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 firsthand 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.

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.

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 are rust
Example of trees infested by mountain pine beetles.

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 privatel 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

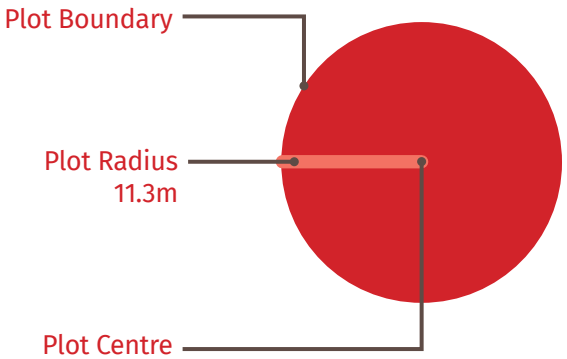
Arrange for your group to share the results of their inventory with a local forester, natural resource specialist, or other forest professional who may help them develop an action plan for improving forest health. For example, learners might work with the forester to plant trees or remove invasive species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

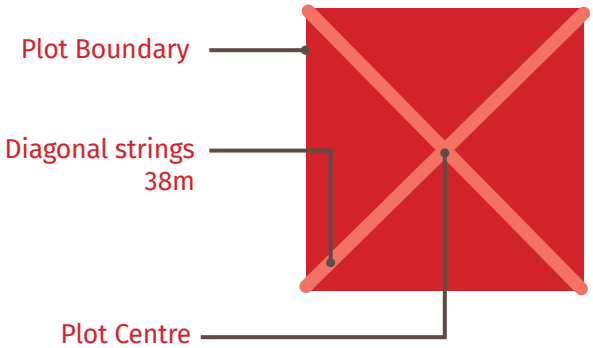
Suggest that learners also add their work on the forest monitoring assessments to their résumés as a way to show hands-on experience. Work with them to draft suitable wording that accurately describes their participation.

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 124 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:

- 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.

- 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 smartphone 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://extension.tennessee.edu/publications/Documents/PB1756.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

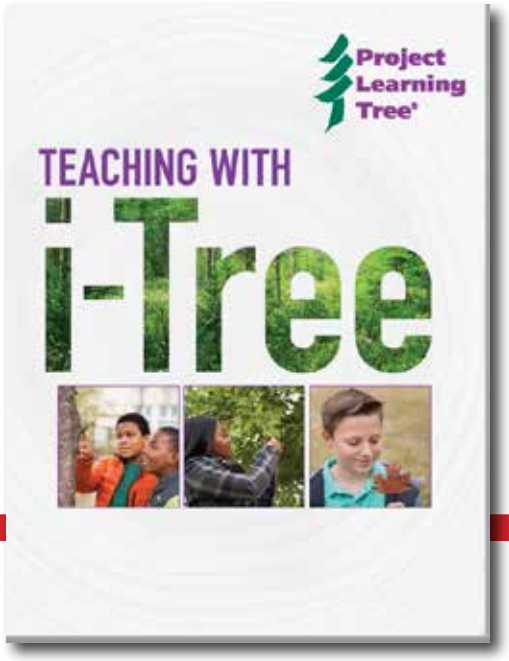
- **Key to Leaves of Virginia Trees**
  This online guide designed for 4-H participants helps to identify common trees in Virginia from their leaves.
  http://dendro.cnre.vt.edu/forsite/key/intro.htm

- **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

Name: _____

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

Name: _____

Date: _____

Location: _____

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 four 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 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: _____

Name: _____

Date: _____

Location: _____

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

Name: _____

Date: _____

Location: _____

WORKSHEET

FOREST HEALTH INDICATOR: SOIL QUALITY

Name: _____

Date: _____

Location: _____

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, labeling 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 5.5–7.2, which is optimum for many plant species	3 Points
Fair	pH of 7.3–8.5 (moderately alkaline) or 4.0–5.4 (moderately acid)	2 Points
Poor	pH of less than 4 (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.

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: A New Soil Quality Index (SQI) for Assessing Forest Soil Health." www.fs.fed.us/rm/pubs/rmrs_rp065.pdf

WORKSHEET

FOREST HEALTH INDICATOR: REGENERATION

Name: _____

Date: _____

Location: _____

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:

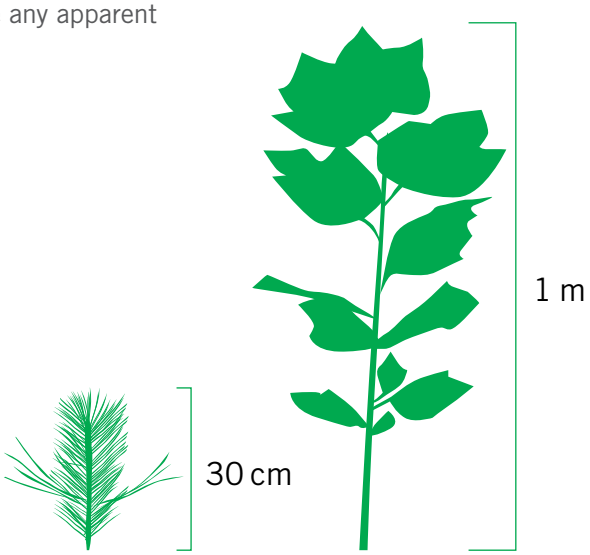
_____ (Value A)

Number of total forest plot segments:

_____ (Value B)

Percentage of plots with at least one healthy seedling:

Value A ÷ Value B x 100 = _____ percent



Coniferous seedling Deciduous seedling

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. "Silvaculture Surveys: Regeneration Surveys."

WORKSHEET

FOREST HEALTH INDICATOR: SNAGS AND COARSE WOODY DEBRIS

Name: _____

Date: _____

Location: _____

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 course woody debris:

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

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

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

Coarse 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.

WORKSHEET
FOREST HEALTH INDICATOR: WILDLIFE

Name: _____

Date: _____

Location: _____

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

Name: _____

Date: _____

Location: _____

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 Quality			
Regeneration			
Snags & Coarse Woody Debris			
Wildlife			
Averages / Conclusions			

What is the Overall Health Assessment for your study plot?

_____

_____

Explain your reasoning.

_____

_____

_____

_____