and each component is explained in detail below.

NAAEE Guidelines for Learning & State Standards

The North American Association for Environmental Education (NAAEE) is the professional association for environmental educators. It is a network of professionals, students, and volunteers working throughout North America and around the world. NAAEE members want people to understand the environment better so that they know how to take care of it. At the same time, NAAEE believes in teaching people *how* to think, not *what* to think, and in moving people from gaining information to acting on that information in ways they think best for their own lifestyles.

As a professional association, NAAEE created several sets of quality standards, called the “Guidelines for Excellence.” One of these sets, the Guidelines for Learning, explains how to integrate environmental education in K-12 classrooms, with guidelines cross-referenced to national standards in a variety of subject areas (e.g., science, math, etc.). The Lessons in the *Growing Native Education Guide* are based on the Guidelines for Learning to help ensure that teachers are using activities that demonstrate high-quality environmental education and meet national learning standards. To learn more about these Guidelines for Learning, visit www.naaee.org/programs-and-initiatives/guidelines-for-excellence/.

In addition to the NAAEE guidelines, the Lessons are correlated to state standards throughout the Potomac River watershed. Visit the education page at www.growingnative.org to find state standards for Maryland, Pennsylvania, Virginia, West Virginia, and Washington, D.C., and the most up-to-date copy of the NAAEE Guidelines for Learning to which each of the Lessons in the *Growing Native Education Guide* have been correlated.

Target Geographic Area

The *Growing Native Education Guide* is intended for formal and non-formal educators throughout the Potomac River watershed, which encompasses parts of Maryland, Pennsylvania, Virginia, and West Virginia, and all of Washington, D.C. Although the content of the Lessons—including many of the student documents, maps, and background information—are focused on the Potomac River watershed, the Lessons may be adapted to teach about the broader Chesapeake Bay watershed.

Target Age

The target age for the Lessons in the *Education Guide* is fourth through eighth grade. This age range was chosen because many states in the target area introduce watershed issues to students in these grade levels. Because the Lessons are designed to be applicable to five grade levels across such a large geographic area, you should modify the Lessons to suit your curricula. The Lessons are extensive, and while it is advisable to complete each in its entirety to cover all of the issues, skills, and standards it presents, this may not be practical. Therefore, it is expected that you will use the Lessons in the *Education Guide* as flexible, rather than a rigid, resources—modifying, abbreviating, or extending them as needed.

Lesson Outcomes

Lesson Outcomes encompass both the enduring understandings and the skills that students will accomplish during the Lesson. Inspired by *Understanding by Design*¹ (a leading approach on curriculum development), the format of the Lesson Outcomes includes two sections:

¹ Wiggins, Grant P. and Jay McTighe. *Understanding by Design*. New York: Prentice Hall, 2005.

Students will understand...

These enduring understandings, based on the larger ideas of the topic being presented, are what the students should ascertain by the end of the Lesson. These understandings give meaning to the facts and skills associated with the topic, and allow students to incorporate these new understandings into their own perspectives of the environment and the world around them.

Students will be able to...

Students will be able to participate in and acquire these key skills and knowledge throughout the course of the Lesson. The knowledge specifics are tied to the larger ideas presented in the Lesson, and the skills are tangible, measurable actions.

Duration of Activity

The durations of the Lessons typically extend beyond a traditional class session. Many are two to three hours long. It will be necessary for you to read through each Lesson and break it up over the course of more than one class—or use only portions of the Lesson—to meet allotted class time.

Vocabulary Words

Each Lesson includes a list of vocabulary words that students will encounter as they complete the Lesson and associated Student Pages. These words are bolded within the Student Pages so that students are aware that they should pay particular attention to them. Additional vocabulary words are also identified with bolding within the Lesson itself. Whether included in the Lesson, Student Pages, or Teacher Pages, definitions for all bold vocabulary words may be found in the Glossary.

Settings

Most of the settings for the Lessons are indoors with an outdoor component. An exception, Section Four includes three outdoor Activities. Occasionally, students will be required to prepare for a Lesson with a homework assignment; if homework is required, it is stated in the Lesson procedures.

Materials

Materials are listed for each Lesson. Many of the materials include supporting Student and Teacher Pages, which are provided within the *Education Guide*. Read through the materials list before starting the Lesson so that you can prepare supplies, including copies of Student Pages.

Background Information

An extensive Background Information section provides details specific to the Lesson topics and to the Potomac River watershed. This section includes information that is important, relevant, and intended to provide you with knowledge of the subject matter so that you can confidently teach the Lesson. If concepts are new to you, it may be necessary to conduct additional research prior to teaching the Lesson.

Essential Questions

Essential Questions are intended to encourage students to explore their thoughts about a topic or issue, and to prompt their interest in the subject matter. These questions do not have simple yes or no answers. According to *Understanding by Design*, the aim of Essential Questions is, “to stimulate thought, to provoke inquiry, and to spark more questions—including thoughtful student questions—not just pat answers.”

Pre-assessment

The Pre-assessment is intended to gauge students’ prior knowledge regarding the subject matter and Lesson topics, and generally involves an introduction of the Essential Questions. It is advisable, and often noted in the Pre-assessments, to record students’ responses to the Pre-assessment discussions, and to compare these initial responses to those during the Post-assessment activities. This will help you gauge what students have learned and determine if the Lesson outcomes were achieved.

Lesson Procedures

Lesson Procedures are composed of step-by-step instructions for you to follow as you teach the Lesson. Detailed information is included in the procedures to make it easy for you to follow, and some Lessons provide additional Teacher Pages to further help you understand the subject matter and administer the Lesson.

Post-assessment

The Post-assessment includes activities that encourage students to summarize what they have learned throughout the Lesson, and should be used to determine if the Lesson Outcomes were achieved. Although it may not be stated within the Post-assessment, when appropriate, you should use your standard grading system to evaluate students' work.

Extensions

Extensions are additional activities you can undertake with students to further teach the concepts and issues presented in the Lesson. These Extensions often include additional research, community investigation, and outdoor experiences. For many of the Extensions, a brief explanation of the activity is presented and includes resources for more detailed instruction. Occasionally, a Lesson may include additional Student Pages that support Extension activities.

Take Action

Numerous environmental problems facing the Potomac River watershed are presented in the Lessons. The Take Action section offers simple, yet effective, ideas that you can suggest to empower students to make an individual, positive difference in their community. These actions are intended to be taken by students outside of the Lesson, on a broader and longer-term scale.

Additional Resources

Additional Resources are provided within each Lesson that are specific to the topics and issues presented. These resources are appropriate for both you and your students, and are intended to help you learn more about the Lesson topics. The Additional Resources often include interactive web sites that offer student-friendly information and activities specific to the Potomac River watershed or the Chesapeake Bay. These resources are not ranked in order of importance, and all are noteworthy.

Student Pages

Each Lesson includes a varying number of Student Pages. These documents are intended to support students in their exploration of the subject matter, and are often designed to help students document what they have learned throughout the Lesson.

Teacher Pages

Teacher Pages are intended to support your implementation of the Lesson. They provide additional background information about the subject matter, specific details for Lesson Procedures, or Answer Keys to Student Pages. The quantity of Teacher Pages varies by Lesson.

