

GREEN



EXPLORING FOREST CAREERS



Project Learning Tree educates teachers and youth about forests and the environment. PLT is an initiative of the Sustainable Forestry Initiative.

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SFI-00001

The Sustainable Forestry Initiative Inc. envisions a world that values and benefits from sustainably managed forests.

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GREEN JOBS: EXPLORING FOREST CAREERS

INTRODUCTION

Green Jobs: Exploring Forest Careers is designed for educators and other adults working with middle-and high-school-aged learners. Its aim is to engage learners in actively exploring green forest careers through activities in which they research forestry jobs, and practice managing and monitoring forest resources.

ABOUT PROJECT LEARNING TREE

Project Learning Tree® (PLT) is an award-winning environmental education initiative designed for teachers and other educators, parents, and community leaders working with youth from preschool through grade 12.

PLT provides educators with high-quality professional development, hands-on activities, and multi-disciplinary supplemental curriculum that can be easily integrated into lesson plans for all grades and subject areas to help teach youth about trees, forests, and the environment.

Project Learning Tree helps develop students' awareness, knowledge, and appreciation of the environment, builds their skills and ability to make informed decisions, and encourages them to take personal responsibility for sustaining the environment and our quality of life that depends on it. Learn more at www.plt.org.

For more about PLT and its educational resources, see pages 82-83.

The Sustainable Forestry Initiative® Inc. (SFI) envisions a world that values and benefits from sustainably managed forests. PLT is an initiative of SFI. Through PLT and other initiatives, SFI supports getting youth outdoors and into nature in ways that inspire them to become environmental stewards and future forest leaders, and to introduce them to green careers. Learn more at www.sfiprogram.org.

Green Jobs: Exploring Forest Careers was developed in partnership with PLT Canada as part of an initiative to place youth in summer jobs within the forestry, conservation, and parks sectors. Providing youth with first-hand experiences in green jobs can inspire them to become lifelong forest supporters and conservation leaders, and help to nurture an enduring connection to nature. Learn more at www.pltcanada.org.

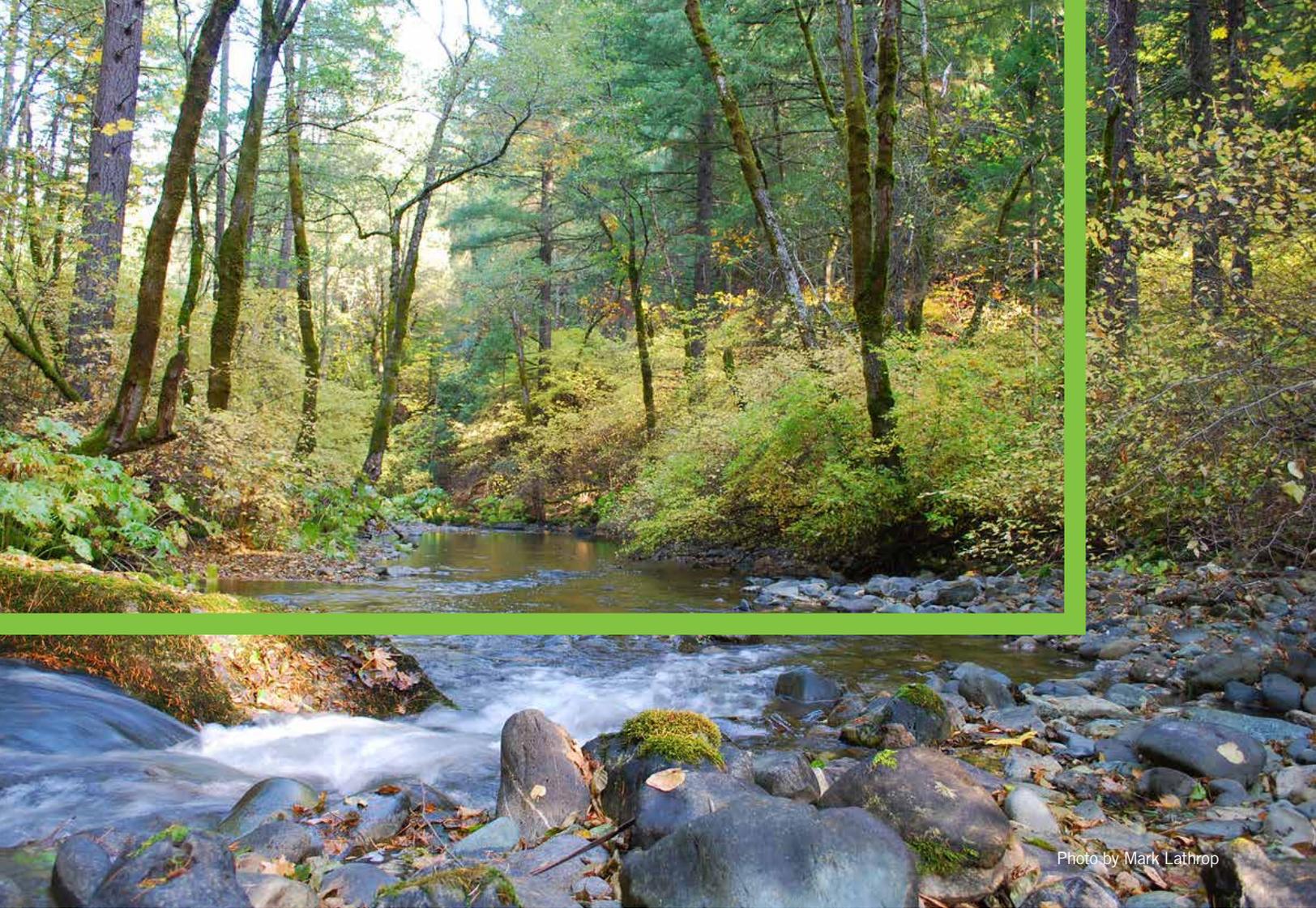


Photo by Mark Lathrop

*“Given the current expectations attached to forests as carbon sinks and considering their role as providers of renewable raw material, pools of biodiversity, regulators of water flows and other environmental services, **it is clear that green jobs in forests will play an increasingly important role in the future.**”¹*

¹ Source: United Nations Economic Commission for Europe (UNECE), 2018 - Green Jobs in the Forest Sector report by the United Nations. www.unece.org/fileadmin/DAM/timber/publications/DP71_WEB.pdf



HOW TO USE THIS RESOURCE

Green Jobs: Exploring Forest Careers is geared for educators working with middle-and high-school-aged youth. It contains four activities and supporting resources to engage learners in actively exploring green careers. It may be used by classroom teachers, youth group leaders, school counselors, career coaches, and many other formal and nonformal educators.

The learning activities have been designed with flexibility in mind. Educators have the option to select activities appropriate for their learners and their unique settings. You may choose to use individual activities or use the entire set of activities as a stand-alone unit.

See Example Standards Connections on pages 79-80 for specific examples of how to connect the activities to education standards.

RELATED SUBJECTS

Some or all of the learning activities may be used to enhance a range of subjects:

- Arts
- Biology
- Career Technology Education
- Earth Science
- Ecology
- English
- Environmental Science
- Forestry
- Geography
- Government
- Information and Communication Technologies
- International Studies
- Mathematics
- Natural Resources
- Science
- Social Studies

LEARNING ACTIVITY



To differentiate between the four learning activities, each one features a unique color theme for its titles, page borders, and text boxes.

WORKSHEET



All of the worksheets contain green borders and are signified by this icon.



LEARNING ACTIVITY COMPONENTS

Each of the four learning activities contains the following components.

LEARNING OBJECTIVES

States the content objectives targeted by this activity for all learners.

LINKING TO LIFE

Lists the materials needed to conduct the activity.

BACKGROUND

Recommends time allotments for leading the activity, including preparation.

GETTING READY

Describes how to prepare for facilitating the activity.

DOING THE ACTIVITY

Provides step-by-step procedures for leading the activity.

STEM IT UP!

Offers suggestions for enhancing the activity's connections to STEM teaching and learning strategies.

CAREER CONNECTIONS

Suggests ways to broaden or deepen learners' exploration of forest careers.

ENRICHMENT

Contains suggestions for exercises that enrich or extend the learning experience in the activity.

WORKSHEETS

Copyright-free reproducible handouts for learners, signified with a green border and common icon. Also available for PDF download at plt.org.

SIDEBAR

STEM SKILLS

Lists the learners' STEM Skills (identified on pages 16-17) that are developed and strengthened by participation in the activity.

MATERIALS

Lists the materials needed to conduct the activity.

TIME

Recommends time allotments for leading the activity, including preparation.



Foresters using a diameter tape to measure a tree and to determine the density of a certified forest.

THE FUTURE IS GREEN

Today's youth, more than ever, seek rewarding careers that will help the world move towards more sustainable lifestyles and greener economies. The next generation wants to work with purpose. They want to find a job they can be proud of, and they want to feel like they are making a difference in the world.

"Green" jobs have outpaced jobs in other categories by almost 250 percent over the last decade, and growth doesn't appear to be slowing down anytime soon. According to the International Labour Organization, there were 9.8 million green jobs in 2017 and by 2030, there will be an additional 15-60 million new green jobs.²

As defined by the U.S. Bureau of Labor Statistics, green jobs are jobs that produce goods or services that benefit the environment or conserve natural resources.³ In helping to care for the environment, green jobs are crucial for ensuring the sustainability of our planet and its resources into the future.

² Frequently Asked Questions on Green Jobs." International Labour Organization. www.ilo.org/global/topics/green-jobs/WCMS_214247_EN/lang-en/index.htm The Future of Jobs. World Economic Forum

³ Green Jobs: Measuring Green Jobs. U.S. Bureau of Labor and Statistics. www.bls.gov/green/home.htm

Green jobs help:

- Create sustainable environments
- Find a balance between environmental, social, and economic needs
- Ensure wise use of energy and raw materials
- Minimize pollution and greenhouse gases
- Protect and restore ecosystems
- Educate about nature and sustainability
- Enhance human health and well-being

Green jobs may be found in forests and conservation, as well as in more traditional sectors like manufacturing or construction. They can be in nonprofit organizations, government, business, or education settings and can encompass areas as diverse as energy, environmental education, food, forestry, transportation, waste management, or water and watersheds, to name just a few.

GREEN JOBS IN FORESTRY

Some of the most exciting—and perhaps greenest—green jobs involve forests. These jobs help to sustain forest ecosystems and ensure that the forest products we rely on are produced in the most sustainable way possible, ensuring that wildlife habitat is conserved, trees are replanted, and workers are treated equitably.

There is a wide array of jobs related to forests, offering opportunities for people with diverse backgrounds, skills, interest areas, and personal qualities.⁴ These include careers in:

- Forest management, inventory, and planning
- Biodiversity and ecosystem functioning
- Education and research
- Wood products manufacturing
- Health and recreation
- Wood and energy production
- Social and urban development

See the “Working for Forests” worksheet on pages 27-30 for a brief description of 24 different forest careers.

⁴ United Nations Economic Commission for Europe (UNECE). 2018 - Green Jobs in the Forest Sector. www.unece.org/fileadmin/DAM/timber/publications/DP71_WEB.pdf.

Because of our forests, we are able to produce wood, recreation opportunities, wildlife habitat, watershed protection, fuel and air quality improvements. Forests provide so much that we use every day and don't even think about!¹¹

Sonja Oswalt, Forester

¹¹ From: Natural Inquirer Scientists and Engineers Card Series. U.S. Department of Agriculture, Forestry. www.naturalinquirer.org/scientists-v-168.html

A trained harvester uses machinery to cut trees, which requires hand-eye coordination to minimize tree damage in a well-managed forest.



WHY FOCUS ON FORESTS

No matter who you are or where you live, you depend on forests. Forests are one of the most prominent natural communities on Earth, covering about 30 percent of the Earth's total land area.

Forests provide a huge variety of benefits and services, as well as multiple and varied opportunities for employment. Our global community needs all kinds of professionals and skilled workers to ensure that forests and forest goods are managed sustainably so that they will continue to provide their many benefits today and for generations to come.

The benefits of forests go far beyond their boundaries. Forests are vital to the functioning of Earth's essential systems, including the carbon cycle, soil cycle, water cycle, and climate. Forests clean the air we breathe and filter the water we drink.



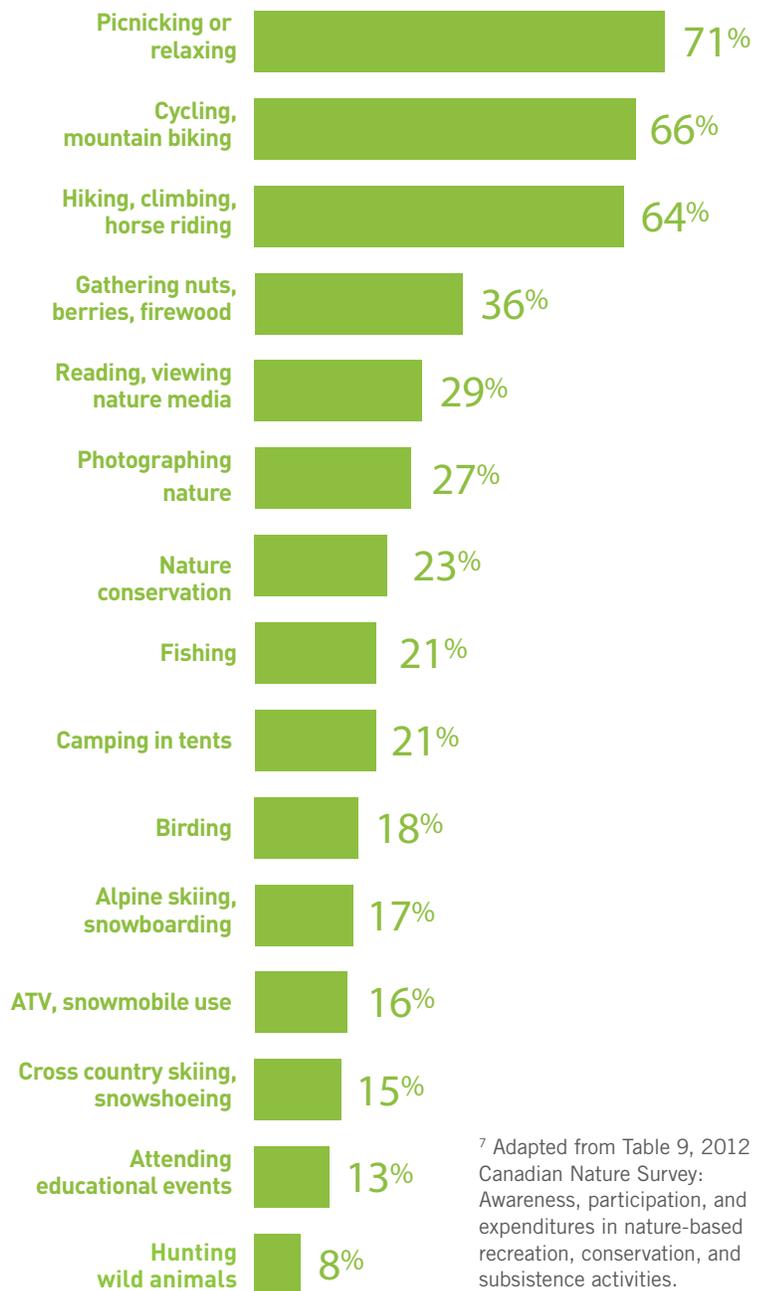
They provide food, fuel, shelter, and a variety of forest products for humans, as well as habitat for millions of plant and animal species. They store carbon from the atmosphere, helping to mitigate the effects of climate change. And they improve our quality of life by providing us with recreational opportunities and natural beauty.

Forests also are crucial to the world economy. The World Bank estimates that the formal timber sector alone employs more than 13.2 million people worldwide, produces 5,000 types of wood-based products, and represents 10% of the world's gross domestic product.⁵

Wood harvested from sustainably grown trees is renewable and recyclable. Sustainable forest management means that the annual timber harvest does not exceed annual forest growth.⁶ It also means protecting water quality, safeguarding fish and wildlife habitat, and ensuring the regrowth of trees after harvest through natural regeneration or tree plantings where applicable. Responsible forest management maintains forestland, while also supplying the world with this remarkable and sustainable material.

FOREST RECREATION

Forest professionals perform a variety of tasks that enable the public to safely access and enjoy activities in forests. This graph shows the results of one study, indicating the percentage of respondents who participate in different forest activities.⁷



⁷ Adapted from Table 9, 2012 Canadian Nature Survey: Awareness, participation, and expenditures in nature-based recreation, conservation, and subsistence activities.

⁵ Forests Generate Jobs and Income. World Bank. March 16, 2016. www.worldbank.org/en/topic/forests/brief/forests-generate-jobs-and-incomes

⁶ Sustainable Forest Management. Oregon Forest Resources Institute. oregonforests.org/content/sustainability

FROM THE FOREST

Many forest jobs are involved in bringing us a wide range of forest products such as:

IN YOUR HOME

Furniture
Picture frames
Piano keys
Medicines
Toothbrushes
Detergent
Carpeting
LCD screens on TVs
Cosmetics
Textiles – lyocel and rayon
Imitation leather
Greeting cards and envelopes
Decks and stairs

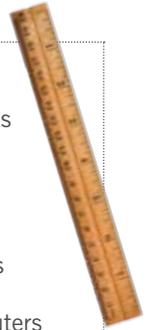
IN THE WORKSHOP

Turpentine
Varnish
Adhesives
Paint
Boxes
Pallets
Doors
Garden tool handles
Sporting goods
Toys



AT YOUR SCHOOL

Books and notebooks
Rulers
Crayons
Paper
Calendars
Glue and adhesives
Cork boards
LCD screens on computers
Desks
Chewing gum
Folders
Bristol board
Kraft paper



IN YOUR KITCHEN

Spices
Mushrooms
Tea
Maple syrup
Nuts
Paper straws and plates
Napkins and paper towels
Waxed paper
Milk cartons
Cabinets
Stirring spoon



AROUND TOWN

Construction materials
(I-beams and joists)
Cross-laminated timber (CLT)
Glulam
Plywood
Lumber
Homes and businesses
Fences
Rubber tires
Shatterproof glass

INDIGENOUS PRODUCTS

Canoes (dugout and birchbark)
Traditional medicines
Acetylsalicylic acid (aspirin)
Baskets
Moccasins
Berries
Lacrosse sticks
Totem poles
Toboggans
Bunk beds

BENEFITS OF GREEN JOBS

Green jobs provide environmental, economic, and social benefits for individuals, communities, and the global society. Major benefits include:

GROWING DEMAND. Green jobs represent one of the fastest growing and changing segments of the global economy. This growing field can provide opportunities for workers, especially if they are creative and flexible.

WORKER SATISFACTION. Most people want to make a positive difference in the world, and pursuing a green job is a great way to do just that. In fact, worker satisfaction is significantly higher in green sectors than in the economy at large.⁸

QUALITY OF LIFE. Workers in green forest jobs are typically able to find a healthy work-life balance. Opportunities to work outdoors doing what they love helps these workers maintain a good quality of life.

FINANCIAL STABILITY. Many green jobs pay well because they require specialized skills. Many also provide job security as they cannot be outsourced.

SUSTAINABLE FUTURE. Green jobs help to ensure environmental sustainability for all of us. Workers in the forest sector help to balance environmental, economic, and societal needs for current and future generations. For more about sustainability, see “What is Sustainability?” on the next page.

What I like about my job is the ability to apply my knowledge practically and to know that I am creating change for the better. Today, as forest managers, we work for the continuous improvement of the forests.⁹

Margaret Donnelly, Regional Biologist
Louisiana-Pacific Corporation

WHAT IS SUSTAINABILITY?

Sustainability is a complex concept. It presumes that resources are finite and should be used wisely with a view to the long-term. A commonly shared definition of sustainability comes from the UN World Commission on Environment and Development: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs.”¹⁰

Sustainable forest practices support environmental health, social well-being and economic prosperity both now and into the future. Many international efforts are underway to increase the sustainability of the world’s forests.

See the activity “Seeking Sustainability” starting on page 70 for more information about the concept of sustainability and details about the Sustainable Development Goals of the United Nations.

Forest certification is one tool to help consumers assess whether the products they buy are from sustainably managed forests. Certification ensures that environmental health, social well-being and economic prosperity are addressed through the management of the forest and product manufacturing. See the Enrichment section on page 73 for more about certification.

I have always enjoyed camping, canoeing, cross-country skiing, and just being in the woods. Forestry gives me a deeper understanding of how the forest works and how people and communities fit into ecology.¹¹

Mike Dockry, Research Forester
U.S. Forest Service

⁸ Holder, Mark. “Higher pay and job satisfaction: Do green jobs offer a snapshot of the future?” Business Green. March 7, 2018. www.businessgreen.com/bg/opinion/3027957/higher-pay-and-satisfaction-do-green-jobs-offer-a-snapshot-of-the-future.

⁹ From: Natural Inquirer Scientists and Engineers Card Series. U.S. Department of Agriculture, Forestry. www.naturalinquirer.org/scientists-v-168.html

¹⁰ Our Common Future: Report of the World Commission on Environment and Development (also known as the Brundtland Report). 1987. www.un-documents.net/our-common-future.pdf www.ictinc.ca/blog/seventh-generation-principle

¹¹ From: Natural Inquirer Scientists and Engineers Card Series. U.S. Department of Agriculture, Forestry. www.naturalinquirer.org/scientists-v-168.html



PREPARING LEARNERS FOR GREEN JOBS

The green economy encompasses a widening array of careers and jobs, which makes it difficult to say with certainty what education or training will be needed for a given job. However, you can help learners prepare for green jobs in general by:

- Promoting green jobs as a viable option for all learners no matter their education pathway – especially if they are from under-represented groups, including females, Indigenous youth, people of color, immigrant youth, students with disabilities, and youth from low-income households.
- Encouraging participants to take science and math courses that will strengthen their knowledge base and help give them a problem-solving mindset. Biology, environmental science, or agriculture courses will be beneficial, whether or not learners pursue careers in these specific fields.
- Offering different opportunities for participants to use technology to conduct research, solve problems, use models, and present their findings. Even entry-level green jobs may require proficiency in word processing, data entry, and other applications.
- Giving learners practice in some of the “soft” or people-oriented STEM skills, not just science, technology, engineering, and math.

Employers are looking for workers who can communicate and collaborate, and who are creative leaders. See the “Ten STEM Skills for Everyone” worksheet on pages 16-17 for a self-assessment of skills that can help any worker in today’s job market.

To me trees are oxygen. They are life. They enable us to have a better quality of life and to live in an environment that nurtures us as living beings.¹²

Bob Baker, Forester
Credit Valley Conservation

¹² From: “Forest Related Careers.” Canadian Forestry Association.
www.canadianforestry.com/kits/english/Vol1_e.pdf/13Forest_Careers.pdf

Wildlife technicians lay down wire to capture grizzly bear fur samples for research that informs forest management decisions.



By doing what I like most, I am able to make useful contributions to our understanding of the environment we live in.¹³

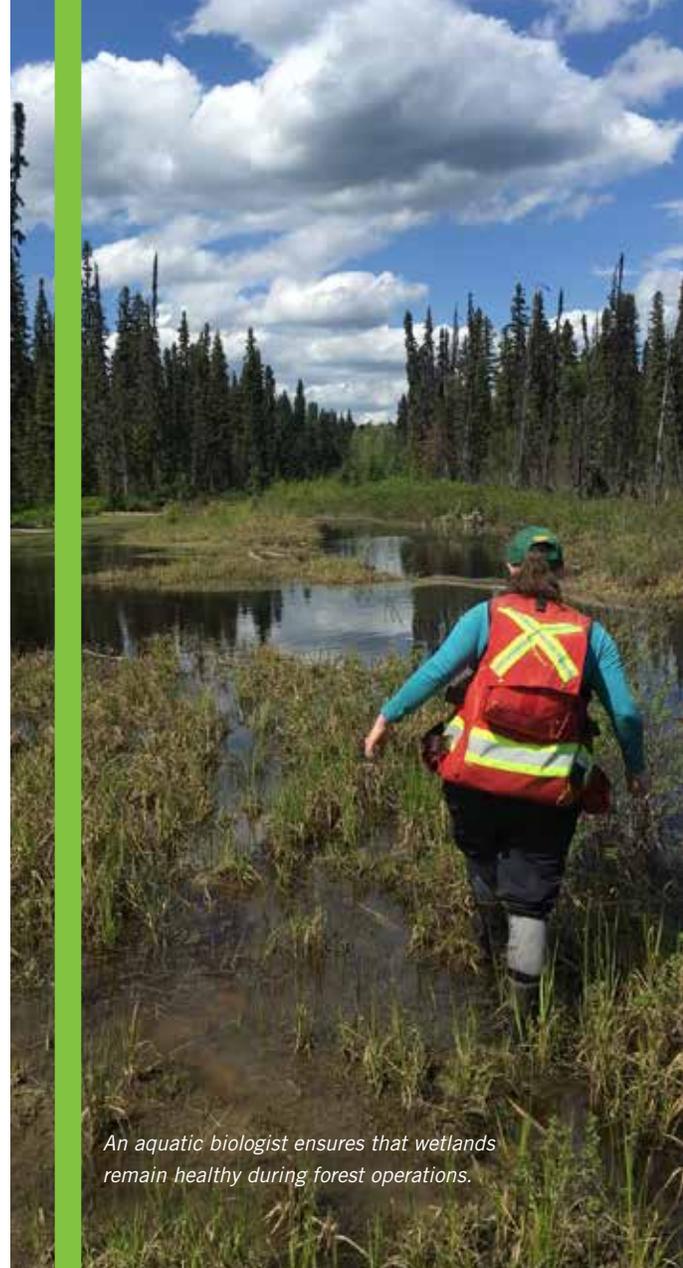
Haiganoush Preisler, Statistical Scientist
U.S. Forest Service

- Inviting people with a variety of green careers to speak with your students about their jobs and how they got into their current line of work. Look for people representing a range of jobs both within the green sector and in more traditional sectors. See “Finding Forest Professionals” on page 77 for suggestions of where to start.

In the area where I live and work, we are now experiencing drier summers, wetter autumns, and more frequent droughts. We are continuing to investigate what effect this may have on streamflow and forest health in the future.¹⁴

Stephanie Laseter, Hydrologist
U.S. Forest Service

GREEN JOBS



An aquatic biologist ensures that wetlands remain healthy during forest operations.

¹³ From: Natural Inquirer Scientists and Engineers Card Series. U.S. Department of Agriculture, Forestry. www.naturalinquirer.org/scientists-v-168.html & Canadian Forestry Association

¹⁴ From: Natural Inquirer Scientists and Engineers Card Series. U.S. Department of Agriculture, Forestry. www.naturalinquirer.org/scientists-v-168.html



WORKSHEET

TEN STEM SKILLS FOR EVERYONE

The term “STEM” usually refers to occupations or learning approaches involving science, technology, engineering, or mathematics. While many people think of STEM in terms of technical (“hard”) skills, most green jobs also require people-oriented (“soft”) skills. The following list of STEM skills developed by Project Learning Tree encompasses a wide variety of skills. These skills can help any job seeker in the green economy, whether or not you are aiming for a STEM career.

Conduct a self-assessment by rating yourself on a scale of 1 to 10 (with 1 low and 10 high) for each STEM skill listed. Compare your results before and after doing the *Green Jobs: Exploring Forest Career* activities.

Collaboration

	LOW										HIGH									
Cooperating with team members	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Finding points of agreement or consensus	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Taking responsibility for individual contributions	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10

Communication

Exchanging ideas with project partners	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Sharing project results	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Using different media to enhance communication	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10

Creativity

Looking at a problem from different perspectives	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Exploring new ideas	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Learning from failures	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10

Data Analysis

Assessing the accuracy of data	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Presenting data in a useful format	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
Identifying patterns in data	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10





Investigation

	LOW	1	2	3	4	5	6	7	8	9	HIGH	10
Posing a question to investigate	1	2	3	4	5	6	7	8	9	10		
Planning and carrying out investigation of a question	1	2	3	4	5	6	7	8	9	10		
Constructing an explanation based on findings	1	2	3	4	5	6	7	8	9	10		

Leadership

Leading projects or supporting a project team	1	2	3	4	5	6	7	8	9	10		
Developing a project plan and timeline	1	2	3	4	5	6	7	8	9	10		
Making decisions supported by data	1	2	3	4	5	6	7	8	9	10		

Nature-Based Design

Finding inspiration in and from nature	1	2	3	4	5	6	7	8	9	10		
Recognizing nature's solutions to problems	1	2	3	4	5	6	7	8	9	10		
Incorporating ideas from nature into design	1	2	3	4	5	6	7	8	9	10		

Organization

Precisely following instructions, protocols, or blueprints	1	2	3	4	5	6	7	8	9	10		
Recording data accurately	1	2	3	4	5	6	7	8	9	10		
Keeping track of lots of different information	1	2	3	4	5	6	7	8	9	10		

Problem Solving

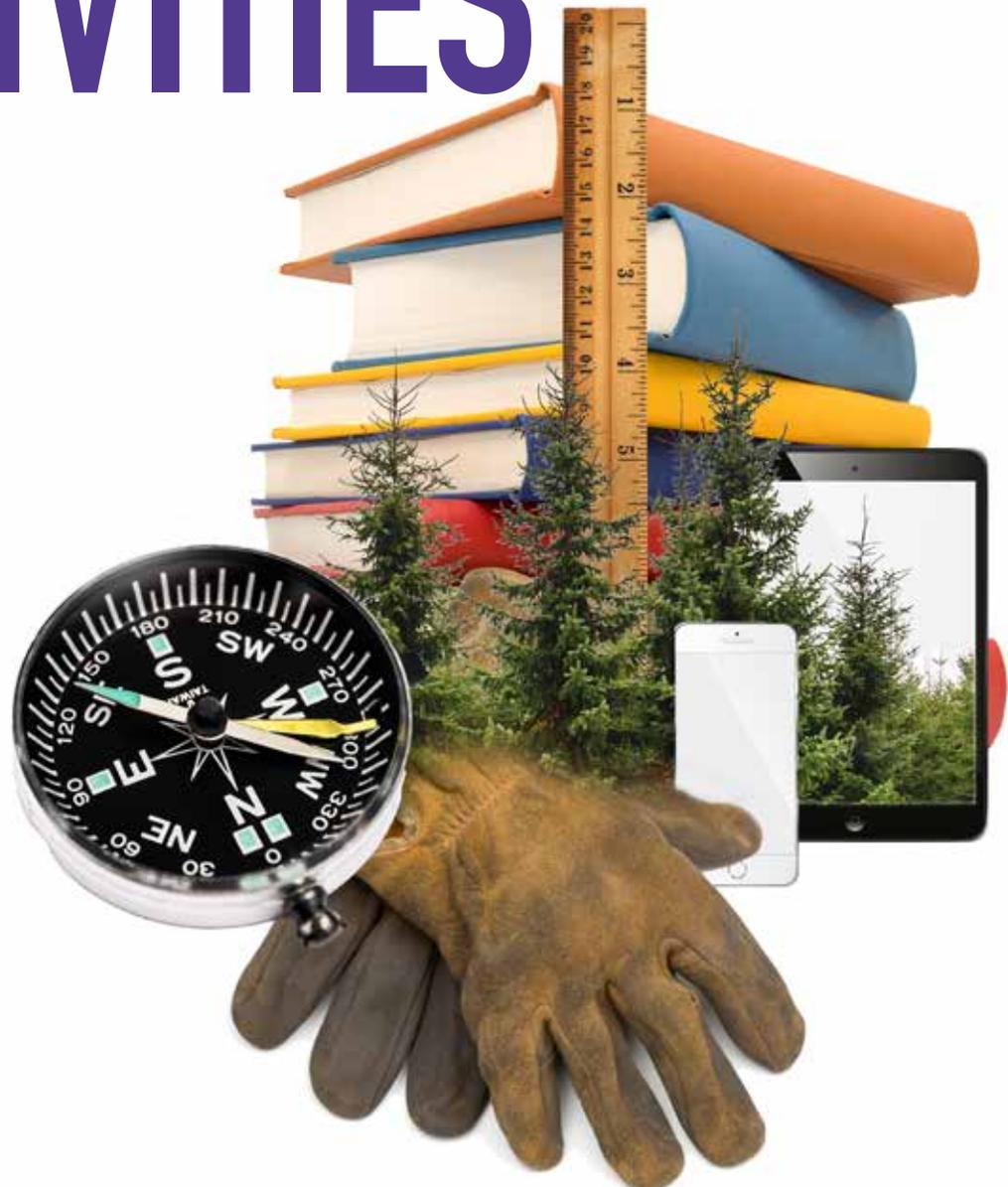
Defining a problem	1	2	3	4	5	6	7	8	9	10		
Finding points of agreement or consensus	1	2	3	4	5	6	7	8	9	10		
Using models to investigate a problem	1	2	3	4	5	6	7	8	9	10		

Technology Use

Identifying appropriate technology for a given application	1	2	3	4	5	6	7	8	9	10		
Using technology tools effectively	1	2	3	4	5	6	7	8	9	10		
Troubleshooting technology problems	1	2	3	4	5	6	7	8	9	10		

GREEN JOBS: EXPLORING FOREST CAREERS

LEARNING ACTIVITIES



ABOUT THE LEARNING ACTIVITIES

The four learning activities contained here will engage youth in exploring forest-related green jobs. They are designed to be flexible and can be used as individual, stand-alone lessons or all together as a cohesive unit of instruction.

Depending on your program, you may teach these activities in the sequence provided, switch the order, or pick and choose components from different activities. You might also consider using individual activities as the framework or basis for other areas of study, including those listed in the Related Subjects box on page 6.

Feel free to use or modify these activities in ways that best meet your program goals.

1. WHO WORKS IN THIS FOREST?

As an introduction to some of the people who work in and on behalf of forests, learners research different forest sector careers to learn what it takes to perform these jobs.

SUGGESTED TIME ALLOTMENT: One to two 50-minute sessions, plus additional time for research

2. IF YOU WERE THE BOSS

Acting as foresters, learners grapple with decisions about how to manage a forest sustainably while serving different needs.

SUGGESTED TIME ALLOTMENT: Two to three 50-minute sessions for research

3. MONITORING FOREST HEALTH

Through a variety of health indicators, learners assess the health of a forest stand, and see how soil scientists, wildlife biologists, arborists, and other forest professionals monitor trees and forests.

SUGGESTED TIME ALLOTMENT: One 50-minute session, plus approximately 90 minutes or more in the field

4. SEEKING SUSTAINABILITY

Learners explore the concept of sustainability by examining the United Nations' 17 Sustainable Development Goals, while also taking a look at some jobs involved in ensuring forest sustainability.

SUGGESTED TIME ALLOTMENT: One to two 50-minute sessions, plus time for groups to prepare their displays



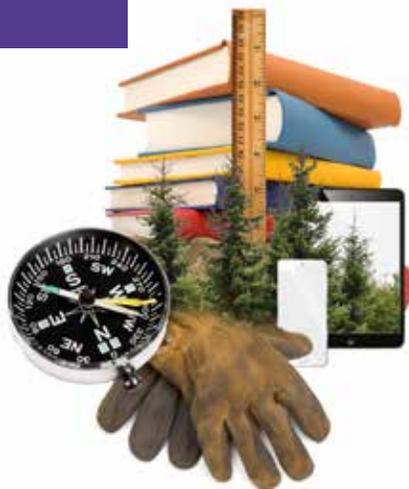
These activities are adapted from existing Project Learning Tree (www.plt.org/) resources:

1. PreK-8 Environmental Education Activity Guide (www.plt.org/curriculum/environmental-education-activity-guide available in the U.S. at shop.plt.org);
2. Exploring Environmental Issues: Focus on Forests (www.plt.org/curriculum/focus-on-forests available only in the U.S. through a PLT State Coordinator); and
3. Global Connections: Forests of the World (www.plt.org/curriculum/forests-of-the-world available only in the U.S. through a PLT State Coordinator).

These and other educational resources from Project Learning Tree offer dozens of related activities that can be used to supplement and extend the learning activities in this guide. See page 77 for more information.



LEARNING ACTIVITY



STEM SKILLS

Communication,
Investigation,
Organization

MATERIALS

Copies of the “Working for Forests” and “Exploring Forest Jobs” worksheets, scissors, access to the internet, video to introduce forest careers (optional)

TIME

PREPARATION

15 minutes

ACTIVITY

One to two 50-minute sessions, plus additional time for research

1. WHO WORKS IN THIS FOREST?

As an introduction to some of the people who work in and on behalf of forests, learners research different forest sector careers to learn what it takes to perform these jobs.

LEARNING OBJECTIVES

- Explore a variety of forest careers.
- Identify the training or education requirements and supporting skills for specific forest sector jobs.

LINKING TO LIFE

- Learners describe a forest-related job that piques their interest and explain what appeals to them about this job.

BACKGROUND

Our society depends on forests for timber and other forest products, as well as for wildlife, clean air, water, and recreation. In nature, forest ecosystems are controlled by sunlight, precipitation, temperature, and soil fertility. Disturbances, such as windstorms, insect infestation, tree disease, and lightning also have a role in regulating forest ecosystems.

Within the field of forestry, people manage forests in ways that mimic nature in a sustainable manner so that forests provide all the things we need and want from them. Forestry is more than just planting trees, fighting forest fires, or harvesting logs, although managing those tasks may be part of a forester’s responsibilities. Forestry also includes professionals who specialize in individual parts of the forest, such as soils, water, or wildlife. It encompasses work in computer modeling, mapping, statistical or budget analysis, and education. It also includes people engaged in harvesting, milling, engineering, or marketing forest products such as lumber, plywood, paper, and pulp.



Urban and community foresters focus on the trees and forests that grow in and around cities, towns, and communities, including naturally occurring and planted trees. These trees provide a number of benefits: reducing energy costs, managing stormwater, enhancing human health, creating jobs, increasing property values, providing food security, and increasing climate resilience. Urban and community foresters develop plans for attaining an optimal number of trees in the urban forest and help to develop tree-related ordinances. They also pay close attention to factors that affect those forests, such as limited growing space, air and soil quality, water availability, and vandalism. Urban and community foresters try to increase the average life span and maintain the aesthetic quality of trees on streets and in parks or surrounding forests.

GETTING READY

- Make copies of the worksheets.
- (Optional) Find a video to introduce forest careers. See “Teaching Tools” on page 78 for possibilities.
- Decide how learners will research different forest jobs and answer the questions on the “Exploring Forest Jobs” worksheet. You may opt to have learners perform informational interviews or conduct online research on their own. Alternatively, you may choose to have individuals with forest-related jobs come and speak to your group, with learners preparing questions to ask each person about their work (see “Finding Forest Professionals” on page 77 for suggestions).
- Check out the PLT Forestry Career Fact Sheets, available at www.plt.org. These provide an overview of individual forestry careers, similar to the sample forester career fact sheet on pages 34-35.

A wildland firefighter maintains the health of the forest by preventing, controlling, and putting out wildfires



CAREER CONNECTION

Invite learners to take a personality test to help them determine what types of forest-related jobs might be a good fit for them, using the “Your Personality and Green Jobs” worksheet on page 32. Also invite them to use the “Ten STEM Skills for Everyone” worksheet on page 16 to further refine their assessment. Learners may use their results to explore potential careers and as criteria for categorizing the jobs listed on the “Working for Forests” worksheet.

Alternative tests include:

Forestry Career Quiz

A brief test that highlights six broad roles in the forestry industry.
workwild.ca/career-profiles/

STEM Type Quiz

A quiz that categorizes eight different STEM job clusters. (Begin with the “Find My STEM Type” button.)
stemjobs.com/stem-type-quiz-main/#/stem_types

Personality Type Questionnaire

A free tool with 68 yes-or-no questions that sort into 16 personality types.
www.personalitytest.net/cgi-bin/q.pl

Myers-Briggs, Keirsey Temperament, StrengthsFinder, or other personality assessment system. Check whether your school or district subscribes to a career-planning service that offers these or other personality tests.

STEM IT UP!

Help learners use LinkedIn or other social media tools to begin developing a career-finding network. They should start by creating or updating their online profile, and then connecting with people among their personal contacts. To expand their network, they might join LinkedIn Groups or other social media interest groups for school groups, volunteer organizations they work with, or other interest areas. Discuss with learners the importance of appearing professional on these sites, such as choosing appropriate pictures of themselves, using proper spelling and grammar, and not posting spam.

DOING THE ACTIVITY

1. (Optional) Share a video to introduce different forest careers to learners. (See Getting Ready.)
2. Ask learners whether they've ever heard the term "green job" before. Can they think of green jobs that are related to forests or the field of forestry? Invite the group to brainstorm and record a list of forest-related green jobs.
3. Elicit from learners their ideas for what forests provide, such as:
 - Plant and animal habitats,
 - Paper and wood products,
 - Places for recreation, and
 - Air, soil, and water protection.

Make the connection that forests can be managed by people to enhance each of these different resources. Challenge learners to add more jobs to their list based on this discussion.

4. Distribute the "Working for Forests" worksheet and have learners cut apart the jobs. Learners may work in pairs or teams to categorize the jobs by different criteria such as indoor versus outdoor, high tech versus low tech, amount of interaction with other people, academic discipline, education level, and so on. Explain that learners will each select a forest-related job to explore more deeply, either one described or listed on the worksheet or another of their choosing.
5. Distribute copies of the "Exploring Forest Jobs" worksheet and have learners use the questions to guide research on a particular job they have chosen. You may have them conduct informational interviews or internet research (see "Informational Interviewing" on the opposite page for tips and "Additional Resources" on page 77 for career websites that may help them). In addition to the questions listed, learners may want to check websites to get a sense of the annual pay range for their chosen job.
6. Ask learners to share their findings with the group, encouraging them to be creative. Possibilities include giving brief oral presentations, producing video clips, designing posters for a gallery walk, or developing career portfolios or résumés for their interview subjects.





INFORMATIONAL INTERVIEWING

An informational interview is an informal conversation with a person working in a particular career field. Encourage learners to conduct informational interviews to glean firsthand information about the realities of working in that field. Make sure they understand that the purpose is to explore careers, not to find job openings or to land a job.

Learners may feel shy about arranging to talk with a stranger about their work. Let them know that most people enjoy spending a few minutes chatting about their chosen profession with someone interested in their field. To find potential contacts, see “Finding Forest Professionals” on page 77 for ideas of where to start. Consider conducting a mock interview session in pairs, with one learner role-playing the interviewee and the other asking questions.

TIPS FOR SUCCESS

Share with learners the following tips for successful interviews:

- Do some homework on the person or the organization they work for, checking the organization's website or the person's online profile to find out their background and interests.
- Contact the person by phone or email. Mention how you got their name and emphasize that you are looking for information, not a job. Ask for a convenient time to talk for 20-30 minutes in person, by phone, or through an app like Skype. Be prepared to ask your questions right then, if that is the best time for the person.
- If the interview is in person, dress neatly and appropriately. Arrive on time or a few minutes early.
- Introduce yourself, your background, and your goals. Ask your prepared questions, but also let the conversation flow naturally.
- Respect the person's time, keeping the interview to the agreed-upon length. Ask whether you may contact them again if you have additional questions.
- Within a day or two after the interview, send a thank you note to express your appreciation for their time and information. This may be hand-written, an email, or a typed business letter.
- Keep in touch with the person. If you followed their advice, let them know how things are going as a result.

ENRICHMENT

- Forest careers are changing and the ability to innovate will be an important aspect of forest jobs in the future. Challenge learners to create a new job or tool related to forests. Encourage them to think about a forest-related problem they would like to solve (such as litter or pollution) and then invent a job or tool to help solve it. For example, their job might involve a virtual reality teaching tool, a mobile app, or a new forest product.
- Invite learners to study the *Green Jobs in the Forest Sector* report from the United Nations Economic Commission for Europe to find possible new jobs to explore. The report includes a table for each forest sector area that lists trends, opportunities, and jobs that would be increasingly needed. http://www.unece.org/fileadmin/DAM/timber/publications/DP71_WEB.pdf
- Print and distribute a set of *Natural Inquirer Scientists and Engineers Cards* (see “Teaching Tools,” on page 78), which describe real-life forest professionals. Try one or more of the following with learners:
 - Organize the cards into the same categories and criteria suggested in step 3 of the activity.
 - Locate a scientist card that contains parallels to specific jobs detailed on the “Exploring Green Jobs in the Forest” worksheet. In what ways does the scientist on the career card embody the necessary skills, characteristics, or training for the job?
 - Pick any card and challenge youth to consider how this person’s personality test results might compare to their own (see the “Career Connection” on page 23).
 - Create new cards, with each learner crafting their own. On one side of the card, youth can put their photo, name, potential forest career, and a job description. On the reverse side, suggest that youth document specific job characteristics, details of a problem they would like to help answer, technology required to advance a potential solution, and the appealing elements of this career choice.

A forester uses a wedge prism to estimate the density of standing trees.





WORKSHEET WORKING FOR FORESTS

People in many different jobs work to sustain our forests. Cut apart the following cards and categorize the jobs by indoor versus outdoor, high tech versus low tech, amount of interaction with other people, academic discipline, level of education, or other criteria.



FORESTER

Foresters, or forest managers, oversee public or private forestlands. In my job, I develop short- and long-term plans for planting and growing, monitor trees for healthy growth, and make sure our forest practices comply with environmental regulations.



ENVIRONMENTAL EDUCATOR

I love teaching children and adults about forests! As an environmental educator, I lead school and community groups in learning activities focusing on trees and forest ecosystems. I especially enjoy guiding field trips where learners can experience nature first-hand.



NATURAL RESOURCE ECONOMIST

I am passionate about ensuring the sustainability of forest resources. I determine the value of assets from the forest such as timber and ecosystem services. I also work to find the most efficient ways to supply or manufacture forest products.



WILDLIFE BIOLOGIST

I study wildlife and their habitats to understand what they need to thrive. I consider the relationship of birds, mammals, fish, reptiles, or amphibians to the forest and to each other. My work helps manage wildlife habitats for the benefit of all.



SAFETY INSPECTOR

I review forestry job sites, either on the field, or at the mills and ensure that the workplace is a safe and healthy place for workers. I provide information, advice, and guidance to both employees and employers to help them meet safety compliance policies and regulations.



FOREST ENGINEER

As a forest engineer, I figure out ways to use trees and other forest resources in the most efficient, cost-effective, and sustainable way. I may develop and test wood products, or design and supervise the construction of a trail or bridge.



WORKSHEET

WORKING FOR FORESTS, PAGE 2



WILDLAND FIREFIGHTER

My job is to help protect and maintain the health of the forest by preventing, controlling, and putting out wildfires. To prepare for fire emergencies, I maintain and test firefighting equipment. I also talk to the public about ways they can help prevent wildfires.



HYDROLOGIST

I investigate water in forests by studying how it travels through the forest, into the soil, and eventually to a stream. In addition to learning about the water cycle, I try to solve questions such as how streamflow affects forests or how climate change impacts watersheds.



MILLWRIGHT

A millwright is an industrial mechanic who maintains or constructs machinery for mills, print shops, or other businesses. As a millwright, I must be familiar with different machines and how they work, and have the analytical skills necessary to fix problems.



SOCIAL MEDIA DIRECTOR

I love spreading awareness about my organization's forestry program to various audiences on social media platforms. I get to be creative when planning media campaigns related to the forest, and work with a team to share stories and build meaningful connections.



PACKAGING TECHNOLOGIST

I'm a problem solver who enjoys working with materials. As a packaging technologist for a forest products company, I am responsible for designing, developing, and manufacturing packaging for a range of products, helping to reduce ocean plastic pollution.



NATURE PHOTOGRAPHER

Forests are my shooting sets. I use various cameras, lenses and tools to document elements of our natural world to share with clients. My work involves traveling to remote areas, where I patiently wait to capture the perfect moment depicting wildlife and nature.



WORKSHEET WORKING FOR FORESTS, PAGE 3



ARCHITECT

As an architect, I try to reduce the ecological footprint of buildings and homes through carefully crafted designs using sustainable and certified materials, such as wood. I want to create spaces that lets people co-exist with nature by bringing the outdoors indoors.



LUMBER MILL WORKER

I work in a mill that cuts logs into lumber for building materials such as framing, flooring, windows, and doors. You may be surprised to learn that my job is very high tech: computers help me determine the best way to cut each log and how to minimize wood waste.



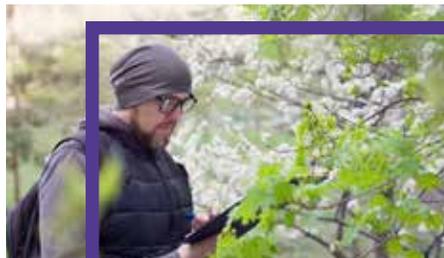
LOGGER

As a logger, I harvest timber from forests, which people rely on for building materials, furniture, paper, packaging, and many other products. My job is to cut the trees safely and in a way that ensures water quality and the long-term health of the forest remains.



PARK RANGER

As a park ranger, I work to educate forest visitors about the forest and to explain and enforce the rules and regulations. I help keep the visitors safe in the forest and help keep the forest safe from visitors.



CARBON MODELER

As a carbon modeler, I work with forest owners to quantify the carbon being stored or sequestered in the forest. Based on this information, owners exchange “carbon credits” with companies that emit carbon dioxide as a way to reduce overall carbon emissions and climate change effects.



PAPER MANUFACTURER

I work as a machine operator for a paper manufacturing company that makes various paper products. I run the paper-making machines and conduct quality inspections on the finished products.



WORKSHEET WORKING FOR FORESTS, PAGE 4



POLICY ADVISOR

As a forest policy advisor, my job is to analyze laws and programs that affect the forest and to provide guidance on ways to improve them. I enjoy looking at all the ways policies might impact people and the forest and finding the best balance.



SUSTAINABILITY MANAGER

As a sustainability manager, I ensure that my organization upholds environmental standards and minimizes environmental harm. I recently helped my organization switch to using paper products that come from sustainably managed forests.



FORESTRY TECHNICIAN

I love working outside and my job takes me into the forest almost every day. As a forestry technician, I work with foresters and forest engineers to maintain forestland. Depending on the need on any given day, my duties can range from fire suppression to data collection to trail repair.



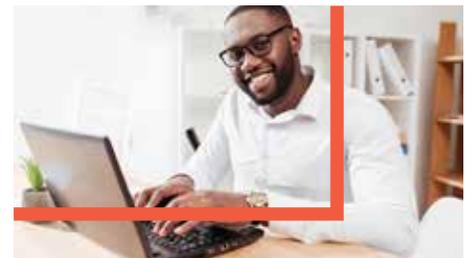
WOOD SCIENTIST

Wood is an amazing natural resource that we use for paper, construction lumber, particle board, and other products. As a wood scientist, I study the physical, chemical, and biological properties of wood to improve the way we process it into different products.



GIS SPECIALIST

I love maps! As a geography or Geographic Information Systems (GIS) specialist, I work with computers to create graphs and maps showing forest-related data, such as land use, tree cover, and environmental practices. My work helps inform the public and decision-makers about forests.



FINANCIAL FORECASTER

I love numbers and – as a financial forecaster for a wood products company – I get to work with them every day. I analyze lumber and paper pulp market prices and international exchange rates to help my company make the best investments and sound financial decisions.



WORKSHEET

EXPLORING FOREST JOBS

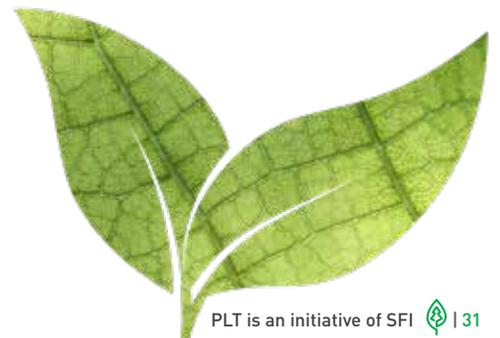
Choose a forest-related job to explore in more detail. If possible, contact a professional who works in that field and ask to conduct an informational interview about their job. You may interview them in person, on the phone, or through an app like Skype, using the following questions as a guide. If you are not able to interview anyone, you may use the internet to research answers to the questions.

JOB TITLE:

SOURCE(S) OF INFORMATION:

QUESTIONS:

1. How would you describe your job?
2. What education or training does someone need for this job?
3. What are some of the necessary skills?
4. What personal characteristics are important for doing this job?
5. What is the most interesting thing about it?
6. What is the most challenging thing about it?
7. Why did you choose this job?
8. Where are some possible places to find this type of job?
9. What are related job opportunities?
10. What are suggested college, university, or trade schools for this career?
11. What do you think the future of this kind of job looks like?
12. How is this job changing?
13. Why is this job important?





WORKSHEET

YOUR PERSONALITY AND GREEN JOBS

Learning about green jobs is the first step to becoming a leader in forestry and conservation. This quiz is a helpful tool to determine how your personality fits into the world of green forest jobs. Circle the characteristics you most identify with in each column, choosing as many as you want.

REALISTIC	INVESTIGATIVE	ARTISTIC	SOCIAL	ENTERPRISING	CONVENTIONAL
Athletic	Analytical	Artsy	Altruistic	Adventurous	Adaptable
Flexible	Cautious	Complicated	Cheerful	Aggressive	Amenable
Frank	Complex	Confident	Compassionate	Ambitious	Careful
Genuine	Critical	Creative	Convincing	Assertive	Conscientious
Handy	Curious	Emotional	Cooperative	Bold	Data-driven
Honest	Independent	Expressive	Generous	Charismatic	Dependable
Humble	Intellectual	Imaginative	Helpful	Dramatic	Detail-Oriented
Mechanical	Introverted	Individualistic	Idealistic	Energetic	Efficient
Nature-focused	Logical	Innovative	Kind	Entrepreneurial	Orderly
Outdoorsy	Methodical	Intuitive	Passionate	Extroverted	Precise
Persistent	Modest	Leader	Patient	Goal-driven	Purposeful
Physical	Quiet	Motivated	People-focused	Inventive	Reliable
Practical	Rational	Open	Responsible	Optimistic	Reserved
Respectful	Scholarly	Original	Tactful	Persuasive	Scheduled
Self-reliant	Scientific	Spontaneous	Team-player	Popular	Structured
Shy	Self-controlled	Unconventional	Understanding	Relaxed	Subdued
Tenacious	Specific	Visionary	Warm	Sociable	Thrifty
TOTAL:	TOTAL:	TOTAL:	TOTAL:	TOTAL:	TOTAL:

SCORING: Once you have selected the traits you identify with, count the number you have circled from each column and record in the bottom row of the table. The higher the score in each category, the more traits you share with that personality type. Many people are a blend of two personality types. See the next page for descriptions of the personality types.

Source: This quiz was based on Holland's Personality Theory, which identifies these six personality types.

YOUR PERSONALITY AND GREEN JOBS, PAGE 2

Consider the descriptions of the personality types below and the related green jobs. Can you picture yourself in these careers? Students entering green jobs means a more sustainable world for us all!

REALISTIC personalities enjoy working with their hands and using tools or machinery. They enjoy working outside and would prefer to work alone to solve problems. They value practical approaches to problems and prefer to work with objects they can see and touch as opposed to ideas. In the forest sector, this personality type would be successful maintaining, troubleshooting, and repairing sustainable systems.

STEM SKILLS: Technology Use, Problem Solving, Nature-Based Design

GREEN JOBS FOR REALISTIC PERSONALITIES:

- Arborist
- Forestry Technician
- Logger
- Lumber Mill Worker
- Millwright
- Wildland Firefighter

INVESTIGATIVE personalities enjoy focusing on the big picture to solve problems. They are analytical and curious, and like working with abstract ideas and concepts. In the forest sector, this personality type would be successful studying the relationships among organisms, soil, water, and forests; or developing uses for raw materials, creating clean energy systems, or designing forestry machinery.

STEM SKILLS: Data Analysis, Investigation, Creativity

GREEN JOBS FOR INVESTIGATIVE PERSONALITIES:

- Engineer
- Hydrologist
- Packaging Technologist
- Soil Scientist
- Wildlife Biologist
- Wood Scientist

ARTISTIC personalities value creative self-expression and problem solving. They tend to enjoy working on visual projects and do well with designs and patterns. They prefer working on projects with flexible guidelines. In the forest sector, this personality type would be successful running social media accounts or connecting the public to the environment through design.

STEM SKILLS: Creativity, Nature-Based Design, Problem Solving

GREEN JOBS FOR ARTISTIC PERSONALITIES:

- Architect
- Filmmaker
- Graphic Artist
- Marketing Director
- Nature Photographer
- Social Media Director

SOCIAL personalities enjoy working in large groups of people and helping them organize to solve problems. They are strong leaders and have great communication skills, which they are able to use to bring people together. In the forest sector, this personality type would be successful in a position informing the public and other organizations about sustainability or working as an educator.

STEM SKILLS: Leadership, Communication, Creativity

GREEN JOBS FOR SOCIAL PERSONALITIES:

- Environmental Educator
- Media Coordinator
- Park Ranger
- Public Relations Associate
- Sociologist
- Tour Guide

ENTERPRISING personalities enjoy leading groups and initiating projects. They are confident and determined, which makes them effective decision makers. They seek out leadership roles and are typically talented public speakers. In the forest sector, this personality type would be most successful in a position leading an organization towards environmental and sustainability goals.

STEM SKILLS: Collaboration, Leadership, Problem Solving

GREEN JOBS FOR ENTERPRISING PERSONALITIES:

- Carbon Modeler
- Environmental Lawyer
- Forester
- Policy Advisor
- Sustainability Manager
- Urban Forester

CONVENTIONAL personalities value organization and neatness. They are detail-oriented and prefer tasks with specific instructions. They enjoy making the workplace more efficient and they typically possess strong numerical skills. In the forest sector, this personality type would be successful working behind the scenes and ensuring an organization runs smoothly.

STEM SKILLS: Technology Use, Organization, Data Analysis

GREEN JOBS FOR CONVENTIONAL PERSONALITIES:

- Business Manager
- Financial Forecaster
- GIS Specialist
- Logistics Specialist
- Natural Resource Economist
- Safety Inspector

CAREER FACT SHEET: FORESTER

Do you care about wildlife, the environment and forests? Do you feel most comfortable in the outdoors, getting your hands dirty? If so, have you considered becoming a forester? Every day, thousands of foresters across the U.S. lace up their boots, don high visibility vests and venture into the wild. Their goal for the day? To manage the health of our forests so that the communities and wildlife that depend on them can thrive!

Foresters are problem solvers. They ask themselves what future problems might be encountered and create plans that tackle these challenges and reflect long-term forest management goals. For example, foresters use scientific information and research to help make decisions that ensure the long-term health of a forest. They also monitor the impacts of the decisions they make, using what they learned to make better choices for the future.

Foresters are great communicators and must share plans with communities, businesses, and state and federal governments. They must include public voices before, during, and after project planning. Foresters are equipped with scientific and ecological knowledge. They collect and analyze field data, using these findings to create a plan for how to best work with forests from multiple perspectives.

PUT YOURSELF IN A FORESTER'S BOOTS: HOW DO YOU THINK CLIMATE CHANGE WILL AFFECT FORESTS?



If excitement is something you value in your everyday life, forestry could be a great fit for you. Some days can be spent creating maps and writing reports, other days can be consumed supervising forestry operations in areas only accessible by helicopter.



A PART OF THE BIGGER PICTURE

Forests can be thought of as a community's lungs, water filter, supermarket, and gathering place. The work done by foresters goes beyond the coordinates of a forest plot or the boundaries of a local park. As a forester, you are part of a global movement.

HOW?

- Follow laws and regulations that help manage our forests.
- Contribute to the United Nations 2030 Agenda for Sustainable Development Goals, supporting global sustainable forest management.
- Plan reforestation operations which help remove CO₂ and mitigate the effects of climate change.
- Collaborate with Indigenous communities to ensure their values are heard and respected.

MOVING FORWARD



In order to become a forester, a bachelor's degree is often required.

HIGH SCHOOL: In high school, plan to study Biology, Chemistry, Mathematics, Physics, and Pre-calculus.

COLLEGE: In college, plan to complete a four-year Bachelor of Science program with a major in forestry. See www.forestryusa.com/universities-colleges.html for a list of U.S. colleges and universities that offer forestry degrees. Check your state's public universities for the most cost-effective options.

DID YOU KNOW?

When you graduate from an accredited college program, you can register as a Registered Professional Forester (RFP). RPFs follow a code of ethics to ensure forest health and sustainability.

For more career fact sheets, see www.plt.org.

SALARY

A forester's annual salary can vary by state, employer and type of work, but average amounts center around \$70,000.

WHERE CAN YOU GROW?

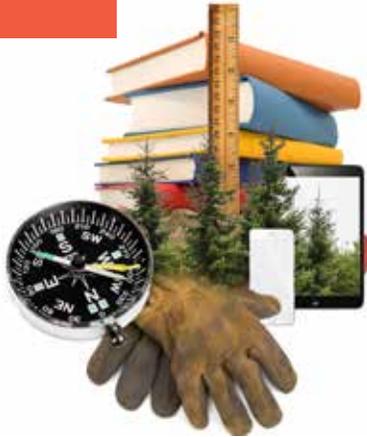
The field of forestry offers many opportunities for personal and professional growth. You might grow your skills as a woodland manager, biodiversity specialist, or environmental consultant. Your knowledge and experience could also land you a job as a forest economist, or maybe you'll find yourself offering forest expertise at the international level.

A forester's skills are desirable to:

- Government agencies (state and federal)
- Forest industry
- Forestry and non-profit organizations
- Consulting firms
- Forest certification auditors



LEARNING ACTIVITY



STEM SKILLS

Collaboration,
Communication, Creativity,
Leadership, Problem-Solving,
Data Analysis

MATERIALS

Worksheets, chart paper,
colored markers, calculators
(optional), masking tape,
video to introduce forest
management (optional)

TIME

PREPARATION

60 minutes

ACTIVITY

Two to three 50-minute
sessions

2. IF YOU WERE THE BOSS

Acting as foresters, learners grapple with decisions about how to manage a forest sustainably while serving different needs.

LEARNING OBJECTIVES

- Generate a plan for managing a forested area.
- Conduct a cost-benefit analysis of their proposed forest management plan in terms of its potential environmental, social, and economic effects.
- Experience some of the duties and dilemmas foresters face in their jobs.

LINKING TO LIFE

- Learners articulate what they have discovered about foresters' work through the process of creating and analyzing a plan for 400-Acre Wood.

BACKGROUND

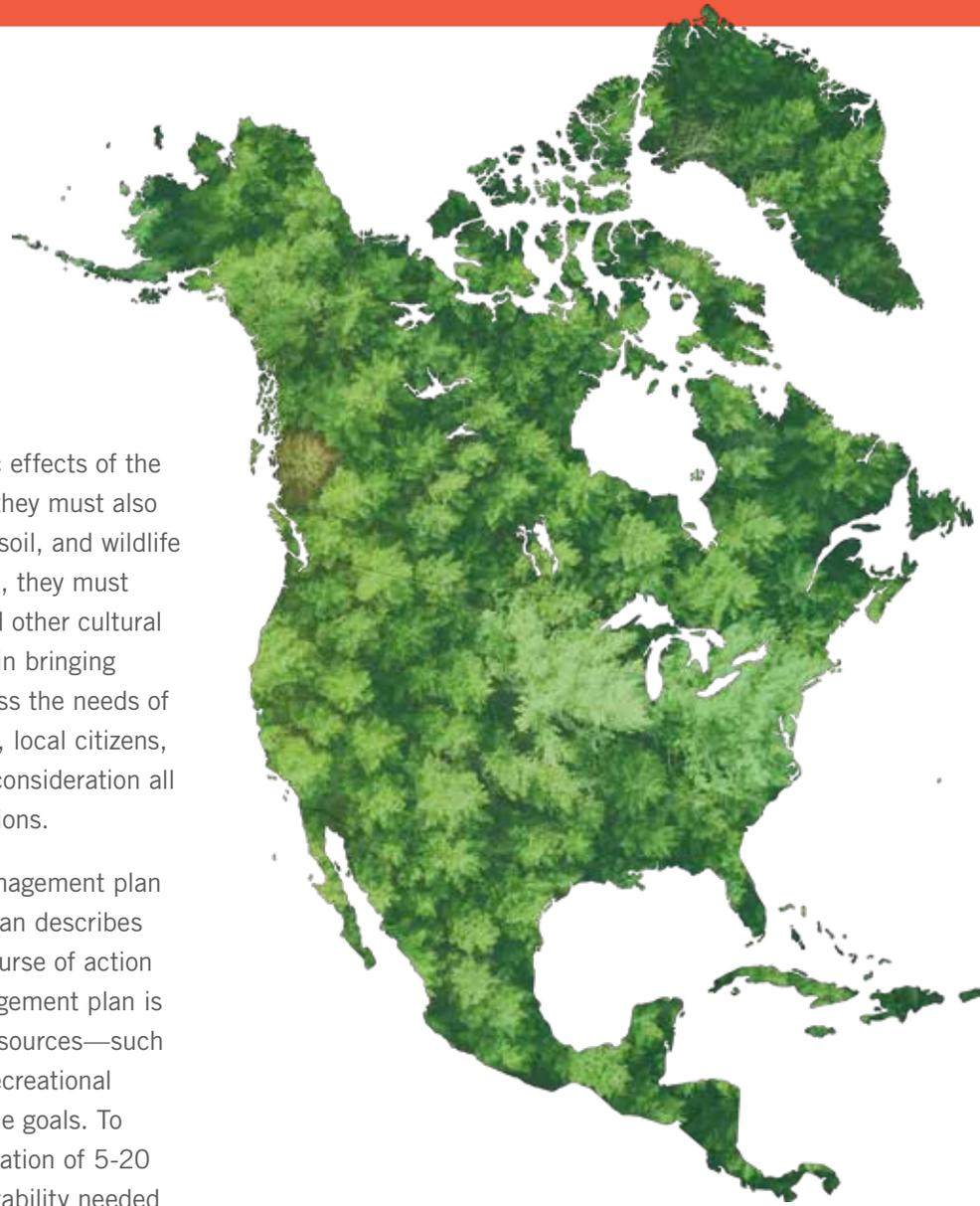
A forest manager, or forester, is a professional who works to maintain forest health and ensure the sustainability of forests and woodlands. Foresters typically manage a designated forest area and the activities that occur in it, including timber production, public recreation, and natural resource conservation. They must often balance competing environmental, economic, and social demands for the forest and the goals of the individual, business, organization, or agency that owns the land.

Public and private forests cover nearly one-third of the United States and 40 percent of Canada. More than just trees, forests are made up of a wide variety of species that interact to create a thriving ecosystem. They provide habitats for many species of plants and animals, as well as vital resources for people. People use forests in many ways such as producing timber, camping, hiking, hunting, and fishing. Forests provide clean water by anchoring the soil, preventing soil erosion, and acting as a water filter. Forests also absorb tremendous quantities of carbon dioxide from the atmosphere and are critical for slowing climate change and reducing its effects on people.

Forest managers must consider the economic effects of the decisions they make about forest lands. But they must also consider elements such as recreation, water, soil, and wildlife values that are harder to evaluate. In addition, they must do all they can to safeguard cultural sites and other cultural values. Foresters also play an important role in bringing together members of the community to discuss the needs of the forest, including Indigenous communities, local citizens, and local governments. They must take into consideration all values of the forest based on these consultations.

An important tool for foresters is a forest management plan specific to the designated forest area. This plan describes the current forest condition and outlines a course of action to achieve management goals. A forest management plan is not just about the trees. It includes all the resources—such as roads, water sources, wildlife habitat, or recreational sites—and anything else that is relevant to the goals. To be effective, these plans typically cover a duration of 5-20 years, which provides for the medium-term stability needed for sustainable forest management while also considering the long-term effects of the plan 100 years or more into the future. In addition, foresters may use an annual plan of operations that outlines specific activities for one year.

Management plans also take into consideration the objectives of the forestland owner. Forests may be managed for timber harvest, to provide recreation, to protect watersheds and wildlife habitat, or other uses. Many forests are managed for multiple uses. For example, forests owned by a forest products company may be used for hiking, fishing, and camping, as well as timber production and ecosystem protection. As this learning activity demonstrates, multiple use management involves making choices about the types of activities that can take place in particular areas of the forest.



STEM IT UP!

Challenge learners to use a map creation app to produce real maps for their presentations. ArcGIS is a powerful, professional mapping software that also has a free student-friendly version. See “Teaching with GIS: Introduction to Using GIS in the Classroom” at ESRI.com for a course on using it with youth. Learners might also try Scribblemaps www.scribblemaps.com, Animaps animaps.com, ZeeMaps www.zeemaps.com, or another app for making their maps.



GETTING READY

- Make copies of the worksheets.
- Make an enlarged map for each team to work on by projecting the 400-Acre Wood map onto a piece of chart paper and using a light-colored marker to trace the map. Teams may also use an electronic version of the map.
- (Optional) Select a video to introduce the concept of forest management. Possibilities include:
 - Forest Management. Oregon Forest Resources Institute (1:54 minutes)
www.oregonforests.org/video/Forest_Fact_Break_Forest_Management
 - Introduction to Managing Your Forest. University of California Extension (7:19 minutes)
www.youtube.com/watch?v=a6AxKqFojog
 - STEM Career: Forest Management. WOUB Public Media (5:26)
www.youtube.com/watch?v=ft09CXrKIVA
 - Forestry in Canada: Discover Sustainable Forest Management. SFM Canada (3:05 minutes)
www.youtube.com/watch?v=vsLE5uF6Bic
- For younger learners, you may plan to simplify the activity by having them create management plans without doing the cost-benefit analysis in step 6 of Doing the Activity, which uses the “What’s the Score?” worksheets.

DOING THE ACTIVITY

1. (Optional) Share a video with learners on forest management See Getting Ready.
2. Ask learners what they understand about the job of forest manager or forester. Introduce the activity by explaining that they will examine some of the complex issues that foresters must face as they oversee a particular forest or woodland.
3. Help learners brainstorm a list of activities that take place in a forest. Encourage them to include a wide range of activities like hiking, visiting ancestral sites, fishing, hunting, reading, taking pictures, birdwatching, camping, rock climbing, skiing, snowmobiling, logging, grazing, or mining. Ask the group to review the list and decide whether any activities would conflict with others if done on the same piece of land. Ask: How might foresters determine the best use of a forest? What criteria might they use to make their decisions?
4. Explain that teams will decide the best use or uses for 400-Acre Wood, a fictitious forest that has been donated to the community. Have them read the “You Decide” worksheet, and then divide the group into teams of four or five. Each team will develop a forest management plan that they think will serve the best long-term interests of the community.
5. (Optional) As necessary, point out that the activity involves a measure called an acre, which foresters typically use to determine area. Explain that one acre is equal to 4840 square yards or a square approximately 70 yards per side. An acre can be any shape and is slightly smaller than a football field without the end zones.
6. Make sure learners understand that their team can use the entire 400 acres for one use or can divide it up for multiple uses. For example, they may devote 200 acres to wildlife management or hiking trails, 80 acres to a campground, and 120 hectares for timber or hunting. Also, be sure that learners understand that no matter what uses they choose, they must plan on keeping the cultural site intact. They must also ensure that any timber harvest doesn’t touch the stream.
7. Before the teams begin, ask the following questions:
 - Which forest uses in the “You Decide” worksheet are compatible with other uses? (for example, building a campground and hiking trail next to each other)
 - Which might be incompatible with each other? (for example, hunting near the cultural site)
 - In terms of wildlife, why are we only focusing on barred owls, wood rats, and salamanders? (looking at three animals with different habitat requirements gives an idea of the general health of the forest ecosystem)
 - What could you learn by figuring out the costs, revenues, trees, wildlife populations, and number of visitors for each management plan? (how the plan affects different forest values)
8. Give each team an enlarged map (see Getting Ready) of 400-Acre Wood. Also give each team a copy of the “What’s the Score?” worksheets. Each team should discuss various strategies for managing the forest. When the team arrives at a consensus on how the land should be managed, direct teams to use “What’s the Score?” to conduct a cost-benefit analysis of their plan. They should discuss what effect their plan would have in terms of five priority interests: 1) number of visitors, 2) wildlife conservation, 3) forest cover, 4) cultural site protection, and 5) costs and revenues.



CAREER CONNECTION

Invite learners to identify the different kinds of jobs that would be necessary to carry out their plan for 400-Acre Wood. Have them select one of these jobs and write a job description for it, including the duties and responsibilities of the job, as well as the education, experience, and skills that would be required to do the job well. You may have learners first look at job descriptions in actual postings. See “Additional Resources” on page 77 for a listing of green job boards.

9. When the teams have completed their management plans, they should illustrate them on their maps using colors and symbols. Remind them to include a map key or legend to help others make sense of their maps.
10. Ask teams to present their plans to the entire group, making clear how they decided on their plans. Have them also share findings from the “What’s the Score?” worksheet. Post the maps around the room.
11. Lead a group discussion about the different plans. Ask questions such as:
 - Which plan enables the most benefits for all users? Which plans cost the most and the least? Which plan has the most effect on wildlife? Which has the least effect on the cultural site?
 - Which do you think is most important: having the most money, the most trees, the most wildlife, the most visitors, or safeguarding the cultural site best? What makes you think so?
 - Which plan seems to provide the best balance of environmental factors (wildlife and trees), social factors (visitors and safeguarding the cultural site), and economic factors? Why do you think so? Should a balance of these things be the goal? Why or why not?
 - What other criteria may be missing from our analysis?
 - What will be the long-term effects of each plan? Which plan is the most sustainable over time? How are we measuring sustainability? Is that an adequate measure?
12. Ask learners to reflect on what they learned about the job of forester through the activity, answering questions in writing such as: What did you learn about foresters in this activity? What skills did you use (such as modeling, calculating, taking leadership, making decisions, negotiating, and so on)? Which skills did you enjoy using? Which did you not enjoy? What might this tell you about jobs that you would want to pursue?



ENRICHMENT

- Conduct the activity with one or more variations:
 - Learners randomly pick forest jobs and incorporate the jobs into their forest plans.
 - Assign different teams a unique objective for their plan, such as promoting wildlife habitat or boosting recreation. Compare the plans and predict how the forest would differ 50 years into the future.
 - Assign different teams to focus on the environmental, social, or economic aspects of a forest in their plans. Then, direct the group to negotiate what a balanced plan would contain.
- Repeat the activity with each team extending its plan into the next year, and calculate the effect on wildlife conservation, forest cover, number of visitors, cultural site protection, and costs and revenues for the second year. Point out that forest management plans cover 5-20 years, with a goal of planning for over 100 years. Discuss the possible benefits of such long-term plans.
- Urge learners to consider the health and wellness benefits of forests, and how these might affect the larger economic consequences of their forest plans. For example, mental health is improved when people recreate outdoors, lowering the societal cost of health care. What other benefits and costs can they identify? Encourage learners to explore forest careers that focus on outdoor recreation and tourism.
- Invite a forester to talk to your group about how his or her organization makes land-use decisions. (See “Finding Forest Professionals” on page 77 for ideas on how to get started.) Encourage learners to ask questions based on what they experienced in the activity. For example, how do foresters weigh the effects of an action on environmental, social, and economic aspects of a forested area?
- Examine the code of ethics foresters adhere to in their work (for example, see the Society of American Foresters’ Code of Ethics at eforester.org). Discuss: Why is a code like this important for foresters? What other jobs have codes of ethics or are regulated by the government? What else do these jobs have in common and how do they differ?
- Challenge learners to consider carbon storage in their forest management plans. Trees absorb carbon dioxide from the atmosphere and store or sequester it in their trunks. Managing for climate change involves maintaining and increasing the forest’s carbon storage while also providing other forest benefits. Invite learners to find out some of the ways forests are managed for carbon (for example, see “Tools” in the U.S. Forest Service’s Forests and Carbon Storage website at www.fs.usda.gov/ccrc/topics/forests-carbon), and then discuss how they might add this approach to their plans.

CAREER CONNECTION

This activity uses a model to help learners examine what might be involved in a forest management plan. Many different forestry sector jobs involve making and using physical or computational models to better understand forest processes, to plan forest management strategies, to help make business decisions (using decision support systems), or to analyze and forecast forest product markets. Invite learners to discuss whether a physical, financial, or data modeling specialist job would appeal to them and why or why not.



WORKSHEET YOU DECIDE

A magnificent forest, 400-Acre Wood, has just been donated to your community. You and your team have the job of deciding what to do with this forest.

As you might have guessed, 400-Acre Wood is a parcel of forestland that is 400 acres in size. An acre is an area of land equal to a square that is 209 feet or 70 yards on each side, and 400 acres is a little less than 1 square mile.

HOW BIG IS AN ACRE?

An acre is a measure of land area that is exactly 4840 square yards. It can be any shape, but is approximately the size of a football field without the end zones.



1 acre = About the area of a football field

400-Acre Wood is made up of pine forest, with about 150 mature pine trees per acre. Because the forest currently has no roads or trails, few people visit it. It has a small stream running through it, which contains trout. In addition, lots of wildlife live in the forest, including owls, deer, bear, woodpeckers, turkey, quails, wood rats, fish, and woodland salamanders.

Wildlife biologists use something called management indicator species to evaluate the positive and negative effects of people's actions on the environment. For 400-Acre Wood, the indicator species are barred owls, wood rats, and woodland salamanders. Wildlife biologists estimate that 8 owls, 400 wood rats and 10,000 salamanders currently live in 400-Acre Wood.

In the northwest corner of 400-Acre Wood is a rock outcropping with three petroglyphs on it. These images were chiseled into the rock surface by Indigenous ancestors and are believed to be 600 to 1000 years old. Your plan should safeguard this cultural site, keeping trails, camping, and exhaust from cars (which can erode the rock) a safe distance away.

You and your team will develop a management plan for 400-Acre Wood and make a map of it. You may decide to do one thing with the entire forest, such as create a campground. Or you may want to divide the forest and do different things in different areas, such as devote 200 acres to wildlife management or hiking, 80 acres to a campground, and 120 hectares for timber or hunting. Your goal is to find what your group thinks is the best balance between five priority interests: 1) the number of visitors, 2) wildlife conservation, 3) forest cover, 4) cultural site protection, and 5) costs and revenues.

NOTE: Managing a landscape for various uses will lead to different effects. Effects can be both positive and negative, and play a huge role into the decisions made on the landscape. The following effects described are specific to this learning activity. Actual forests may have very different effects depending on the geography, species of trees, types of animals, and people involved, as well as other local conditions.

Metric Unit Conversion:

1 acre = 0.4047 hectare

1 hectare = 1 square kilometer

Below are the different forest uses you can include in your plan. The “What’s the Score?” worksheet will help you evaluate your plan’s total effect on the five priority interests (wildlife, trees, visitors, cultural site, and cost and revenue).

FOREST USE

EFFECTS

Wildlife Management Area

The purpose of a wildlife management area is to allow wildlife to thrive by preserving important ecosystem features and removing any impact from human activities. Typically, wildlife management areas have no roads, operations, graded trails, or campsites.

Wildlife management areas will bring some visitors to the forest. The numbers of trees and wildlife will remain the same. These areas are also compatible with the cultural site. It will cost money to monitor the area.

Timber Harvest and Regeneration

Timber harvest and regeneration involves cutting trees for logs and planting new trees. Part of sustainably managing a forest includes determining which areas of the forest to harvest and regenerate. Using sustainable practices based on research, trees are removed in a way that minimizes effects on wildlife and people, while also producing logs over the long-term. For pine trees, which take 35 years to reach maturity, one-fifth of the trees are cut every 7 years. Trees must also be removed to build the road.

Note that to protect the stream’s water quality, timber production may not occur next to the stream. This is called a streamside management zone.

With the addition of roads, some visitors will come to this area. The timber harvest and regeneration will have a minimal effect on the three indicator species. It will cost money to build and maintain the road and for management, but the harvested trees can be sold.

Trails

Graded trails allow different types of visitors to enjoy a forest area, including walkers, cyclists, families with strollers, and wheelchair users. Trails should not be built near a cultural site.

Trails will bring more visitors, but will also disturb the wildlife, particularly the owls and wood salamanders. It costs money to build and maintain trails, and trees will need to be cut to make room for the trails. But you may sell the cut trees and charge an entrance fee.

Campground

A campground allows visitors to enjoy a forest area overnight or over the weekend. It typically has campsites, plus picnic tables, fire pits, parking spaces, and bathrooms. A campground also needs to have a road winding through it. Campgrounds should not be built near a cultural site.

A campground will bring more visitors, but will cause all three indicator species—owls, wood rats, and salamanders—to disappear from the area. Trees will need to be removed to build the road and campsites. It costs money to build and maintain the campground. But you may sell the cut trees and charge a camping fee.





FOREST USE

EFFECTS

Hunting and Foraging

Some forest areas are managed to encourage game animals (deer, turkey, and quail) for hunters and edible items (medicinal plants, mushrooms, and berries) for foragers.

Hunting and foraging will bring some visitors, but with regulations to keep game populations constant, there should be no effect on the three indicator species—owls, wood rats, and salamanders. It will cost money to manage the area. But you may charge a license fee.

Reservoir

To supply water to the nearby community, a forest stream can be dammed to form a freshwater reservoir. A reservoir will bring visitors for kayaking and other non-motorized boating. Trees will also need to be removed to create the reservoir.

The reservoir will cause all three indicator species—owls, wood rats, and salamanders—to disappear from the flooded area. It will cost money to build the dam, and it will cost money to manage the reservoir. But the cut trees can be sold, and visitors may be charged a recreation fee.

Cultural Sanctuary

The purpose of a cultural sanctuary is to allow space to honor the people who lived there before and to respect the history, culture, and beliefs of Indigenous people today. A cultural sanctuary has no roads, graded trails, or campsites.

A cultural sanctuary will not change the number of visitors, trees, or wildlife. It will cost money to monitor the area.





WORKSHEET

400-ACRE WOOD

- 400-Acre Wood measures 20 acres by 20 acres.
- Each small square is 1 acre and is 209 feet per side.
- Diagonally across one square measures 294 feet.

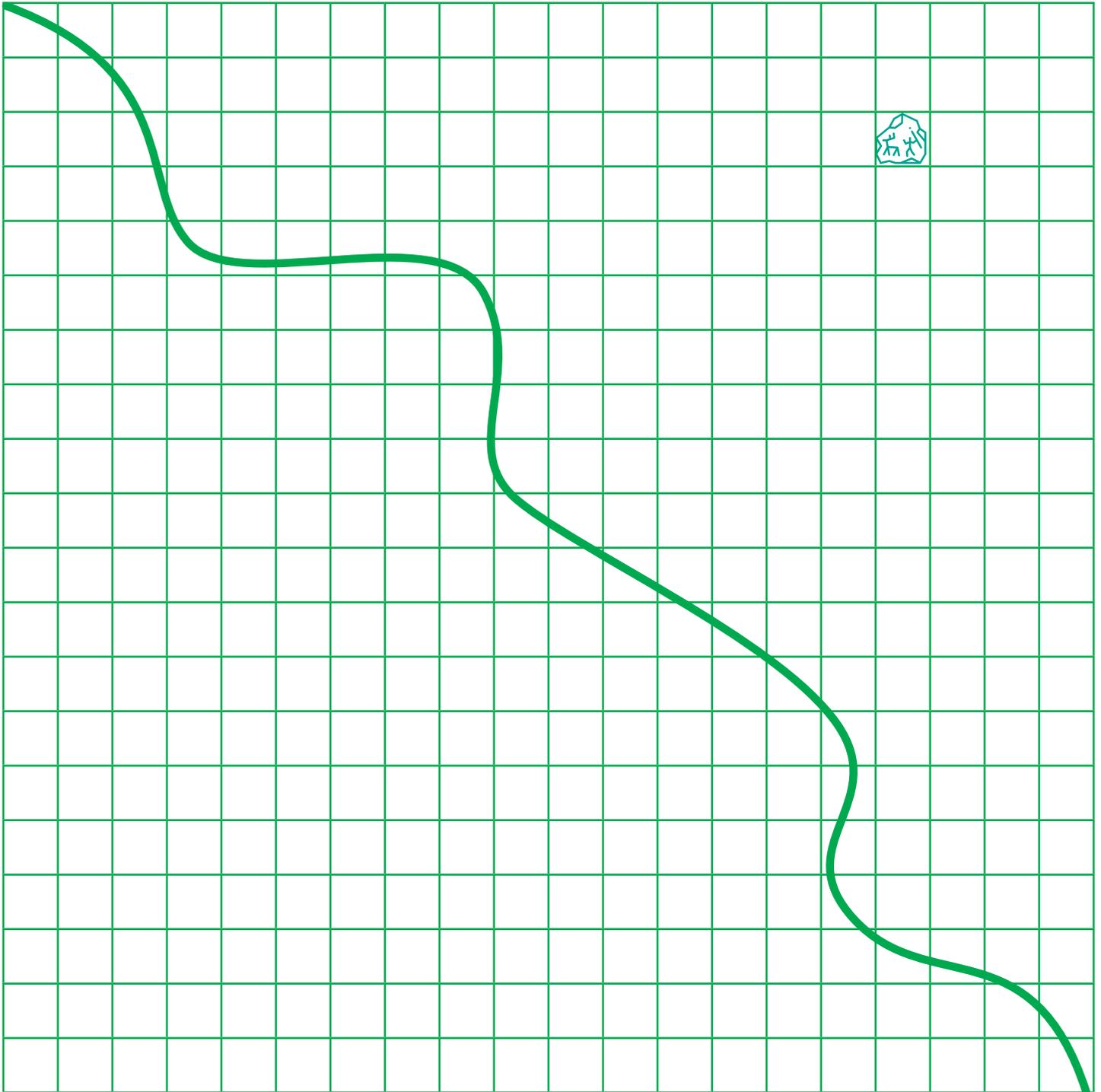
LEGEND



Stream



Cultural site





WORKSHEET

WHAT'S THE SCORE?

FOREST USE

Identify how many acres you plan for each forest use. Remember the total must equal 400 acres.

	FOREST USE							
	Wildlife	Timber	Trails	Campground	Hunting/ Foraging	Reservoir	Cultural Sanctuary	TOTAL
Area (acres)								400 Acres

ENVIRONMENTAL FACTORS

STEP 1 – WILDLIFE CONSERVATION

Determine how this plan will affect the wildlife management indicator species. Put the number of planned acres for each forest use in all the blank boxes below for that use (a black space means that the species won't live in an area with that use). Multiply the total acres per species by the number of animals per hectare. (For owls and wood rats, round down to the nearest whole animal.) Compare the new population totals you get to the original population of 8 owls, 400 wood rats and 10,000 salamanders.

	FOREST USE							TOTALS		
	Wildlife	Timber Production	Trails	Campground	Hunting/ Foraging	Reservoir	Cultural Sanctuary	Total Acres Per Species	Animals Per Acre	New Population
Owls									.20	
Wood Rats									1.0	
Salamanders									25	



STEP 2 – FOREST COVER

Trees will need to be removed for any trails, roads, campground, or timber harvest and regeneration your plan includes. Put the number of planned acres for each forest use in the blank boxes below for that use. Multiply the total acres for each use by the number of trees removed per acre. Sum up the total trees removed. There are initially 37,000 trees in 400-Acre Wood: Calculate how many trees will remain with your plan.

	FOREST USE							TOTAL	
	Wildlife	Timber	Trails	Campground	Hunting/ Foraging	Reservoir	Cultural Sanctuary	Trees Removed	Trees Remaining
Area (acres)									
Trees Removed per Acre	0	40	10	20	10	150	0		
Total Trees Removed									
Total Trees Remaining Per Plan									

STEP 3 – STREAM PROTECTION

To protect the stream, timber harvest may not occur next to it. Check that your plan does not have any timber harvest and regeneration squares touching the stream.

SOCIAL FACTORS

STEP 4 – NUMBER OF VISITORS

Calculate the number of visitors your plan will attract to the forest each year. Multiply the number of acres for each forest use by the numbers below. Then, sum the totals.

	FOREST USE							TOTAL
	Wildlife	Timber	Trails	Campground	Hunting/ Foraging	Reservoir	Cultural Sanctuary	
Area (acres)								
Visitors per Acre per Year	5	5	25	50	2	60	0	
Visitors per Plan per Year								

STEP 5 – CULTURAL SITE PROTECTION

Calculate how well your plan safeguards the cultural site. For each forest use in your plan, measure on your map the nearest distance (in feet) to the cultural site, and place that distance in the table below. Assign points based on the distance from the site, with 1 point for each 500 feet in distance (rounded to the nearest whole number). Wildlife and Cultural Sanctuary are 10 points each as they do not affect the site. The final score is the lowest of the points that isn't 0.

	FOREST USE							SCORE
	Wildlife	Timber	Trails	Campground	Hunting/ Foraging	Reservoir	Cultural Sanctuary	
Area (acres)								
Distance (in feet)								
Points	10						10	

ECONOMIC FACTORS

STEP 6 – COST AND REVENUE: FOR DEVELOPMENT

Calculate the net cost of developing the site for your plan. To determine the construction cost, multiply the number of acres for each forest use by the dollar amounts below, and then sum the total. To calculate the revenue, multiply the number of trees removed for each forest use (from Step 2 above) by \$50 per tree, and then sum the total. Subtract the total revenue from the total construction cost to determine the net cost. (If the number is positive, it is a cost; if it is negative, it is a revenue.)

		FOREST USE							TOTALS
		Wildlife	Timber	Trails	Campground	Hunting/ Foraging	Reservoir	Cultural Sanctuary	
Area (acres)									
Costs	Construction Cost per Acre		\$2,025	\$1,200	\$6,000	\$2,025	\$16,200		
	Total Construction Cost								
Revenue	Revenue: Sale of Trees (\$50 per Tree)								
Net Cost	Net Cost (Total Construction Cost Minus Income)								

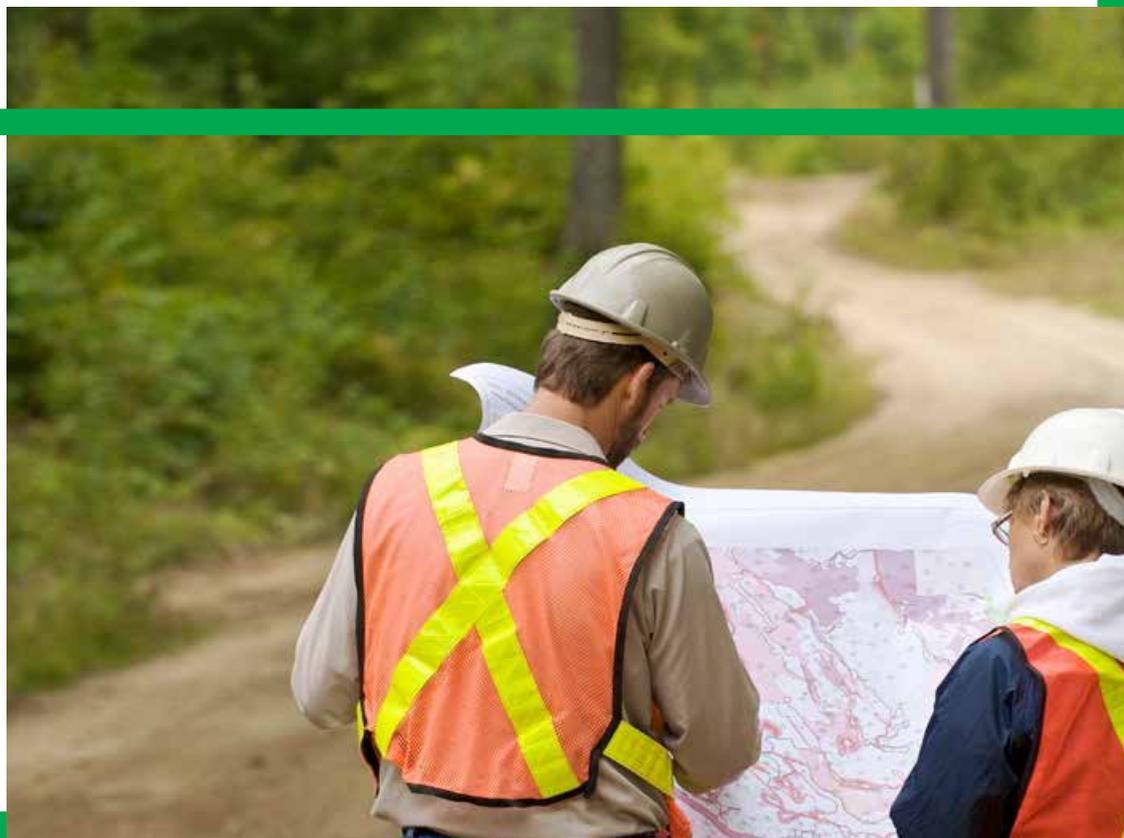
STEP 7 – COST AND REVENUE: EACH YEAR

Calculate the annual management cost for your plan. To calculate the management costs, multiply the management costs per acre by the number of acres for each forest use, and then sum the totals. To determine the income from fees, multiply the fees per visitor by the number of visitors for your plan (from Step 3), and then sum the totals. Subtract the Total Revenues from the Total Management Costs to determine the annual cost or revenue. (If the number is positive, it is a cost; if it is negative, it is a revenue.)

		FOREST USE							
		Wildlife	Timber	Trails	Campground	Hunting/ Foraging	Reservoir	Cultural Sanctuary	TOTALS
Area (acres)									
Costs	Management Costs per Acre	\$4	\$40	\$20	\$100	\$8	\$20	\$4	
	Total Management Costs								
Revenue	Revenues: Fees per Visitor	\$1	\$2	\$2	\$8	\$6	\$6	\$0	
	Total Revenues								
Net Cost	Net Cost or Revenue (Total Management Costs minus Total Revenue)								

Foresters use maps to make forest management decisions that ensure forest health and support culturally important areas.

Project Learning Tree



LEARNING ACTIVITY



STEM SKILLS

Collaboration, Data Analysis, Investigation, Technology Use

MATERIALS

Copies of worksheets (see Getting Ready); area map showing potential study sites (optional); two images of a forest area (see Getting Ready); flag markers; clipboards, tape measures; string; colored chalk; compasses; tree identification guides (optional); transparency film; spades or trowels, plus paper cups or small plastic bags; tablespoons; distilled water; eyedroppers; Petri dishes or plastic containers; pH paper (with range of at least 5–10); printer paper or other white paper; binoculars or magnifying glasses (optional)

TIME

PREPARATION

60 minutes

ACTIVITY

One 50-minute session, plus approximately 90 minutes or more for conducting and analyzing the assessments

3. MONITORING FOREST HEALTH

Through a variety of health indicators, learners assess the health of a forested area, and see how soil scientists, wildlife biologists, arborists, and other forest professionals monitor forests.

LEARNING OBJECTIVES

- Conduct a forest health inventory of a local wooded area.
- Analyze data to determine forest health.
- Experience first-hand some procedures forest professionals use to monitor forest health.

LINKING TO LIFE

- Learners identify different jobs and tools involved in monitoring trees and forests.

BACKGROUND

Forest health describes the resiliency, productivity, and sustainability of forest ecosystems. The health of the forest is one indicator that foresters use to assess the forest's condition and to develop options for managing the forest.

A forest is a complex system with many interdependent elements, including plant and animal species, soil and water, and cycles and processes. When it is functioning well, this system supports a diversity of species, helps to store and filter water, improves air quality, stores carbon, and performs other vital ecosystem services. Since it would be impossible to measure each individual component, forest health monitoring focuses instead on specific indicators of forest health, such as tree and crown condition, forest diversity, and presence of wildlife.

Many people in many different roles can be involved in assessing forest health. For example, a wildlife biologist might determine the animal species supported by the forest ecosystem, a tree physiologist may assess the health of individual trees, a statistician may collect and help interpret forest data, and a geographer may map the assessment results. Together, this information helps forest managers determine the best courses of action for a given forest.

FOREST



A forestry technician uses a clinometer to measure the height of a tree.

By monitoring forest health, forest managers can ascertain how stable the forest ecosystem is, determine the magnitude of any changes, and identify departures from normal within the indicator parameters. Using this information, foresters can develop a management plan that addresses possible health issues and that ensures the long-term sustainability of the forest. For example, if foresters detect a reduction in forest productivity, they may recommend thinning or harvest to reinvigorate forest growth. To address decreased diversity of wildlife habitats, they may intentionally add habitat features (such as downed trees) to encourage more wildlife. Or, if they find an increase in invasive species populations, foresters may develop a plan to remove the invaders.

HEALTHY OR NOT?

It should be noted that even though a forest may appear “unhealthy” based on an assessment like the ones in this activity, its condition may be perfectly normal and natural. Many healthy ecosystems in their natural state may, for example, lack diversity, show few lichens, or have acidic soil. In working forests where timber production is the primary objective, a lack of diversity or other conditions actually may be beneficial. In addition, health issues that are identified through the assessment may be caused by human activity or they may be part of natural forest processes.

HEALTH



HEALTHY FOREST: Needles are green

Example images of a healthy and an unhealthy forest to share with learners (see Step 1 of Doing the Activity).



UNHEALTHY FOREST:

Needles on trees infested by Mountain pine beetles typically turn 'rust' colored.

GETTING READY

- Plan to share the two images above by printing them or showing them electronically.
- Consider having a forester or other community partner to help with the overall forest health assessment process.
- Review the seven “Forest Health Indicators” worksheets and determine whether your group will conduct all seven assessments or a subset of them.
- Make copies of the “Forest Health Indicators” worksheets for each assessment you choose and make copies of the “Forest Health Summary” worksheet. Make a copy of the “100-Circle Grid” worksheet on transparency film (check with your local copy shop to see if they can do it for you).
- Investigate one or more forested areas that would be suitable for this activity. Possibilities may include a plot of trees on school grounds, a nearby urban park or botanical garden, a greenway, a university campus, or a public or privately-owned forest. Consider whether you or the learners will make the final site selection. After choosing the site, obtain any permission you might need from the landowner or government agency and check for any safety hazards.
- Identify potential study plots for doing the activity. Foresters use a standard plot size of 0.04-hectare or 400-square-meters (0.1-acre or 4,356 square feet), but you may use a smaller plot size if that is what is available. Keep in mind that a smaller plot size will produce less accurate data.
- To save time, you may choose to mark the study plots in advance (as described in step 6 of Doing the Activity) instead of having learners do it.

CAREER CONNECTION

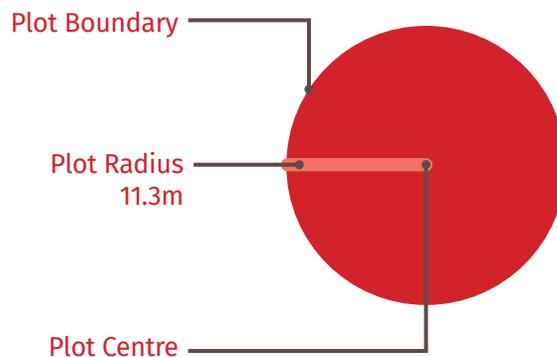
Arrange for your group to share the results of their inventory with a local forester, natural resource specialist, or other forest professional who may help them develop an action plan for improving forest health. For example, learners might work with the forester to plant trees or remove invasive species to increase forest diversity.

(See “Finding Forest Professionals” on page 77 for ideas on how to get started.) Invite the forest professional to also talk with your group about the work they and others do to monitor the forest.

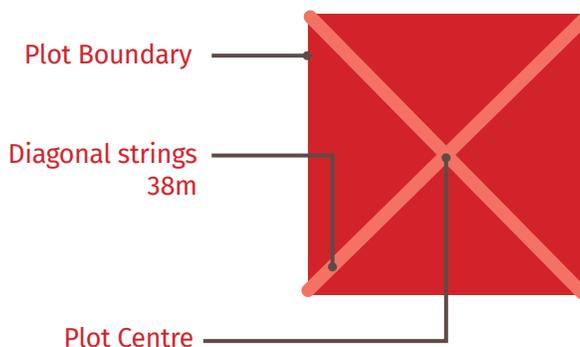
Suggest that learners also add their work on the forest monitoring assessments to their résumés as a way to show hands-on experience. Work with them to draft suitable wording that accurately describes their participation.

DOING THE ACTIVITY

1. Show learners the two images of the same forest area and ask them what differences they notice. Ask learners: “What do you think forest health means? Which of these forest conditions do you think is healthier? Why should we care whether forests are healthy or not? What factors do you think might promote or diminish forest health? Who do you think assesses forest health?”
2. Explain that the task ahead involves studying a local forest to look for indications of its health. Point out that just as a doctor takes the temperature and measures blood pressure to assess a patient’s general health, foresters use specific vital signs to assess forest health.
3. Ask what sorts of things might indicate that the forest is healthy and list learners’ ideas on the board. Ask what might indicate poor health and add those ideas to the list. Distribute copies of the “Forest Health Indicator” worksheets and discuss the indicators included. How do the indicators compare with the list generated by the group? Is there anything from the group list that should be added as an indicator? If so, how might that indicator be investigated? Are there any indicators on the provided list that would not make sense for your forest?
4. Describe the forest site(s) you have investigated for facilitating your forest inventory (see Getting Ready). You might point out each location on a map. If learners are selecting the forest area to study, have them discuss the pros and cons of each site and then vote for the forest they want to study.
5. Explain that the group will mark off a plot or several plots, within which separate teams will conduct one or more of the investigations. You may choose to let each team have its own plot for doing all the investigations, or you may have one plot to study as a group, with different teams doing different investigations. In either case, have at least two teams conduct each investigation to increase data validity.
6. At the study site, decide whether the plot(s) should be circular or square, depending on the slope of the terrain and location of trees. Have learners mark the boundaries of each 0.04-hectare or 400-square-meter plot (0.1-acre or 4,356 square feet plot) as follows:



For a circular plot, have learners place a flag in the ground to denote the center of the plot. Then, have them use a tape measure to measure 11.3 meters (37 feet) from the center. They should make a circle around the center marker with the outstretched tape and should place flags to mark the circumference of the circle.



For a square plot, have learners measure a square with sides 20 meters (or 66 feet) long. It may help to stretch two strings diagonally from corner to corner (the strings should be 38 meters, or 93 feet, long) to establish the plot’s boundaries, plot center, and corners. Have learners flag the plot boundaries.

Note that if you will be using smaller plot sizes, adjust the measurements accordingly.

STEM IT UP!

Foresters regularly use pacing to quickly estimate distances and areas in the field. A pace is a person's natural step while walking briskly and is counted from one foot hitting the ground to that same foot hitting the ground again. The length of a pace varies between people and across different types of terrain, but most people's pace is around 1.5 meters (5 feet).

To help learners determine their pace:



2nd pace

- Measure out a course that learners can pace over several times, such as 30 meters (100 feet).



- Direct them to walk the course with a natural stride, counting each pace (double-step) from the beginning to the end of the course.



1st pace

- Urge them to walk the course four different times to determine their average pace.



- Have them calculate their pace by dividing the length of the course by the average number of paces.

Invite learners to use their average pace to measure the plots in step 6 of this activity. Discuss other situations where pacing might be useful. Encourage them to record their pace for future reference.

7. Divide the group into teams to perform the investigations. You might have groups mark trees with chalk (with a different color for each group) to indicate which trees were sampled.
8. Give each person a copy of the “Forest Health Summary” worksheet to complete. If all the teams conducted each of the investigations, have the teams tally their results on that page. If different teams conducted different investigations, have teams summarize the procedure and share their results. Give teams sufficient time to reach a conclusion about the overall health of the forest plot.
9. Discuss the following questions:
 - What was your assessment of the overall health of the forest plot?
 - What evidence supports your conclusion?
 - Do you think the results are representative of the entire forested area? Why or why not? (for example, only one plot was used or the plot location could have influenced findings)
 - In what circumstances might an “unhealthy” rating be natural or even desired?
 - How might a more accurate assessment be obtained?
 - How do human activities either degrade or enhance the health of this forest?
 - What could people do to improve it?
10. Point out that part of the job of forester involves educating the public about the forest. Discuss with learners how they might communicate the results of their forest health assessment with public stakeholders. For example, they might prepare a presentation for a community meeting, create a park brochure, or write a summary of the project for the forest website.

ENRICHMENT

- Use an online calculator—such as the National Tree Benefit Calculator available at www.treebenefits.com—to assess the benefits of individual trees on the school grounds or other chosen location. With this tool, users enter the climate zone, diameter at breast height (in inches), and tree species, and receive information about the tree's effects on storm water, energy, carbon dioxide, and air quality.
- Revisit the same forest site at another time of year or visit a different site, repeating the “Forest Health Indicators” investigations or the analysis from the treebenefits.com website. Compare the results. What factors may explain any differences?

RESOURCES

Forest Health Indicators: Forest Inventory and Analysis Program

This brochure describes in simple terms the indicators used by the U.S. Forest Service Forest Inventory and Analysis Program. USDA Forest Service. Document no. FS-746. October 2002.

fia.fs.fed.us/library/brochures/docs/Forest_Health_Indicators.pdf

Tree Identification Tools

Look for apps (such as LeafSnap) that identify trees based on a photo taken with a smart phone or tablet.

Many local jurisdictions have tools for online tree identification. Search the Internet by using “tree identification” and your state or locality. Here is a sampling of such online tools:

- **The All-Season Pocket Guide to Identifying Common Tennessee Trees**

A key to finding the names and features of trees commonly seen in Tennessee.

<https://www.tn.gov/content/dam/tn/twra/documents/treeidguide.pdf>

- **Common Trees of the Pacific Northwest**

This dichotomous key helps users identify tree species through a series of choices about the trees’ form and structure.

http://oregonstate.edu/trees/dichotomous_key.html

- **Key to Leaves of Virginia Trees**

This online guide designed for 4-H participants helps to identify common trees in Virginia from their leaves.

<http://dendro.cnre.vt.edu/forsite/key/intro.htm>

- **Tree Atlas Ontario**

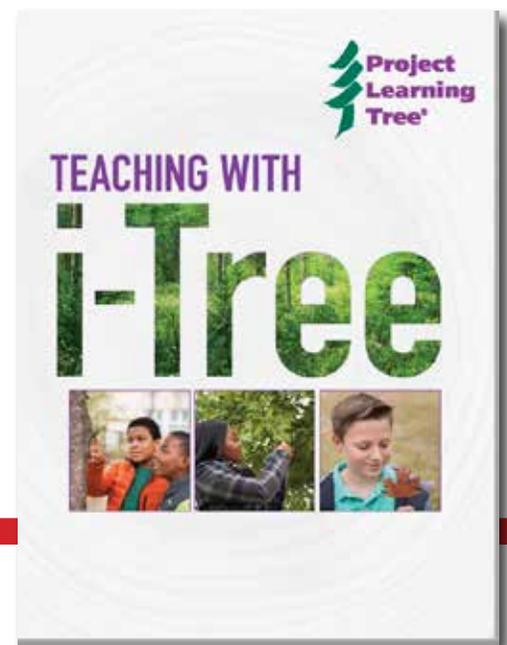
This map and identification tool provides information about trees native to Ontario and the best species to plant in a given location.

<https://www.ontario.ca/environment-and-energy/tree-atlas>

CAREER CONNECTION

An urban forest is the collection of trees that grow within a city or town and that provide critical benefits to people and wildlife. Urban foresters inventory and monitor the health of the urban forest using a variety of tools.

Give learners practice using i-Tree, an online tool used by urban foresters in the field (available at www.itreetools.org). See Project Learning Tree’s Teaching with i-Tree for three hands-on activities using i-Tree (available at www.plt.org/curriculum/teaching-with-itree). In particular, Activity 3: Land Manager Role Play explores various land management and forest-related careers.





WORKSHEET

FOREST HEALTH INDICATOR: TREE AND CROWN CONDITION

Date: _____

Location: _____

Damage to trees by disease, air pollution, weather, or human activities can affect the health of forests and can also be an indication of overall forest health.

MATERIALS

Paper, pencils, chalk

METHOD

Count all the trees in the plot, marking the trees with colored chalk to help you keep track. Note trees that have one or more signs of disease or damage (see below). To count it as diseased or damaged, 10 percent or more of the tree should be affected. Calculate the percentage of all trees in the plot that have such signs.



Sign of Disease or Damage

What It May Indicate

Tree has ragged leaves with holes	Insects feeding on the leaves
Black or brown leaves	Stem or leaf disease
Spots or bumps on leaves	Insects and mites
Twisted or malformed leaves	Insects and disease, herbicides
Leaves changing color before fall	Trunk or root damage, drought, pollution
Branch decay	Unhealed wounds
Peeling or broken bark, holes in the bark	Trunk wound, canker disease, or damage caused by humans or animals
Dying branches on one side of crown	Root decay, root injury or internal stem disease, insect attack
Canker (a dead section of a trunk or branch)	Fungal infections
Splits	Broken branches
Hollows	Water entering through old wounds and supporting wood decay by fungi
Fungi or mushrooms growing on tree	Internal decomposition of wood by fungi
Green or brown spots on needles	Air pollution

RESULTS

Total number of trees with signs of disease or damage in plot: _____ (Value A)

Total number of trees in plot: _____ (Value B)

Percentage of trees damaged = Value A ÷ Value B x 100 = _____ percent

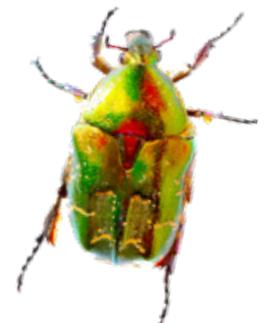
RATING

Good Less than 25 percent of trees have damage 3 Points

Fair 25–50 percent of trees have damage 2 Points

Poor Greater than 50 percent of trees have damage 1 Point

Overall Tree and Crown Condition rating for plot: _____





WORKSHEET

FOREST HEALTH INDICATOR: FOREST DIVERSITY



A healthy forest includes a variety of different plants and animals. One way to assess this diversity is to determine whether there is a mix of plant species of different sizes and ages, thus creating forest “layers” that provide habitat for many species.

MATERIALS

Pencil, paper, tape measure, chalk, tree identification guide (optional)

METHOD

Look at the leaves, bark, seed pods, or flowers of the trees in your forest plot to determine whether they are the same or different species. Use the *Tree Species Diversity* chart below to catalog this information. Tree identification guides are helpful with this step, but not necessary. If a tree identification guide is not available, use your observation skills to describe the differences in tree types and include this information in the *Tree Species Diversity* chart below.

For all trees in the sample plot, measure or estimate the diameter at a distance of 1.3 meters (4.5 feet) from the ground.

This is known as diameter at breast height or DBH. Count or estimate the number of trees of different size classes using the corresponding DBH size classifications found in the *Size Diversity* chart below and record your findings. To help you, consider using chalk to mark the trees you have already counted.

Assess the presence or absence of different forest layers, using the descriptions found in the *Forest Layer Diversity* chart and record your findings.

RESULTS

Tree Species Diversity

Species	Name/ Description	# Found in Sample Plot
Species 1		
Species 2		
Species 3		
Species 4		
Species 5		

Size Diversity

Tree Size	DBH	# Found in Sample Plot
Saplings or Poles	10–24 cm (4–9 inches)	
Small	25–37 cm (10–14 inches)	
Medium	38–49 cm (5–19 inches)	
Large	50–75 cm (20–29 inches)	
Giant	> 75 cm (30 inches or greater)	

Forest Layer Diversity

Tree Layer	Description	Present in Sample Plot? (Yes/No)
Overstory	Trees whose canopies are fully exposed to the sun	
Understory	Trees growing in the shade of other trees	
Tall shrub	Shrubs (woody plants with several stems arising from the base) greater than 1.8 meters (6 feet) in height	
Short shrub	Shrubs less than 1.8 meters (6 feet) in height	
Forb	Herbaceous (non-woody) plants such as ferns, wildflowers, and grasses	
Leaf litter	Dead and decaying leaves and other matter on the forest floor	

RATING

Tree Species Diversity

Good	Three or more tree species present	3 Points
Fair	Two tree species present	2 Points
Poor	One tree species present	1 Point

Tree Species Diversity rating (points) for plot: _____ (Value A)

Size Diversity

Good	Three or more size classes present	3 Points
Fair	Two size classes present	2 Points
Poor	One size class present	1 Point

Size Diversity rating (points) for plot: _____ (Value B)

Forest Layer Diversity

Good	Five or six layers present	3 Points
Fair	Three or four layers present	2 Points
Poor	One or two layers present	1 Point

Forest Layer Diversity rating (points) for plot: _____ (Value C)

OVERALL FOREST DIVERSITY RATING

Determine the overall rating by adding up the points shown for the tree species, size, and forest layer diversity ratings; then dividing the total by 3. Round the total to the nearest whole number.

(Value A + Value B + Value C) ÷ 3 = _____ (Average point value)

Good	Average point value of 3
Fair	Average point value of 2
Poor	Average point value of 1

Overall Forest Diversity rating for plot:

Sources: Greenleaf Forestry and Wood Products Inc. 2010. "Forest Health Checklist." www.greenleafforestry.com/services_006.php

Portland State University. 2010. "Protocol: Measuring Tree Diameter, Class Size, and Average Species Diameter."



WORKSHEET

FOREST HEALTH INDICATOR: LICHEN ABUNDANCE

Lichens often grow on trees and shrubs, absorbing nutrients from the atmosphere. Because lichens are very sensitive to air pollution—particularly to sulfur dioxide, fluoride, and ammonia—their presence or absence is an indicator of forest health. The acidity of a tree’s bark can also affect lichen abundance.

A lichen is actually two different organisms—either a fungus and an alga, or a fungus and a cyanobacterium—living in a symbiotic relationship. The fungus provides protection and moisture, while the alga or cyanobacterium provides food through photosynthesis.

MATERIALS

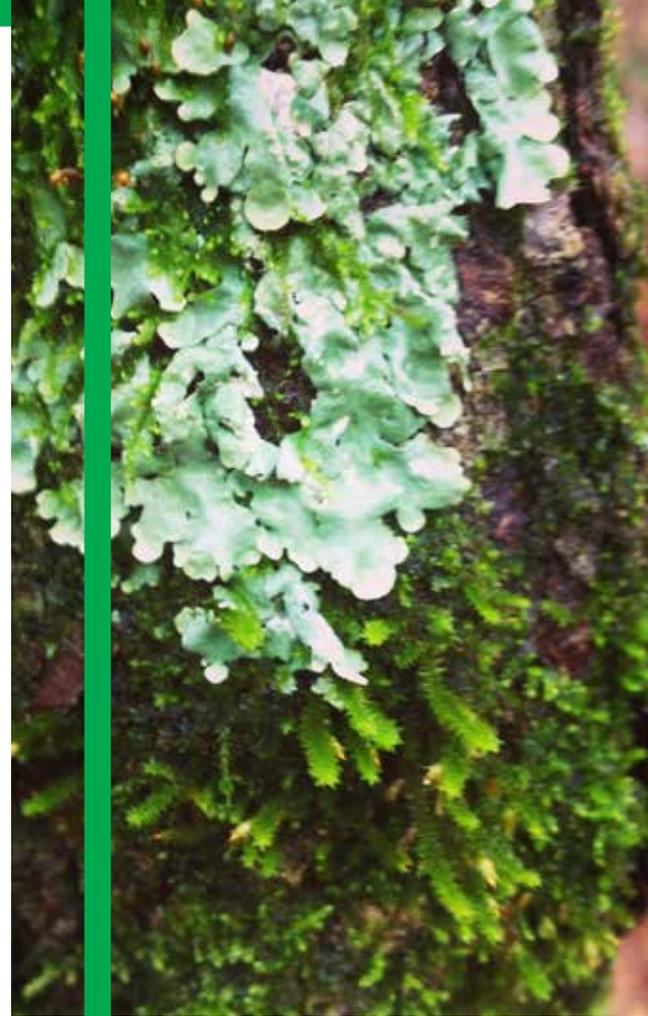
String, tape measure, compass, chalk, 100-Circle Grid transparency (page 61)

METHOD

Select 10 trees on your study plot to sample. For each tree, measure a distance of 1.3 meters (4.5 feet) from the ground, and tie a string around the tree trunk at that height. Use a compass to determine north, south, east, and west; then mark the directions with chalk on the tree at the string line. At each of the 4 directions, place the 100-Circle Grid transparency against the tree, and count the number of circles in which lichens are showing. That number represents the percentage of lichen coverage. For each tree, find the average lichen coverage by totaling the lichens found within the circles and then dividing the total by 4. Find the total average lichen coverage of the plot.

RESULTS

For each tree and direction, record in the following chart the number of circles that show lichens. This number represents the percentage of lichen coverage.



Trees help support many other living organisms, including these lichens. Far from harming the tree, lichens indicate pollution-free air.

Photo by USDA Forest Service - Northeastern Area Archive, USDA Forest Service.

LICHEN

LICHEN ABUNDANCE						
	North Side	East Side	South Side	West Side	Total	Tree Average (%)
Tree 1						
Tree 2						
Tree 3						
Tree 4						
Tree 5						
Tree 6						
Tree 7						
Tree 8						
Tree 9						
Tree 10						
Total of Tree Averages						
Average Lichen Coverage						

For each tree, total up the results from the four directions and then divide by four to get the tree average.

Add up the tree averages and divide this total by the number of trees sampled to get the average lichen coverage for the entire sample plot.

Average Lichen Coverage for sample plot: _____ percent

RATING

Good	Greater than 5 percent lichen coverage	3 Points
Fair	3–5 percent lichen coverage	2 Points
Poor	0–2 percent lichen coverage	1 Point

Overall Lichen Abundance rating for plot: _____

Sources

Pathfinder Science. 2006. "Sampling Procedure for Lichen Coverage." www.pathfinderscience.net/so2/cproto1.cfm

Smith, Gregory L., and Thomas R. Baker. 2003. "Lichens as Bioindicators." NSTA WebNews Digest. www.nsta.org/publications/news/story.aspx?id=48645



WORKSHEET

100-CIRCLE GRID



○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○
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○	○	○	○	○	○	○	○	○	○
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○	○	○	○	○	○	○	○	○	○



WORKSHEET

FOREST HEALTH INDICATOR: SOIL QUALITY

The quality of the soil in a forest is an important indicator of forest health. How well the soil functions directly influences the health of the trees and other forest organisms. An evaluation of soil quality usually involves measuring the soil's physical, chemical, and biological makeup at different depths.

MATERIALS

Spade or trowel, 3 paper cups or plastic bags, tablespoon, distilled water, eyedropper, 3 Petri dishes or plastic containers, pH paper, white paper

METHOD

Choose a soil sample site that represents the overall forest plot. On the ground, measure a square approximately 30 cm (1 foot) on each side, marking the corners with sticks or rocks. Within the plot, first remove the leaf litter layer with a spade or trowel. Next, collect soil samples from depths of approximately 7.5 cm (3 inches), 15 cm (6 inches), and 30 cm (1 foot). Use paper cups or plastic bags to store the samples, labelling each sample.

Conduct the following assessments for each sample, recording your results in the Soil Quality Results and Rating chart that follows.

RESULTS

Soil Type

Most soils are a mixture of sand, silt, and clay. The specific content of a given soil influences how well it holds nutrients and water. To find out your soil type, take a small amount of soil (about the size of a marble), and moisten it with a few drops of water. Squeeze it between your thumb and fingers. Record your results in the Soil Quality Results and Rating chart that follows.

Soil Type	Squeezed Moist Soil	Rating
Sand	Feels gritty and cannot hold ball shape	Poor – Has few nutrients, holds little water, and is prone to drought
Sandy Loam	Can be molded into a ball, but ball breaks up easily	Good – Has good balance of nutrients and moisture retention
Silt	Can be molded into a ball that is easily deformed; does not feel gritty and has silkiness like flour	Fair – Has more nutrients and holds more water than sand, but washes away (erodes) easily
Loam	Can be molded into a ball that can be handled quite freely without breaking	Good – Has good balance of nutrients and moisture retention
Clay Loam	Can be formed into a long thin rod or “ribbon” that will break readily, barely sustaining its own weight	Good – Has good balance of nutrients and moisture retention
Clay	Sticky and can easily be formed into long thin rod or “ribbon”	Fair – Holds water very well, but does not allow movement of air or water, so doesn't drain well

Soil pH

Soil pH is a measure of how acidic or alkaline the soil is, and it is an indicator of soil quality. Measure 1 tablespoon of soil from each depth, place this amount onto individual Petri dishes or plastic containers, and label the soil samples. Wet each soil sample with 5 drops of distilled water, and allow it to sit for 3 to 5 minutes. Place one piece of pH paper on each soil sample. Determine the approximate pH of your soil.

RATING

Good	pH of 5.51–7.2, which is optimum for many plant species	3 Points
Fair	pH of 7.2–8.5 (moderately alkaline) or 4.0–5.5 (moderately acid)	2 Points
Poor	pH of 4.0 and less (acid), or greater than 8.5 (alkaline)	1 Point

Record your results in the Soil Quality Results and Rating chart that follows.

Soil Organisms

The presence of living organisms in the soil is an important indicator of productive soils. Soil organisms aid in nutrient cycling, soil creation, and decomposition of organic matter and dead organisms. Pour the remaining soil sample onto a white piece of paper, and look for the presence of the following organisms. For each type, circle whether it is present or not. (Soil fungi are microscopic cells that grow as long threads or strands in the soil.)

Soil Depth	Ants/Termites	Centipedes/ Millipedes	Earthworms	Fungi	Other: _____	Other: _____
7.5 cm (3 in)	Y / N	Y / N	Y / N	Y / N		
15 cm (6 in)	Y / N	Y / N	Y / N	Y / N		
30 cm (12 in)	Y / N	Y / N	Y / N	Y / N		

RATING

Good	3 or more types of soil organisms present in soil sample	3 Points
Fair	1 or 2 types of organisms present in soil sample	2 Points
Poor	no soil organisms present in soil sample	1 Point

Record your results in the Soil Quality Results and Rating chart that follows.

SOIL



RATING

Circle the ratings that apply for each depth and each assessment. Determine the average score for each depth by adding up the points shown for each rating and dividing the total by 3. Find the average of the three “Average Soil Quality at Each Depth” ratings to get the overall soil quality.

Soil Quality Results and Rating

	7.5 cm (3 in) deep			15 cm (6 in) deep			30 cm (12 in) deep		
Soil Type									
Soil Type Rating	Good 3 Points	Fair 2 Points	Poor 1 Point	Good 3 Points	Fair 2 Points	Poor 1 Point	Good 3 Points	Fair 2 Points	Poor 1 Point
Soil PH Rating	Good 3 Points	Fair 2 Points	Poor 1 Point	Good 3 Points	Fair 2 Points	Poor 1 Point	Good 3 Points	Fair 2 Points	Poor 1 Point
Soil Organism Rating	Good 3 Points	Fair 2 Points	Poor 1 Point	Good 3 Points	Fair 2 Points	Poor 1 Point	Good 3 Points	Fair 2 Points	Poor 1 Point
Total Points									
Average Soil Quality at Each Depth (rounded to nearest whole number)									
Overall Soil Quality (rounded to nearest whole number)									

OVERALL RATING

Good Average point value of 3

Fair Average point value of 2

Poor Average point value of 1

Overall Soil Quality rating for plot: _____

Source: USDA Forest Service. 2007. “Soil Vital Signs: Soil Quality Index (SQI) for Assessing Forest Soil Health.” www.fs.fed.us/rm/pubs/rmrs_rp065.pdf





WORKSHEET

FOREST HEALTH INDICATOR: REGENERATION

Forest regeneration is a good measure of the health of the forest habitat. When a forest can produce enough young trees to replace the canopy trees when they are cut, blown down, or die, such production is an indication that the forest is vibrant and sustainable. Regeneration is measured by the number of tree seedlings present.



MATERIALS

Tape measure, string or other marker

METHOD

Using a tape measure and string or other marker, divide the study plot into 9 equal segments (8 equal segments, if it is a circle plot). Survey each segment and determine whether there is a healthy seedling that is at least 30 cm (12 inches) tall if it is a conifer, and at least 1 meter (39 inches) tall if it is a deciduous tree. To be considered healthy, the seedling must not have any apparent damage to its leaves or stems.

RESULTS

Number of forest plot segments with at least one healthy seedling:

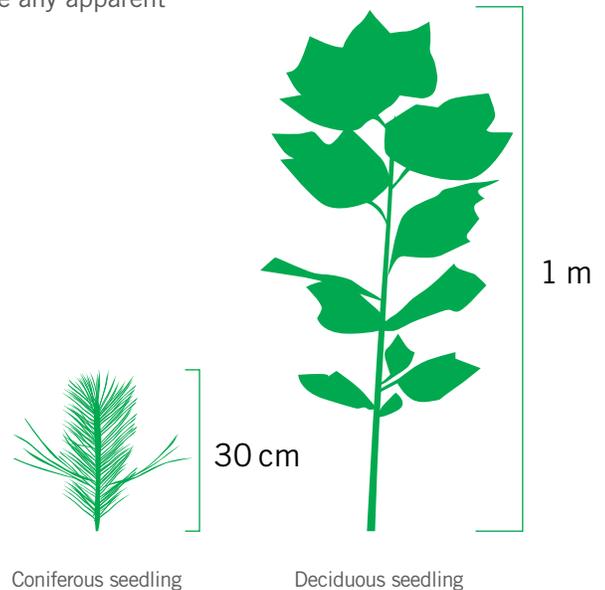
_____ (Value A)

Number of total forest plot segments:

_____ (Value B)

Percentage of plots with at least one healthy seedling:

Value A ÷ Value B x 100 = _____ percent



RATING

- | | | |
|-------------|---|----------|
| Good | More than 66 percent of plot segments have at least one healthy seedling. | 3 Points |
| Fair | 33 to 66 percent of plot segments have at least one healthy seedling. | 2 Points |
| Poor | Less than 33 percent of plot segments have at least one healthy seedling. | 1 Point |

Overall Regeneration rating for plot: _____

Source: Forestry Branch, Province of Manitoba. 2010. "Silviculture Surveys: Regeneration Surveys."



WORKSHEET

FOREST HEALTH INDICATOR: SNAGS AND COARSE WOODY DEBRIS

In natural forest ecosystems, snags (standing dead trees) and coarse woody debris (dead logs and large branches on the ground) are important indicators of forest health. Their presence indicates a forest of diverse ages, and the snags and debris provide animal habitat, energy and nutrient cycling, and stable soils.

Note: In parks or near structures, forest managers may remove snags or coarse woody debris to prevent fire and other safety hazards. If your forest plot is in such an area, the presence of snags or debris will not be a relevant forest health indicator.



MATERIALS

Tape measure

METHOD

Count the number of snags and the number of live trees in your forest plot, and calculate the percentage of standing trees that are snags. Then, count the number of dead logs and downed large branches in your plot that are more than 10 cm (4 inches) in diameter and more than 1 m (39 inches) in length, and calculate their abundance.

RESULTS

Snags

Number of snags in plot: _____ (Value A)

Number of live trees in plot: _____ (Value B)

Total number of standing trees in plot:

Value A + Value B = _____ (Value C)

Percentage of snags:

Value A ÷ Value C x 100 = _____ percent (Value D)

Coarse Woody Debris

Number of logs and downed branches greater than 10 cm (4 inches) in diameter and 1 m (39 inches) in length:

_____ (Value E)

Abundance of coarse woody debris:

(Value E ÷ Value B) x 100 = _____ percent (Value F)

(Note: For some forest plots, abundance may be more than 100 percent.)

SNAGS

RATING

Snags

Good	More than 10 percent of standing trees are snags.	3 Points
Fair	From 5 to 10 percent of standing trees are snags.	2 Points
Poor	Fewer than 5 percent of standing trees are snags.	1 Point

Snags rating for plot: _____ points (Value G)

Coarse Woody Debris

Good	More than 15 percent abundance of coarse woody debris.	3 Points
Fair	From 5 to 15 percent abundance of coarse woody debris.	2 Points
Poor	Fewer than 5 percent abundance of coarse woody debris.	1 Point

Course Woody Debris rating for plot: _____ points (Value H)

OVERALL RATING

Determine the overall rating by adding up the points shown for the snag and coarse woody debris ratings, and then divide the total by 2. Round to the nearest whole number. Then, assign a rating based on the average point value.

(Value G + Value H) ÷ 2 = _____

Good	Average point value of 3
Fair	Average point value of 2
Poor	Average point value of 1

Overall Snags and Coarse Woody Debris rating for plot: _____

Source: National Park Service. 2009. "Forest Health: Coarse Woody Debris and Snags." Resource Brief, Northeast Temperate Network. science.nature.nps.gov/im/units/NETN/Education/Resource%20Briefs/NETN_RB_CWDSnags_FINAL.pdf

WOODY DEBRIS



WORKSHEET

FOREST HEALTH INDICATOR: WILDLIFE

The presence of a variety of wildlife is an indicator that a forest is vibrant and healthy. Actually seeing the animals may be difficult, but tracks, droppings, burrows, dens, nests, chewed leaves and pinecones, and other evidence or “signs” reveal their existence. You are more likely to see or hear the animals if you are quiet, respectful, and patient.

MATERIALS

Pencil, paper, binoculars or magnifying glass (optional)

METHOD

In your forest plot, look on the ground, under shrubs, and in trees for mammals, birds, reptiles, amphibians, spiders, or insects, or for signs of those animals. Record your observations.

RESULTS

ANIMAL CLASS	SIGNS	SIGHTINGS
Mammals		
Birds		
Reptiles		
Amphibians		
Spiders		
Insects		
Other		

RATING

- | | | |
|-------------|--|----------|
| Good | Signs or sightings of 4 or more different classes of animals | 3 Points |
| Fair | Signs or sightings of 2–3 different classes of animals | 2 Points |
| Poor | Signs or sightings of 0–1 different classes of animals | 1 Point |

Overall Wildlife rating for plot: _____





WORKSHEET

FOREST HEALTH SUMMARY

Use this page to tally the Forest Health Indicator investigations that you have conducted for your forest plot, while noting any key observations. Use the indicators to make an assessment of the forest's overall health. Note that these points and ratings offer a snapshot of forest health. Foresters assess forest health based on the objectives for and conditions of a particular forest.

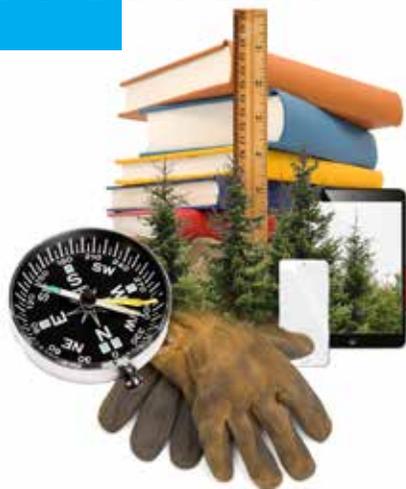


Forest Health Indicator	Overall Point Value (3, 2, or 1)	Overall Rating (Good, Fair, or Poor)	Key Observations
Tree and Crown Condition			
Forest Diversity			
Lichen Abundance			
Soil Condition			
Regeneration			
Snags & Course Woody Debris			
Wildlife			
Averages / Conclusions			

What is the Overall Health Assessment for your study plot?

Explain your reasoning.

LEARNING ACTIVITY



4. SEEKING SUSTAINABILITY

Learners explore the concept of sustainability by examining the United Nations' 17 Sustainable Development Goals, while also taking a look at some jobs involved in ensuring forest sustainability.

LEARNING OBJECTIVES

- Review and consider the multiple elements of forest sustainability.
- Recognize connections between forests and the United Nations Sustainable Development Agenda.
- Identify jobs that help countries move toward sustainability goals.

LINKING TO LIFE

- Learners explore criteria for measuring and monitoring sustainable development locally and globally.

BACKGROUND

Forests are a top environmental concern for many countries, and international efforts are working to address the growing challenges facing forests. At the United Nations' 1992 Rio de Janeiro Earth Summit, world leaders from 102 countries adopted two international declarations that affirmed the importance of the forests of the world. The Statement of Forest Principles was the first global agreement on forests and their sustainability, and Agenda 21 was an international action plan for sustainable development that included environmental, social, and economic dimensions of sustainability.

Sustainable forest management addresses forest health and deforestation, while increasing direct benefits to people and the environment. Sustainable forest management contributes to livelihoods, quality of life, and employment. It also contributes to important services such as carbon storage and the conservation of water, soil and biodiversity.

In 2015, governments from around the world adopted the 2030 Agenda for Sustainable Development, also known as the 2030 Agenda. Since then, the 2030 Agenda and its 17 Sustainable Development Goals (SDGs) have become the overarching framework for sustainable development, including forest sustainability. It commits the international community to act together to overcome the complex challenges facing the world in the 21st century.

STEM SKILLS

Collaboration, Communication, Leadership, Nature-Based Design

MATERIALS

Copies of worksheets, presentation software or markers and poster paper, internet access

TIME

PREPARATION

20 minutes

ACTIVITY

One to two 50-minute sessions, plus time for groups to prepare their displays

The 2030 Agenda is centered on four main objectives: eradicate poverty, heal the planet, secure prosperity for all, and foster peace and justice. It reaffirms the need to make progress in all three dimensions of sustainable development—economic, social and environmental—and for a comprehensive, far-reaching and people-centered approach that can yield transformational change towards sustainability. In terms of forests, the 2030 Agenda provides a framework for examining the contribution that forests make to sustainable development.

Sustainable Development Goals are a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity. This work requires many different partners, collaborators, and people on the ground.

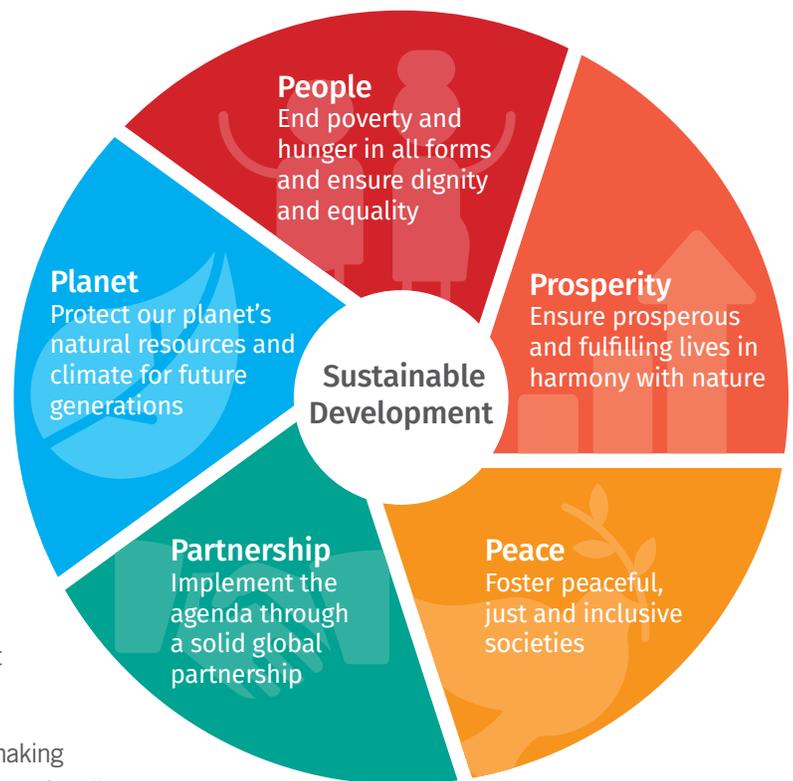
Many different jobs are involved in monitoring progress and making strides toward forest sustainability, both domestically and internationally. These include forestry jobs like the learners explore in the If You Were the Boss and Monitoring Forest Health learning activities. But, they also include jobs in carbon accounting, green energy, sustainable supply chains, environmental justice, international law and policy, and more. This work also requires people with skills in developing international agreements, planning and implementing actions on the ground, and monitoring results.

GETTING READY

Make copies of the worksheets.

DOING THE ACTIVITY

1. Ask the group what they think the word “sustainable” means. Divide learners into small groups and challenge each to come up with a definition for sustainable, either by talking among themselves or by doing an online search. Have groups share their definitions. Then, have learners identify the key components of the definitions they’ve shared. Ask, “What might the term ‘forest sustainability’ mean? What things would you expect to be true if a particular forest use is sustainable?”
2. Give everyone a copy of the “Forest Sustainability” worksheet. Have them read it and discuss within their small groups the merits and weaknesses of this definition of forest sustainability and how it differs from the one they crafted.
3. Introduce the Sustainable Development Goals using the “Sustainable Development Goals of the United Nations” worksheet (also see Background).



Agenda 2030's Sustainable Development Goals aim to promote prosperity while protecting the planet.

SUSTAINABLE DEVELOPMENT AND FORESTS

Forests play a key role in meeting the world's Sustainable Development Goals. For example:

- **Goal 2 — Zero Hunger:** Healthy forests support crop production by sustaining watersheds, promoting soil fertility, and sheltering pollinators and seed dispersers.
- **Goal 6 — Clean Water and Sanitation:** Well-managed forests conserve sources of clean water. Over half the drinking water in the US and nearly two-thirds in Canada comes from forests.

All 17 Sustainable Development Goals have at least some connection to forests, which learners can explore in this activity. For more information, see [Forests and Sustainable Development Goals at nydfglobalplatform.org/forests-and-sustainable-development-goals](https://nydfglobalplatform.org/forests-and-sustainable-development-goals), SFI and Sustainable Goals at www.sfi-program.org/sfi-and-sdgs, or try searching online using the search term “forests and SDGs.”



FOREST SUSTAINABILITY

CAREER CONNECTION

As learners analyze a particular Sustainable Development Goal in step 5, challenge them to identify: 1) how that criterion can be measured, monitored, and assessed and 2) the different technology tools that would be required to capture such measurement and analysis. Learners can explore specific technologies by doing an internet search using key words such as “forest tools” or “forest monitoring.” They might start their exploration of related jobs by looking at the United Nations Career page at careers.un.org

4. Assign each group two or more of the Sustainable Development Goals to examine. Be sure that the following are spread among the groups as they have more connections to forests: Goal 1, Goal 2, Goal 5, Goal 6, Goal 7, Goal 8, Goal 11, Goal 12, Goal 13, and Goal 15.
5. Explain that each group will be responsible for making a visual display of their assigned goals. Their display should include a description of each goal, its connection to forests, and what green jobs might help countries work toward the goal. To create a visual display, learners may use digital tools such as presentation, animation, mind-mapping, video, or other online application, or physical poster-making materials such as poster paper and marking pens.
6. Encourage students to use the suggested Resources and the questions on the “Sustainable Development Goals of the United Nations” worksheet to focus their display.
7. Have each group present their displays to the group. Each presentation should include a description of each goal, its forest connections, and relevant green jobs.
8. After all the presentations, discuss the following:
 - What is the aim of the Sustainable Development Goals?
 - Why are the Sustainable Development Goals important?
 - How do the Sustainable Development Goals help move the world’s forests toward sustainability?
 - How might these Goals relate to the sustainability of other natural resources like water, air, fish, or wildlife?
 - What job opportunities are inherent in the Sustainable Development Goals?
 - What could we do in our own lives to support the Sustainable Development Goals?

ENRICHMENT

- Ask a representative from your local or regional forest agency or association, a forest products company, or a conservation group to talk with learners about forest sustainability and how and by whom it is measured in your area. See “Finding Forest Professionals” on page 77 for suggestions.
- Find opportunities for learners to collect data as citizen scientists for local or regional forest resource agencies or organizations to monitor forest sustainability. Check iNaturalist, eBird, or Track My Fish for international projects.
- Forest certification is one way to encourage sustainable forest management by certifying that certain forests have been managed or harvested under specific forestry standards. Wood products from these forests are labeled so consumers can easily see that they are from a certified forest. Have learners research one or more certification systems to learn how these systems assess sustainability and who does the assessments.

Forest certification systems in the U.S. include: Sustainable Forestry Initiative (www.sfiprogram.org); Forest Stewardship Council (www.fsc.org); and the American Tree Farm System Certification (www.treefarmssystem.org) for family forest owners.

- Analyze a global map showing the location of the world's forests (such as one available at Our World in Data at ourworldindata.org/wp-content/uploads/2013/11/the-worlds-forest-cover-density-2010-fao.png) and determine whether political boundaries generally align with forest boundaries. Discuss what happens when a forest region is located in more than one country: Who should make policies involving the forest? How might those policies affect the environmental, economic, or social aspects of sustainability?
- Study a variety of maps on the world's forest resources, available from the Food and Agriculture Organization of the United Nations at www.fao.org/forest-resources-assessment/current-assessment/maps-and-figures/en/. What patterns or trends can learners identify?



STEM IT UP!

Encourage learners to review their country's most recent forest report (see Resources) and select three to five graphs or data charts related to one of the Sustainable Development Goals to analyze. Have them describe any trends the graphs or charts reveal, and what those trends might indicate in terms of forest sustainability.

RESOURCES

National Report on Sustainable Forests, 2010

The U.S. Department of Agriculture develops periodic reports on monitoring of the nation's forests, such as this one from 2010.

www.fs.fed.us/research/sustain

The State of Canada's Forests: Annual Report 2017

This is one of a series of annual reports published by Natural Resources Canada, which tracks progress toward sustainable forest management.

www.nrcan.gc.ca/forests/report/16496

The State of the World's Forests, 2018

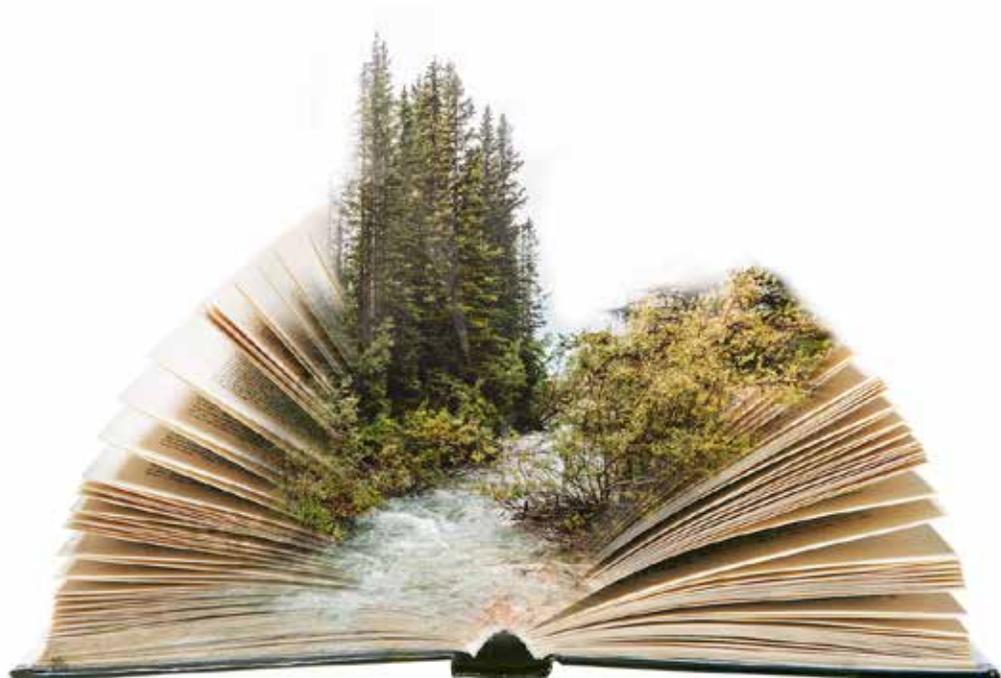
This report from the Food and Agriculture Organization of the United Nations identifies connections between forests and the Sustainable Development Goals.

www.fao.org/3/I9535EN/i9535en.pdf

Transforming Our World: The 2030 Agenda for Sustainable Development

This United Nations web page contains the agreement adopted by countries around the world to work toward sustainable development by the year 2030. It lists 169 targets for the 17 Sustainable Development Goals.

sustainabledevelopment.un.org/post2015/transformingourworld





WORKSHEET FOREST SUSTAINABILITY

Forest sustainability may be defined as managing forests to meet the needs of the present without compromising the ability of future generations to meet their needs. It is often seen as a balance between society’s demands on forests, and the need to conserve forest health and diversity.

TRADITIONAL PERSPECTIVES

For Indigenous peoples of North America, the concept of sustainability, known as the Seventh Generation Principle, is based on an ancient philosophy that the decisions we make today should result in a sustainable world as far as seven generations into the future. It is represented in the “Seventh Generation Principle” graphic, on the right. In considering the long-term effects of actions affecting natural resources, this philosophy helps to ensure both sustainability and stewardship.

TRIPLE BOTTOM LINE

Many people use a “triple bottom line” approach to measure sustainability by looking at three elements: economy, environment, and society. One way to think of those three elements is shown in Figure 2. Each of the elements—economic prosperity, environmental protection, and social well-being—is interdependent with the others, and each may be present to a greater or lesser degree in a particular situation. The ultimate goal of forest sustainability involves a balance of all three, as indicated by the shaded area in the middle.

The essential idea of forest sustainability is that environmental, social, and economic issues and ideals must be included in decisions and actions that affect forests, while also taking into account future and present needs.

FIGURE 1. SEVENTH GENERATION PRINCIPLE OF SUSTAINABILITY

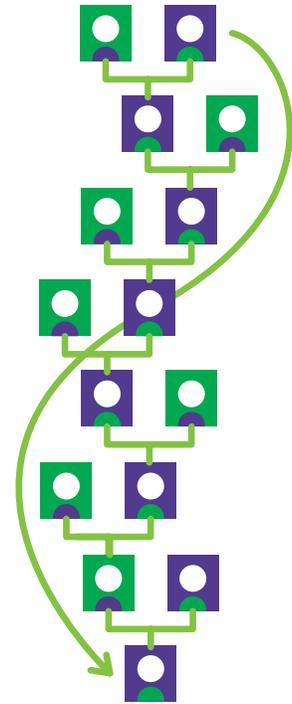
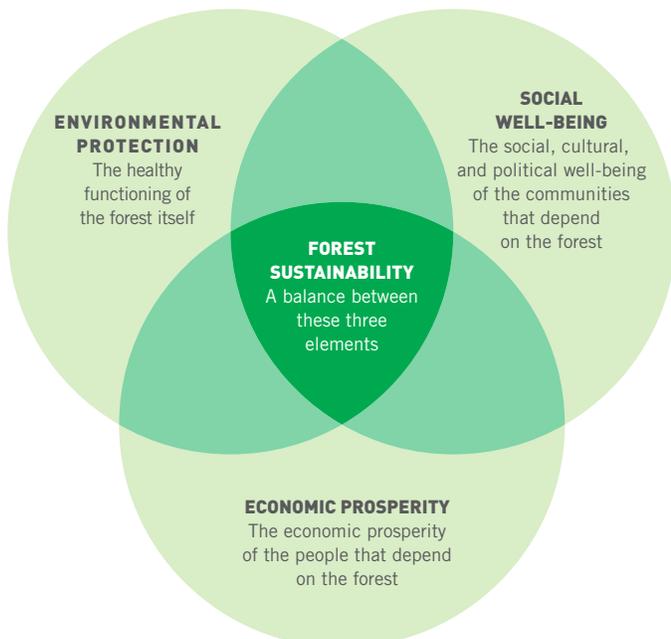


FIGURE 2. TRIPLE BOTTOM LINE APPROACH TO SUSTAINABILITY





WORKSHEET

SUSTAINABLE DEVELOPMENT GOALS OF THE UNITED NATIONS



In 2015, 193 countries around the world agreed to 17 Sustainable Development Goals, which chart a course towards a better, more prosperous future for the planet and all its people. As part of the 2030 Agenda for Sustainable Development, the aim of these goals is for countries to mobilize efforts to end all forms of poverty, fight inequalities, and tackle climate change by the year 2030.

For each of the goals, consider:

- How are forests and trees connected to this goal?
- In what ways do forests and trees contribute to achieving this goal?
- In what ways does this goal help to ensure forest sustainability?
- What baseline data or monitoring is required to determine progress toward this goal?
- What green jobs can help countries work toward this goal?



NO POVERTY

End poverty in all its forms everywhere.



ZERO HUNGER

End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.



GOOD HEALTH AND WELL-BEING

Ensure healthy lives and promote well-being for all at all ages.



QUALITY EDUCATION

Ensure inclusive and quality education for all and promote lifelong learning.



GENDER EQUALITY

Achieve gender equality and empower all women and girls.



CLEAN WATER AND SANITATION

Ensure access to water and sanitation for all.



AFFORDABLE AND CLEAN ENERGY

Ensure access to affordable, reliable, sustainable, and modern energy for all.



DECENT WORK AND ECONOMIC GROWTH

Promote inclusive and sustainable economic growth, employment, and decent work for all.



INDUSTRY, INNOVATION, AND INFRASTRUCTURE

Build resilient infrastructure, promote sustainable industrialization, and foster innovation.



REDUCED INEQUALITIES

Reduce inequality within and among countries.



SUSTAINABLE CITIES AND COMMUNITIES

Make cities inclusive, safe, resilient, and sustainable.



RESPONSIBLE CONSUMPTION AND PRODUCTION

Ensure sustainable consumption and production patterns.



CLIMATE ACTION

Take urgent action to combat climate change and its impacts.



LIFE BELOW WATER

Conserve and sustainably use the oceans, seas, and marine resources.



LIFE ON LAND

Sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.



PEACE, JUSTICE AND STRONG INSTITUTIONS

Promote just, peaceful, and inclusive societies.



PARTNERSHIPS FOR THE GOALS

Revitalize the global partnership for sustainable development.

Source: United Nations. Transforming Our World: The 2030 Agenda for Sustainable Development. September 2015. sustainabledevelopment.un.org/post2015/transformingourworld

APPENDICES

ADDITIONAL RESOURCES

The following organizations, websites, and teaching tools focus on green jobs and may be used to deepen learners' exploration of forest-related careers.

FORESTRY CAREER INFORMATION WEBSITES

These websites provide detailed information about specific forestry and forest-related job titles.

Agriculture and Forestry Careers
EnvironmentalScience.org

www.environmentalscience.org/careers/agriculture-and-forestry

Careers in Forestry and Natural Resources
forestrycareers.org

Career in STEM
www.careerinstem.com

Careers in Sustainable Forestry
U.S. Bureau of Labor Statistics
www.bls.gov/green/forestry/sustainable_forestry.htm

Forestry Works
www.forestryworks.org

PLT Green Career Fact Sheets
www.plt.org/green-jobs

GREEN JOB BOARDS

These websites list job openings, internships, and volunteering opportunities in forestry and other green careers.

Environmental Career Center
www.environmentalcareer.com

Conservation Job Board
www.conservationjobboard.com

Environmental Career Opportunities (ECO)
www.ecojobs.com

Forestry Jobs in America
www.forestryusa.com/jobs.html

Forestry Jobs in Canada
www.canadian-forests.com/job.html

PLT Canada
www.pltcanada.org

Society of American Foresters Career Center
careercenter.eforester.org

FINDING FOREST PROFESSIONALS

To locate forest professionals to speak with your group, try contacting:

Federal agencies in the United States

U.S.D.A Forest Service
U.S.D.A. Cooperative Extension Service
Bureau of Land Management
National Park Service

State, county, or local agencies

Department of forestry
Department of fish and wildlife
Department of natural resources
Department of parks and recreation

Professional organizations

500 Women Scientists
Society of American Foresters
State Forestry Associations
American Forest and Paper Association
Forest Products Association of Canada

Other networks

Forest product manufacturers
Companies with timberlands or tree farms
Logging and forest operators
Conservation research organizations
University schools of forestry
SFI Implementation Committees

TEACHING TOOLS

These teaching tools are designed for use with youth and may supplement the learning activities provided in this resource.

VIDEOS

Find Your Path. Oregon Forest Resources Institute

This set of two-minute videos highlights 16 different forestry jobs in the voices of real people.

www.learnforests.org

Forest Proud

This organization offers a variety of videos of forest professionals (see “Forest Voices”) and on forests in general (see “Forests 101” and “Forest Choices”), telling the forestry story in an engaging manner.

forestproud.org

Project Learning Tree (PLT) Canada videos

These videos provide an “insider” view of young people engaged in summer jobs obtained through PLT Canada.

www.pltcanada.org

Work Wild videos

These videos introduce basic concepts in forest management and different forest careers.

workwild.ca/forestry-resources/videos/

CURRICULA

Envirothon. National Conservation Foundation

This environmental education program and annual academic competition aims to develop knowledgeable, skilled, and dedicated individuals who have an understanding of natural resources.

www.envirothon.org

Green Jobs: Job Corps—Integrating Career Technical Training into the “Green” Economy. U.S. Department of Agriculture, Forestry.

The five lessons in this curriculum are designed to teach students about both the “green” economy and how developing “green” skills can benefit them.

www.fs.usda.gov/internet/fse_documents/stelprdb5212120.pdf

Project Learning Tree (PLT)

PLT offers a range of instructional materials exploring forests and forest management. Peruse the wide variety of electronic resources available at shop.plt.org. To inquire about attending a training near you, contact your local PLT Coordinator at www.plt.org/your-state-project-learning-tree-program/.

www.plt.org

OTHER RESOURCES

Focus on Forests. Forests Ontario

This collection of free education resources includes those that introduce and discuss green jobs.

www.focusonforests.ca

Green Jobs in the Forest Sector. United Nations Economic Commission for Europe

This report provides a worldwide overview of existing green forest jobs and identifies possible areas for future job growth in the forest sector.

www.unece.org/fileadmin/DAM/timber/publications/DP71_WEB.pdf

Natural Inquirer Scientists and Engineers Card Series. U.S. Department of Agriculture, Forestry

This set of cards features over 215 different scientists and engineers that work for the U.S. Forest Service, helping students envision possible forestry career opportunities.

www.naturalinquirer.org/scientists-v-168.html

Project Learning Tree (PLT) Canada Résumé Builder

Learners can create a résumé and then export a PDF of their résumé to save. Note that they first need to register with PLT Canada to access the builder.

www.pltcanada.org

EXAMPLE STANDARDS CONNECTIONS

Teaching and learning about green jobs can be incorporated into diverse subject areas, including science, math, geography, English, social studies, career education, biology, environmental education, communication technologies, and vocational education, among others.

In the United States, each state defines its own education standards and curriculum mandates for schools, so that exact curriculum links vary by jurisdiction. Many states, however, use national standards as the foundation for their state-specific standards.

The table on the next page represents an overview of example curriculum links for the four activities included in this guide, based on the following national standards:



We invite you to use the examples in the following table as a springboard for identifying curriculum links in your state for your specific subject areas or content areas of interest. You can also request supporting professional development on standards alignment from your PLT State Coordinator for this PLT resource or any other. To contact your State Coordinator see:

www.plt.org/your-state-project-learning-tree-program/.

EXAMPLE STANDARDS ALIGNMENT

SUBJECT AREA	NATIONAL STANDARD	GREEN JOBS ACTIVITY
SCIENCE	Evaluate competing design solutions for maintaining biodiversity and ecosystem services. (NGSS.MS-LS2-5)	2
	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. (NGSS.HS-LS2-2)	2
	Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity. (NGSS.HS-ESS3-3)	2
	Analyze and Interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (NGSS.MS-LS2-1)	3
	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (NGSS.MS-ESS3-3)	3
	Analyze a major global challenge to specify quality and quantitative criteria and constraints for solutions that account for societal needs and wants. (NGSS.HS-ETS1-1)	4
MATHEMATICS	Reason abstractly and quantitatively. (CCSS.MATH.PRACTICE.MP2)	2, 3
	Model with mathematics. (CCSS.MATH.PRACTICE.MP4)	2
	Attend to precision. (CCSS.MATH.PRACTICE.MP6)	3
ENGLISH LANGUAGE ARTS	Prepare for and participate in a range of conversations and collaborations with diverse partners, building others' ideas and expressing their own clearly and persuasively. (CCSS.ELA.HST-SL.6-12.1)	1, 2, 3, 4
	Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation. (CCSS.ELA.HST-W.6-12.7)	1
	Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations. (CCSS.ELA.HST-SL.6-12.5)	4
SOCIAL STUDIES	Evaluate alternative approaches to solutions to current economic issues in terms of benefits and costs for different groups and society as a whole. (C3.D2.ECO.2.6-8)	2
	Use marginal benefits and marginal costs to construct an argument for or against an approach or solution to an economic issue. (C3.D2.ECO.2.9-12)	2
	Examine the origins, purposes, and impact of constitutions, laws, treaties, and international agreements. (C3.D2.Civ.3.6-8)	4

Additional standards connections are available at the PLT website: <https://www.plt.org/alignment-to-standards>

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PLT EDUCATIONAL RESOURCES

Project Learning Tree offers lesson plans and activities for all ages that can be easily incorporated into existing curriculum or used in informal settings.

E-Units for Grades K-2, 3-5, and 6-8

PLT's new online curriculum includes Tremendous Science! for grades K-2, Energy in Ecosystems for grades 3-5, and Carbon & Climate for grades 6-8. The e-units include step-by-step lesson plans and multi-disciplinary, hands-on activities constructed around NGSS, aligned with Common Core and the C3 Framework for Social Studies. They incorporate background information, downloadable student pages, assessment tools and rubrics, links to supplementary resources, and more! Energy in Ecosystems is a Learning® magazine 2019 Teachers' Choice® Award winner.

Learn more at www.plt.org/online-environmental-education-units

PreK-8 Environmental Education Activity Guide

This curriculum resource contains 96 multi-disciplinary activities each tailored to specific grade levels and correlated to state and national academic standards. Hands-on activities develop students' STEM, critical-thinking, problem-solving, and other 21st century skills. Each activity includes background information, assessment tools, literature connections, technology extensions, cooperative learning, and differentiated instruction.

Learn more at www.plt.org/curriculum/environmental-education-activity-guide/

Teaching with i-Tree

Middle and high school students discover and analyze the many ecosystem services that trees provide and calculate the dollar value of these benefits using a free, state-of-the-art online tool.

Learn more at www.plt.org/curriculum/teaching-with-itree

Secondary Modules

For high school educators, PLT's secondary modules challenge students to explore in depth the many facets of environmental issues. Hands-on classroom studies, research, and collaborative field investigations provide students opportunities to debate issues and engage with experts. PLT's secondary modules include Focus on Forests, Forests of the World, Places We Live, Municipal Solid Waste, Biodiversity, Focus on Risk, and Biotechnology.

Learn more at www.plt.org/curriculum-offerings/high-school/

Environmental Experiences for Early Childhood

Designed for educators who work with children ages 3 to 6, over 130 hands-on experiences engage young children in outdoor exploration and play. Activities integrate investigations of nature with art, literature, math, music, and movement. An accompanying music CD encourages children to sing, dance, and move. This activity guide is a Learning® magazine 2011 Teachers' Choice® Award winner.

Learn more at www.plt.org/curriculum/environmental-education-for-early-childhood/

More PLT Resources

Attend a Professional Development Workshop

Receive PLT's instructional materials and earn continuing education credits by attending a PLT professional development workshop. PLT offers both online courses and in-person workshops tailored for specific grade levels, topics, and teaching situations. Learn new teaching skills and become comfortable teaching outdoors.

Learn more at www.plt.org/trainings

Green Your School

PLT's GreenSchools program includes an adult leader's guide and a set of five hands-on, student-driven investigations that focus on STEM education: Energy, Water, School Site, Waste and Recycling, and Environmental Quality. The program combines environmental education, service learning, and leadership opportunities for students.

Learn more at www.greenschools.org

Apply for a Grant

PLT offers GreenWorks! grants for environmental service-learning projects that link classroom learning to the real world. Students implement an action project they help design to green their school or to improve an aspect of their neighborhood's environment.

Learn more at www.greenworks.org

Connect Children to Nature

Encouraging children to spend time outside and play in nature can improve their creativity and imagination, classroom performance, and academic achievement, as well as their overall health and fitness. PLT's fun and easy-to-do Nature Activities for Families can be used while exploring your own backyard, visiting a local park, or walking in the woods—as well as indoors!

Learn more at www.plt.org/activities-for-families

Stay Connected to PLT through The Branch

Sign up today to receive PLT's newsletter, The Branch. Each issue features environmental education resources, lesson plans, grant opportunities, and tips from educators for teaching about the environment in the classroom and outdoors.

To subscribe, go to www.plt.org/signup



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EXPLORING FOREST CAREERS



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