Connecting With Nature:

An educational guide for grades seven and eight

David Suzuki Foundation

SOLUTIONS ARE IN OUR NATURE

Connecting With Nature: An educational guide for grades seven and eight

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Introduction

Two common requests we get at the David Suzuki Foundation are for Dr. Suzuki to speak to schools and for ideas on what young people can do to help protect nature. Because scientists haven't yet figured out how to clone enough David Suzukis to meet all the speaking requests, we crafted this educational resource to help young people explore their profound connection to nature and experience the power of collective action.

The eminent biologist E.O. Wilson coined the term *Biophilia*, referring to our need to affiliate with other species (*bio* = life and *philia* = love). He believes this need is built into our genes, a reflection of our evolutionary roots.

You can see biophilia in children and their curiosity about the natural world around them. Connecting children with nature in their everyday lives is the first step in an environmental education. That's why this guide encourages students to get outside in every lesson.

Because scientists haven't yet figured out how to clone enough David Suzukis to meet all the speaking requests, we crafted this resource to help young people explore their profound connection to nature and experience the power of collective action.

Studies have shown that spending time in nature helps with recall and memory, problem solving, and creativity. Children (and adults) who spend more time outside are also physically healthier.

Each day we face a barrage of stories about environmental risks and disasters, vanishing wilderness, and endangered species. This resource explores many of those issues and helps students understand how they are connected with nature, how their actions affect nature, and how they can take action to bring about positive change.

If we want to protect the natural world on which our survival depends, we must learn that we are a part of it, and we must encourage our children to appreciate its wonders. As you work through the lesson plans with your students, encourage creativity and share your own personal experiences connecting with nature.

The David Suzuki Foundation is a science-based organization committed to helping Canadians act on the understanding that we are all interconnected and interdependent with nature — and each other. Helping young people develop a love of nature is key to achieving that vision.

Quick start guide

This resource includes five cross-curricular lessons, each comprising idea/activity-based learning that inspires environmental stewardship in both the classroom and beyond. These lessons are suitable for students in grades seven and eight. There is an indoor and outdoor component to most lessons. Teacher tips are provided as well as guiding questions, reflection questions, and inspirational quotes.

In designing the lessons, we preferred activities that are fun, hands-on, and thought provoking. We encourage you to combine the information in this guide with other resources that you find relevant to the needs of your students, including other activities, guides, books, and articles. To reduce the footprint of this resource and your classroom, please use projectors and Smartboards when possible to share background information.

This resource will help your students discover that, collectively, they can make a difference by taking a conscious and active role in protecting nature. They will have opportunities to share what they are learning with their fellow students, families, and community members.

This educational guide is aligned with *Acting Today, Shaping Tomorrow*, the Ontario Ministry of Education's policy framework for environmental education.

Key concepts

Connect with nature

Young people will feel compelled to protect what they understand and feel connected to. Because we learn best by experiencing and doing, spending time outside is the best way to nurture a relationship with nature in youth.

Everything in nature is connected

As biological creatures, humans depend on clean air, clean water, clean soil, and clean energy, as well as a variety of plants and animals (biodiversity) for our well-being and survival. We are linked to nature by what we buy, how we get around, what we eat, and where we live.

Nature is valuable

Although most Canadians recognize the importance of the environment to their well-being, the services that nature provides are often not accounted for. For example, trees clean our air and wetlands filter our water. Green urban spaces absorb carbon, cool our cities, and protect us from storms. It would be expensive to develop facilities to replace these ecosystem services.

Live within the limits of nature

Everything we do has an impact on nature. Air, water, and land are finite resources, and we cannot expand the planet to accommodate our growing population. We must live within the limits of nature or face consequences like climate change and resource scarcities.

Change is all about personal decisions and collective action

We all play a part in making change. Our everyday actions and choices can have a profound impact on nature. It is also important to take collective action when tackling our most pressing environmental challenges. Joining together to achieve a common goal can be a powerful force for change.

Good discussion can be controversial

We have a right to have our voices heard. We must also respect the opinions of others, even when we disagree. By sharing our views with people in positions of influence, from parents to neighbourhood committees to governments, we can change the way things are done.

The power of collective action

It is important that students come away from the activities not only understanding the concepts, connections, and impacts of daily choices, but knowing that their actions make a difference. This resource offers many ideas for students to take individual action to protect nature, in the classroom and beyond. The activities give them a chance to be creative, display their talents, and develop new skills.

Taking it home

To help your students apply what they learn in these lessons to their everyday lives outside the classroom, encourage them to continue discussions at home. The community/home engagement activities offer ways for students to review what they've learned and share their knowledge with their community and family.

Some other ideas:

- Encourage students to repeat experiments or activities at home with their families.
- Ask students to discuss one of the reflection questions at home.
- Invite families to participate in some activities and presentations, encouraging even greater collective action.

ABOUT DAVID SUZUKI

David Takayoshi Suzuki was born in Vancouver, BC, on March 24, 1936. His grandparents had come to Canada from Japan in the early 1900s, making him a third-generation Canadian.

But the fact that David was born in Canada meant sadly little when Canada went to war against Japan in 1941. The Canadian government insisted that people of Japanese descent — even those born in Canada — be shipped off to internment camps, ghost towns in the Rockies, and plantations. David and his family were sent to a camp in interior BC.

After the war, the Japanese were freed, and the Suzukis moved east to Ontario. In Leamington, they were the only non-white family in the neighbourhood. Life was lonely for David, and he began spending hours exploring the swamp near his home. He now recalls this swamp as his inspiration to protect nature.

After high school, David studied zoology and genetics in university. He earned his PhD and became a professor at the University of British Columbia, where he ended up teaching for 40 years. His teaching skills transferred well to TV and radio, and he hosted his first TV show for kids (called *Suzuki on Science*) in 1970. In 1979, he began hosting a popular CBC science show called *The Nature of Things*, which he still hosts today.

Then, in 1989, David had a new idea. His radio series, *It's a Matter of Survival*, had called people's attention to the serious state of the planet, and thousands of listeners were writing to him, asking what they could do to help the environment. So David and his wife, Tara Cullis, a professor at Harvard University, created the David Suzuki Foundation, an organization dedicated to finding solutions for environmental problems.

The foundation began by focusing on projects in other countries, such as protecting indigenous people in Colombia and salmon in Japan. When environmentalists from all over the world gathered in Brazil for the Rio Earth Summit in 1992, David, Tara, and other Foundation members created the Declaration of Interdependence, to remind everyone that we are one with the Earth.

Now his seventies, David still volunteers for the foundation he created in Vancouver. When he's not in the office, he's usually sharing his knowledge through speaking presentations, recording episodes of *The Nature of Things*, and spending precious time with his children and grandchildren.

Lessons described

LESSON 1: MAPPING NATURE IN YOUR COMMUNITY

Subject areas

Grade 7	Grade 8
Science and technology • Understanding life systems: interactions in the environment	**Science and technology** • Understanding structures and mechanisms systems in action
History and geography • Physical patterns in a changing world • Natural resources around the world: use and sustainability	**History and geography** • Global settlement: patterns and sustainability • Global inequalities: economic development and quality of life
Language arts • Oral communication, reading, writing, media literacy	**Language arts** • Oral communication, reading, writing, media literacy
Mathematics • Geometry and spatial sense/ data management and probability/patterning	**Mathematics** • Geometry and spatial sense/ data management and probability/patterning
The arts • Environmental education and the arts (visual arts)	**The arts** • Environmental education and the arts (visual arts)

LESSON 2: INTRODUCING ECOSYSTEM SERVICES

Science and technology • Understanding life systems: interactions in the environment	**Science and technology** • Understanding structures and mechanisms systems in action
History and geography • Physical patterns in a changing world • Natural resources around the world: use and sustainability	**History and geography** • Global settlement: patterns and sustainability • Global inequalities: economic development and quality of life
Language arts • Oral communication, reading, writing, media literacy	**Language arts** • Oral communication, reading, writing, media literacy
Mathematics • Data management and probability/patterning	**Mathematics** • Data management and probability/patterning

LESSON 3: DISCOVERING ECOSYSTEM SERVICES AROUND US

Subject areas

Grade 7	Grade 8
Science and technology • Understanding life systems: interactions in the environment	**Science and technology** • Understanding structures and mechanisms systems in action
History and geography • Physical patterns in a changing world • Natural resources around the world: use and sustainability	**History and geography** • Global settlement: patterns and sustainability • Global inequalities: economic development and quality of life
Language arts • Oral communication, reading, writing, media literacy	**Language arts** • Oral communication, reading, writing, media literacy
Mathematics • Measurement/geometry and spatial sense/ data management and probability/patterning	**Mathematics** • Measurement/geometry and spatial sense/ data management and probability/patterning
The arts • Environmental education and the arts (visual arts)	**The arts** • Environmental education and the arts (visual arts)

LESSON 4: TAKING ACTION FOR ECOSYSTEMS

Science and technology • Understanding life systems: interactions in the environment	**Science and technology** • Understanding structures and mechanisms systems in action
History and geography • Physical patterns in a changing world • Natural resources around the world: use and sustainability	**History and geography** • Global settlement: patterns and sustainability • Global inequalities: economic development and quality of life
Language arts • Oral communication, reading, writing, media literacy	**Language arts** • Oral communication, reading, writing, media literacy
The arts • Environmental education and the arts (dance, drama, music, visual arts)	**The arts** • Environmental education and the arts (dance, drama, music, visual arts)

LESSON 5: SHARING THE AIR WE BREATHE

Subject areas

Grade 7	Grade 8
Science and technology Understanding matter and energy • Pure substances and mixtures History and geography • Physical patterns in a changing world • Natural resources around the world: use and sustainability Language arts • Oral communication, reading, writing, media literacy Mathematics • Measurement/geometry and spatial sense/ data management and probability/patterning The arts • Environmental education and the arts (dance, drama, music, visual arts)	Science and technology • Understanding structures and mechanisms • Systems in action History and geography • Global settlement: patterns and sustainability • Global inequalities: economic development and quality of life Language arts • Oral communication, reading, writing, media literacy Mathematics • Measurement/geometry and spatial sense/ data management and probability/patterning The arts • Environmental education and the arts (dance, drama, music, visual arts)

LESSON 6: COMPLETING A WASTE AUDIT OF YOUR SCHOOL

Science and technology • Understanding life systems: interactions in the environment History and geography • Physical patterns in a changing world • Natural resources around the world: use and sustainability Language arts • Oral communication, reading, writing, media literacy Mathematics • Measurement/geometry and spatial sense/ data management and probability/patterning The arts • Environmental education and the arts (dance, drama, music, visual arts)	Science and technology • Understanding structures and mechanisms • Systems in action History and geography • Global settlement: patterns and sustainability • Global inequalities: economic development and quality of life Language arts • Oral communication, reading, writing, media literacy Mathematics • Measurement/geometry and spatial sense/ data management and probability/patterning The arts • Environmental education and the arts (dance, drama, music, visual arts)

LESSON 7: WATER FILTRATION AND CLEAN DRINKING WATER

Subject areas

Grade 7	Grade 8
Science and technology • Understanding matter and energy • Pure substances and mixtures	**Science and technology** • Understanding earth and: space systems; water systems
History and geography • Physical patterns in a changing world • Natural resources around the world: use and sustainability	**History and geography** • Global settlement: patterns and sustainability • Global inequalities: economic development and quality of life
Language arts • Oral communication, reading, writing, media literacy	**Language arts** • Oral communication, reading, writing, media literacy
Mathematics • Measurement/geometry and spatial sense/ data management and probability/patterning	**Mathematics** • Measurement/data management and probability/patterning
The arts • Environmental education and the arts (dance, drama, music, visual arts)	**The arts** • Environmental education and the arts (dance, drama, music, visual arts)

LESSON 8: CAPTURING THE ENERGY OF THE SUN

Science and technology • Understanding earth and • space systems • Heat in the environment	**Science and technology** • Understanding structures • and mechanisms • Systems in action
History and geography • Physical patterns in a changing world • Natural resources around the world: use and sustainability	**History and geography** • Global settlement: patterns and sustainability • Global inequalities: economic development and quality of life
Language arts • Oral communication, reading, writing, media literacy	**Language arts** • Oral communication, reading, writing, media literacy
The arts • Environmental education and the arts (dance, drama, music, visual arts)	**The arts** • Environmental education and the arts (dance, drama, music, visual arts)

LESSON 1

TIME REQUIRED

45 minutes

WHAT YOU NEED

- paper, 11 x 17 inches or larger
- pencils
- erasers
- pencil crayons (optional)

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LESSON 1: GETTING STARTED

Mapping nature in your community

Guiding question

How aware are we of nature in our community?

What's the point?

In this lesson, students create mental maps of their routes from home to school in order to communicate the important places and features of their community. By comparing the features they include (green spaces, roads, gardens, buildings and so on) with those they leave out, we can help determine the importance of nature to our students and their community.

Hook

Show different maps made from a variety of perspectives (for example, artistic, historical, political, cultural, and transportation). Discuss the similarities and the differences between them. Are all the maps accurate representations of the real world? How might the cartographer's perspective be reflected in the map?

What you do

1. Instruct students to draw the route from their home to school from memory. As a demonstration for students, draw a mental map of your own commute from home to work.
2. Ask students to circulate around the room and compare their maps to at least two others.
3. As a class, create a list of the natural features they included in their maps. Create another list of the landmarks constructed by humans. Then compare the number of naturally occurring features and the number of landmarks constructed by humans.

> "Knowing through mapping builds a foundation of ecological values. Maps are clothespins — tools for hitching children's lives to their places."
>
> — David Sobel, *Mapmaking from the Inside Out: The Cartography of Childhood*

Reflection questions

1. What kinds of nature did you include in your map? What did you leave out? Why did you include or not include natural features?
2. In what ways are your maps similar? Different?
3. What features or details were left out of your map but included in others? Why do you think these differences happen?
4. How do you think your own perspective shaped your mental map?
5. Based on our mental maps, how important is nature to our class as a whole?

Taking it further

- Research examples of maps as art, and share examples with students. Then revisit their original mental maps and challenge them to make their own artistic renditions of their maps.
- On their way home, have students make a list of all the types of nature on their route. They could record data using a camera, a notebook, or a checklist.

LESSON 2

TIME REQUIRED

45 to 90 minutes

WHAT YOU NEED

- Lesson 2 handout: Ecosystem Services Definition and Chart (copies for each group)

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LESSON 2: ECOSYSTEM SERVICES

Introducing ecosystem services

Guiding question

How do we depend on nature?

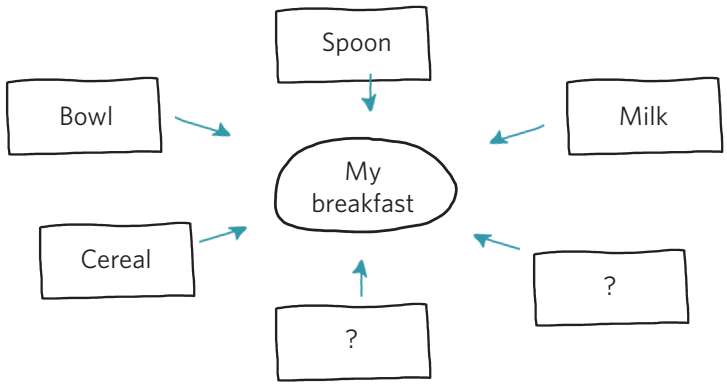
What's the point?

In this lesson, students connect their everyday habits to the services ecosystems provide for free. By identifying the many ways they depend on nature and how ecosystems meet these needs, students begin to understand the value of protecting the ecosystems in their communities.

Hook

In small groups, have students brainstorm all the activities they did from the moment they woke up to the present moment. Have them choose one of the activities and list all the ways nature was involved in it. For example, to eat cereal, you need oats, which are grown in soil, pollinated by wind, and watered by rain. The soil is enriched by fungi and worms. The oats are delivered by trucks, which run on fossil fuels, and so on.

Students can then arrange their lists into Dependency Maps (see example below).



What you do

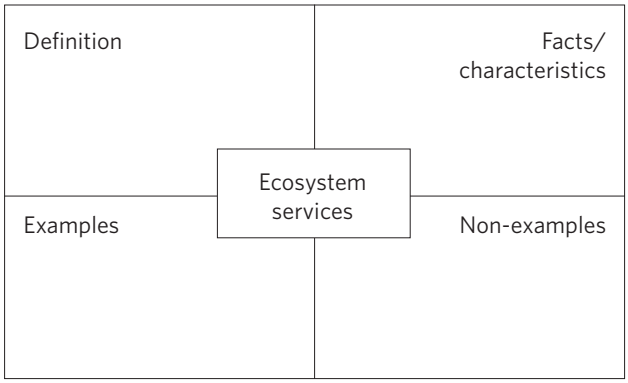
1. Begin with a discussion of ecosystem services, defined in the **Lesson 2 Handout** on page 17. Have students break down the term into its component words and brainstorm the collective meaning of the two words. Then go over the definition together.
2. Divide students into small groups. Provide each group with a copy of the **Lesson 2 Handout** and have them cut it into strips so that each strip contains an ecosystem service name and explanation. Have the groups sort and classify ecosystem services into categories of commonalities, which they can choose themselves.
3. Afterward, invite students to view the sorting and classification systems of the other groups. Have them record their classification system by taking a picture of their sorting, or by creating a graphic organizer to illustrate their categories.
4. Have students revise the Dependency Maps they made at the beginning of the lesson by noting all the ecosystem services that were involved in performing the activity. For instance, to eat cereal, you need oats grown in soil, which requires soil retention as an ecosystem service.

Reflection questions

1. In what ways are the classification systems similar? Different? How did the different classification systems help you to understand the ecosystem service?
2. Were there any items that fit into two or more categories? How?
3. What are some other examples of ecosystem services? How do they work, and how do they benefit your community?
4. If the ecosystems involved in your daily activities were harmed, how would your life be affected?

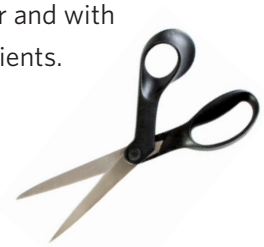
Taking it further

- Have students explain or create their own definition of ecosystem services by using the Frayer Model graphic organizer.



Ecosystem services definition and chart

The term "ecosystem service" can be broken down into two parts. First, an ecosystem is a community of animals, plants and other organisms interacting with one another and with their environment. Ecosystems include nonliving things like soil, water and nutrients.



People are part of ecosystems too, and we benefit from them in many ways. Collectively, these benefits are known as ecosystem services. The chart below explains just ten of the many ecosystem services we encounter every day.

Ecosystem service	How it benefits us
 Clean air	Trees clean our atmosphere by intercepting pollutants in the air. Forests also renew our air supply by absorbing carbon dioxide and producing oxygen. A single tree can absorb 10 pounds of air pollutants a year, and produce nearly 260 pounds of oxygen- enough to support two people.
 Food production	Ecosystems provide a range of food products, including plants, animals and bacteria.
 Climate regulation	Ecosystems influence climate in many ways. Ecosystems like oceans affect both temperature and precipitation. Others, like forests, keep greenhouse gases like carbon dioxide out of the atmosphere.
 Pollination	Pollinators like bees and butterflies transfer pollen from one plant to the next, fertilizing them so they can make fruit and seeds, which humans rely on for food. About one-third of the food we eat comes from pollinators!

Ecosystem service	How it benefits us
 Nutrient cycling	Through decay and recycling, nutrients move from physical environments into living organisms and back to the physical environment.
 Soil retention	Root systems and decaying plant material keep soil from being eroded by wind and water. This allows crops and other plants to grow.
 Biological control	One population of organisms consumes another, keeping it in check. Biological controls reduce the need for harmful chemicals to control pests.
 Clean water	Wetlands, soils and vegetation filter and remove solids and chemicals from water, making it potable, or safe to drink.
 Medicine	Many plants, fungi and microbes naturally produce substances used in medicine.
 Recreation	Many ecosystems provide places for humans to spend time away from work. Recreation in natural areas makes people healthier and less stressed.

LESSON 3

TIME REQUIRED

45 to 90 minutes

WHAT YOU NEED

- clipboards – one per group
- ecosystem services cards – one per group
- maps of neighbourhood block (one per group)
- paper
- pencils
- camera

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LESSON 3: ECOSYSTEM SERVICES

Discovering the ecosystem services around us

Guiding question

Which ecosystem services exist in our community?

What's the point?

Students conduct research to identify and document the ecosystem services around their school. They'll also find areas for improvement.

Hook

Using the information from the Ecosystem Services Definition and Chart in the **Lesson 2 Handout**, students work within their groups to create summary cards based on the template below.

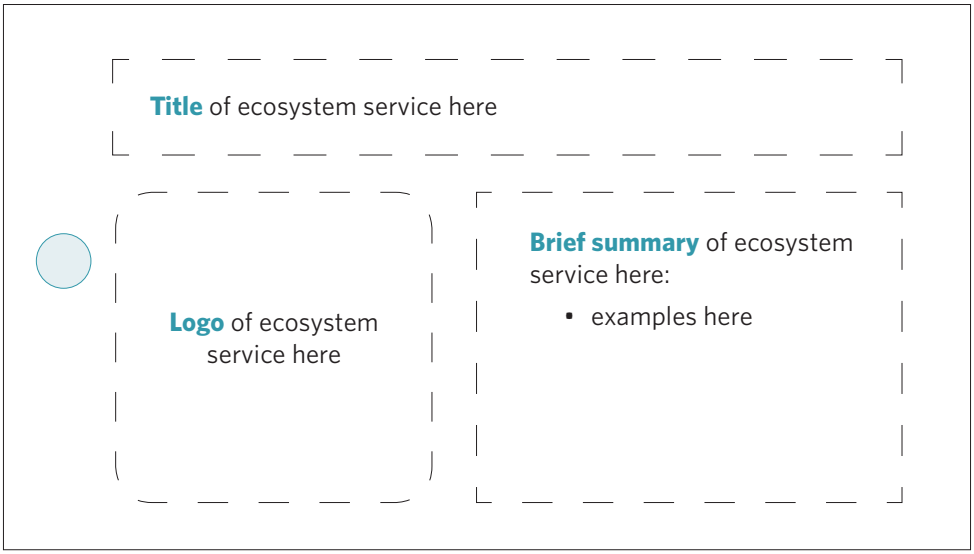
Encourage artistic thought and design using digital media or freehand drawing to create a logo for each ecosystem service. These summary cards will be used for the upcoming neighbourhood survey.

Depending on how the groups are created, students can negotiate within their groups the roles they may need for this research project. They can then figure out what extra materials they may need for their tasks.

What you do

Part A: Outdoors

1. Divide students into small groups and assign each group an ecosystem service to observe and document outside.
2. Have each group determine the roles of its members (for example, photographer, writer, cartographer, data collector, and videographer).
3. Ensure that each group has an ecosystem service card describing their assigned ecosystem service. This card will help keep them on track outside.
4. Take the class outside and have them split up into their groups, searching the schoolyard and/or surrounding area for evidence of their assigned ecosystem services.
5. Document the evidence of the ecosystem services with photos, writing, maps, and so on.



Part B: Classroom

1. Back in the classroom, gather in groups to plan a creative presentation to teach the rest of the class about their findings. They might choose to teach through photos, videos, graphs/charts, a skit, and so on. The more creative, the better!
2. Encourage students to not only present what they found, but also what they found lacking.

Reflection questions

1. From your investigations, can you describe why ecosystems services are important for your school and community?
2. What are the differences between schools and communities that have multiple ecosystem services versus those that have few or none?
3. What things would you change to encourage ecosystem services within your school and community?
4. What are some possible obstacles in introducing ecosystem services to communities that may not have any?
5. What are some possible solutions to help overcome such obstacles?
6. After completing your research on your community's ecosystem services, how would you defend your position on the value of ecosystem services?

Teacher tip

This exercise could be a great opportunity to further build community by having adult volunteers participate as extra bodies to help monitor student safety.

> "In nature, nothing exists alone."
>
> — Rachel Carson, *Silent Spring*

LESSON 4

TIME REQUIRED

45 to 90 minutes

Taking action for ecosystems

Guiding question

How can you creatively share what you've learned about the value of ecosystem services?

What's the point?

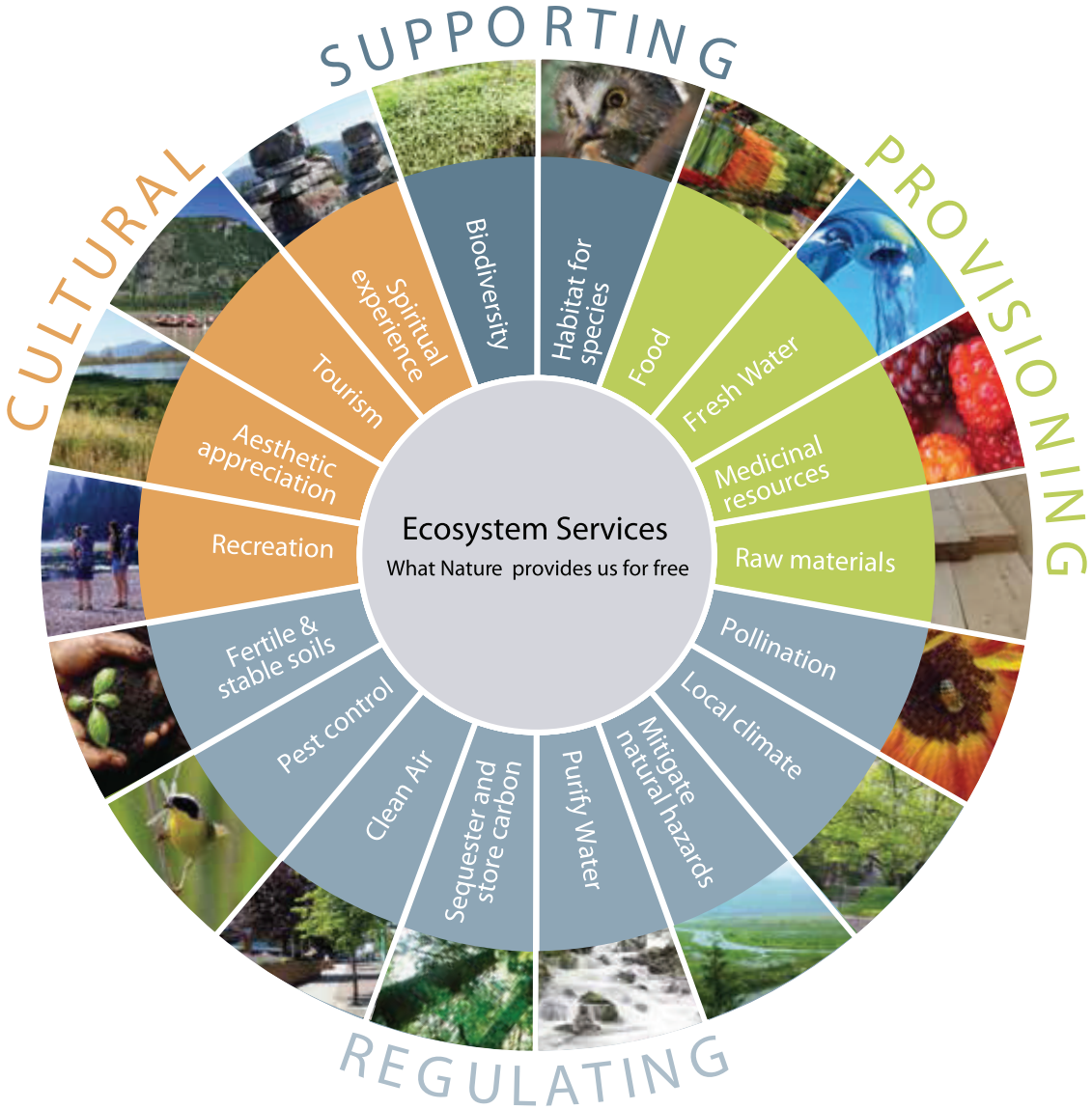
Students now have an understanding of the ecosystem services surrounding their school and what might be improved. In this lesson, they'll come up with creative ways to advocate for ecosystem services.

What you do

1. As a class, brainstorm ways you can help enhance ecosystem services in your community (for example, pollinator gardens, native plants to help with soil retention, an onsite composter, etc). Pick one to focus on.
2. Depending on the activities chosen, you and your students may want to create a public exhibit showcasing their findings. Public participation could lead to further community interest, and possibly to public speaking opportunities at school board meetings or with other community groups advocating for the health and betterment of the community.
3. Consider creating a public performance with the theme of the benefits of ecosystem services.

Reflection questions

1. Collaborate with other classes and grades within your school. How would you advocate for the improvement of ecosystem services within your community to a larger audience?
2. Are neighbouring schools also working toward community improvement? How could ideas be shared?



GRAPHIC SOURCE: METRO VANCOUVER'S ECOLOGICAL HEALTH ACTION PLAN, WWW.METROVANCOUVER.ORG

LESSON 5

TIME REQUIRED

Two 40-minute periods

WHAT YOU NEED

- three white plates
- petroleum jelly
- a magnifying glass

Sharing the air we breathe

Guiding question

How do our decisions affect the quality of our air?

What's the point?

In this lesson, students learn how their decisions affect the air we breathe. They will gain an understanding of how air pollution is hurting our environment and learn how they can help.

Hook

Look up the local air quality index for your community (theweathernetwork.com is a good source), and begin a conversation with your students about it. Some students might have stories to share about sensitivities to poor air quality.

What you do

Part A: Classroom/Outdoors

Air may have tiny grains of sand, dust, ash, and other things floating in it. In Mexico City, for example, people have even found tiny bits of dung floating in the air. What can you find in the air around you?

1. Cover each plate with petroleum jelly to make air quality detectors.
2. Put two plates outside in different locations and one on a windowsill inside your classroom. Try to find test sites where the plates will be protected from the rain, which could wash away evidence. Leave them there for a week.

3. Have students check the plates every day and record any changes.
4. Collect the plates at the end of the week and examine them carefully with the magnifying glass. Have students identify any differences between the plates. Have you caught any strange-looking particles or specks? Are there any surprises?
5. Here's a rough pollution guide: mark a 0.5 centimetre (1/4 inch) square on each plate and count the number of particles you see. If there are around 15, the site is probably fairly clean. But if there are 100 or more, the air quality could be quite poor.
6. Optional: Collect two or three leaves from each test site in labelled plastic bags. Press a strip of clear tape against each leaf on both the top side and the underside. Any particles will stick to the tape. Have students remove the pieces of tape, put them in a notebook, and label them with the site names. Are there any differences between these results and those from the plates?

ADAPTED FROM DAVID SUZUKI AND BARBARA HEHNER'S *LOOKING AT THE ENVIRONMENT* (STODDART, 1989)

Part B: Classroom/Outdoors

Start an anti-idling campaign! An engine left running while a vehicle is stopped (also known as "idling") produces more greenhouse gas emissions per minute than a vehicle in motion. Idling creates a lot of air pollution, which can cause serious breathing problems.

Challenge your students to come up with an anti-idling campaign to convince drivers near your school to turn off their engines when stopped. Begin by brainstorming ways to raise awareness about idling. Students might come up with catchy anti-idling slogans, make and post signs near high-traffic areas, or host an outdoor event.

Check out ecokids.ca for tips.

An engine left running while a vehicle is stopped (also known as "idling") produces more greenhouse gas emissions per minute than a vehicle in motion.

Reflection questions

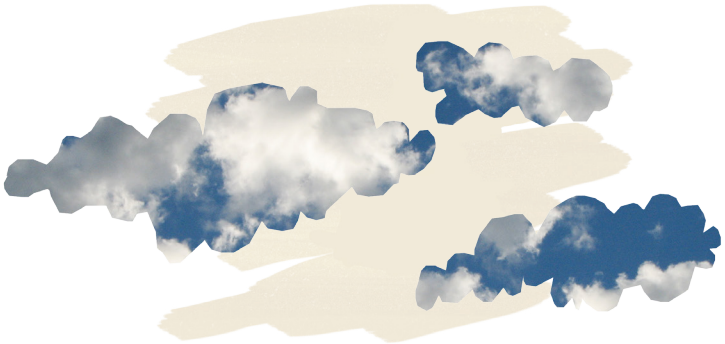
1. Based on your results in the classroom activity, can you determine why air quality might be better in one area rather than another?
2. Now that you have your results, what can you do with this information?
3. How can you make changes in your daily life to help improve air quality in your community?
4. How do you feel about how air pollution is affecting our bodies?
5. How would reducing air pollution benefit our communities?
6. What can you personally do to reduce air pollution?

Taking it further

- Research community policies for air quality control, issues, and standards.
- Research career opportunities that deal with air and air quality.
- Add plants to your classroom to help filter toxins in the air and measure air quality over time.
- Research the importance of greenbelts to a city's air quality. You'll find some good resources at davidsuzuki.org

Community/home engagement activities

- Students can conduct similar air quality tests at home and report back to the class with their findings. Encourage them to talk with their families and brainstorm ways they can improve air quality in their homes.



LESSON 6

TIME REQUIRED

45 to 90 minutes
over two days

WHAT YOU NEED

- Copies of *Completing a Waste Audit of Your School*, downloadable from ontarioecoschools.org/forms&resources/downloads/Waste_Audit_Instructions.pdf

David Suzuki Foundation

LESSON 6: WASTE

Completing a waste audit of your school

Guiding question

How efficient is your school's waste management system?

What's the point?

In this lesson, students complete a garbage audit of their school to determine the efficiency of its waste management system. Students learn that the most effective waste management strategy is to reduce the amount of waste generated.

Hook

View sections of the film *Garbage Island* to introduce students to issues surrounding waste, recycling, and overconsumption. Begin with vice.com/en_ca/toxic/toxic-garbage-island-1-of-3

PHOTO COURTESY VBERGER/WIKIMEDIA COMMONS

What you do

You may begin with Part A or Part B.

Part A: Classroom

1. Invite the custodian into your classroom to participate in the waste audit. He or she is an important part of this activity and will be able to provide valuable information.

2. With the custodian, review the school's waste record for the past 12 months. Before completing the audit, use this information to predict its results. Alternatively, you could complete the audit first, then compare results with this information.

3. Now students are ready to determine whether this waste management system is effective. Begin by asking them what they think a waste audit is. The waste audit will help familiarize students with the school's current waste management system. It will also highlight the types of waste being produced, its quantity, and its origins.

4. Review the steps of *Completing a Waste Audit of Your School* with students. They will use this template to complete the waste audit.

5. Look at the school's waste. What do you notice? Take note of:
   - What is being disposed of or recycled? For example, is paper being used on both sides before being recycled?
   - Are people using the bins properly? How much waste is being placed in the wrong bins?
   - Which places generate a lot, a little, and average amounts of waste?
   - Where is recycling taking place?

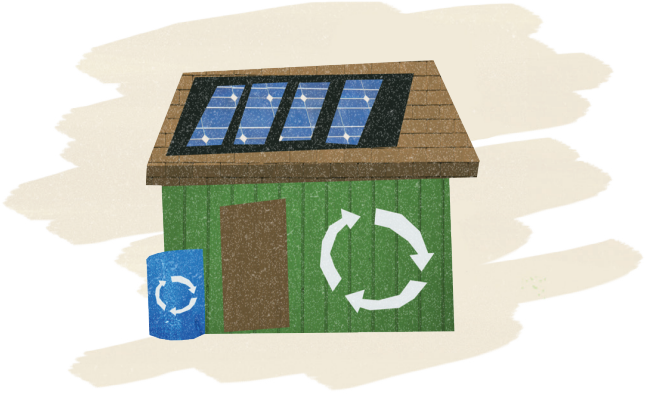
6. Brainstorm and record ideas generated by the following question: What should be done to reduce the quantity of waste and improve the school's waste management system? These ideas can be put into action during a follow-up lesson.

Part B: Outdoors

1. Ask students to work together to calculate the total area of their school playground. For the amount of garbage found during the waste audit, rope off an area to illustrate unusable land. One way to measure might be for every bag of garbage produced, a square metre of land is no longer available for use (one bag of garbage would be equal to one square metre of land; two bags of garbage would equal two square metres of land).
2. Have students complete the calculations and measurements, and rope off unusable areas. Doing so will simulate landfill space on their schoolyard.
3. Ask students to calculate how long it would take to fill their entire schoolyard, based on the rate the school is producing garbage.
4. Ask students to brainstorm how to gain back space.
5. Conduct weekly waste audits. For each decrease in garbage bag totals, adjust the usable area of land accordingly.
6. Map this area out on chart-sized graph paper to record and track land use.
7. Clean up and put the waste in the proper bins.

Reflection questions

1. How did completing a waste audit change or reinforce your understanding of the school's waste management system?
2. How did you feel after seeing all the waste collected in just one day?
3. What findings surprised you?
4. What can be done to improve the school's waste management system?



Taking it further

- Show students William McDonough's TED talk on the concept of Cradle to Cradle Design (ted.com/talks/william_mcdonough_on_cradle_to_cradle_design.html) and investigate what the concept means to students.
- Have students create their own paper using the school's waste paper.
- Before completing your waste audit, have students create a music playlist filled with songs they like. Playing music during the audit will make the hard work even more enjoyable. Here's a challenge: Try to think of songs that are related to the environment, or check out the David Suzuki Foundation's "Playlist for the Planet." You can get more information about the playlist at youtube.com/watch?v=o71-qGA1t5c
- Take videos or pictures during your waste audit. Photos could be used in a report, and videos could be shown to other classes in an upcoming assembly.
- Check out the additional school waste audit resources at wrwcanada.com/schools#Resources

> "Our choices at all levels — individual, community, corporate and government — affect nature. And they affect us."
>
> — *David Suzuki*

Community/home engagement activities

- Challenge other schools, libraries, civic centres, and local businesses in your area to complete a waste audit of their own.
- Have your students complete a waste audit at home to show their families what they've learned. Ask students to select and implement waste reduction strategies to cut down on the amount of waste generated at home. Compete to see who can cut down on the most waste. Get creative!
- Check provincial legislation regarding regulations for waste control. In Ontario, for example, schools with more than 350 students are required to complete waste audits and develop waste reduction plans (Ontario Regulation 102).

Teacher tip

The best time to complete the waste audit is after lunch or the last nutrition break.

LESSON 7

TIME REQUIRED

120 to 140 minutes, plus discussion

WHAT YOU NEED FOR PART A

- water quality test strips (pH strips)
- clear reusable glasses (enough for each student to have two)
- bottled water
- tap water
- water sample from a local water source
- *Story of Bottled Water,* video at storyofstuff.org/movies-all/story-of-bottled-water/

WHAT YOU NEED FOR PART B

- a pail of muddy water
- a clear plastic pop bottle
- a paper coffee filter
- sand
- powdered charcoal

David Suzuki Foundation

Water filtration and clean drinking water

Guiding question

How do we make our water safe enough to drink?

What's the point?

In this lesson, students learn about water filtration and the process their water goes through to make it potable, or safe to drink. By creating their own natural filtration system, students learn how water gets cleaned.

Hook

Have students discuss whether they prefer to drink tap or bottled water, and why. Students then taste samples of tap and bottled water while blindfolded and decide which one they think tastes better. Can they predict which sample came from the tap? At the end of the taste test, have students compare the cleanliness of tap and bottled water by using pH test strips. Is there a difference between them?

What you do

Part A: Classroom

1. Following the taste and pH test, have students discuss what they noticed about the safety and cleanliness of tap water.
2. Watch the video *Story of Bottled Water* to help inform students on the topic. How did the video change their opinion of tap water?
3. Research the local water quality report. This information can typically be found on your municipality's website.

4. Investigate background information to learn about natural water filtration. Invite a representative from your community's water treatment facility to visit your classroom to help students learn about the water filtration process at their local water treatment facility. Or talk to a representative via email, phone, or Skype. Encourage students to come up with their own questions as well.

Part B: Outdoors

1. Cut the top off the bottle, about 10 centimetres down from the mouth. A teacher should be responsible for this step; students can do the rest.
2. Turn the top of the bottle upside down. Set it in the bottom of the bottle.
3. Put a coffee filter in the upside-down section. Put a layer of sand in the filter. On top of the sand, put a layer of charcoal. Then add another layer of sand.
4. Slowly pour the muddy water into the filter. Don't let it overflow. The water will drip through the sand and charcoal into the bottle underneath. Observe what the water looks like now.

WARNING: Although the water now looks much cleaner, it is not safe to drink. In a real water purification plant, chemicals are added to kill germs in the water. Water purification plants take lake or river water and make it flow through a series of tanks. Chemicals are added to take away bad tastes and smells and to kill germs. As the water goes from tank to tank, the solid bits of dirt sink to the bottom. Finally the water is filtered though sand and gravel to catch other, smaller bits of dirt. The clean water goes into a holding tank, ready to be piped to your house.

ADAPTED FROM *LOOKING AT THE ENVIRONMENT* BY DAVID SUZUKI AND BARBARA HEHNER (STODDART, 1989)

Reflection questions

1. How do the results of the blind taste test affect how much tap water or bottled water you will consume?
2. What does your community's water quality report say about the quality of your tap water?
3. What are the differences between using natural filtration processes versus chemicals to filter water?
4. Nature provides water filtration services for free. How difficult would it be for communities to do it themselves?
5. What does your own water filtration device tell you about the effectiveness of natural materials to filter water? Would you drink the water without any filtration at all?
6. What choices can you make to reduce waste and your use of bottled water?

> "Water is a precious resource that belongs to all of us. Let's not take it for granted. And let's not put it in plastic."
>
> — *David Suzuki*

Community/home engagement activities

- Students can conduct the same blind taste test with their families and use the results to support a family pledge to stop buying bottled water. Students can inform their families about the cleanliness of their tap water and promote the use of reusable water bottles.

Taking it further

- Have students collect water samples around their school or local community, then complete water quality tests with the water quality test strips. Possible sample sources include a water fountain, street run-off, toilet water, and rain water.
- Research the Amsterdam Water Supply Dunes (coastalguide.org/dune/aws/index.html) to see a natural filtration system on a large scale. Could such a system be used in Canada?
- Ask students to conduct a disposable water bottle audit around their school. Students could reinforce the behaviour of using reusable water bottles, and see if disposable water bottle usage declines and reusable water usage increases. This audit is a great opportunity to campaign to improve the cleanliness of the school tap water and to make use of the drinking fountains in the school.

SOURCE: banthebottle.net

- Ask students to research the policies and acts that regulate clean drinking water in their community.

Teacher tip

Teachers can purchase a water quality testing kit at their local home building supply store; it tests for multiple water contaminants such as chlorine, nitrates, iron, copper, hydrogen sulphide, and bacteria, and qualities such as water hardness and acidity. You may use this tip in the lesson hook and outdoor lesson.

LESSON 8

TIME REQUIRED

45 to 90 minutes

WHAT YOU NEED

Have students bring in the following items:

- pizza boxes (used but not messy are fine)
- foil pie plates
- plastic wrap (transparencies work)
- glue
- aluminum/tin foil
- scissors
- utility knife (teacher to provide)
- black construction paper
- paper and pencils
- thermometers
- crackers, sliced cheese, and tomato sauce
- for a nice alternative, graham crackers, marshmallows, and chocolate — ingredients for S'mores

David Suzuki Foundation

Capturing the energy of the sun

Guiding question

How can we make a cooker that captures and runs on the energy of the sun?

What's the point?

In this lesson, students harness the power of the sun and conduct their own scientific investigations by making and testing solar cookers. They also measure for the hottest temperatures on the playground.

Time required: a full day or longer. Because of the time it will take to construct the solar cooker and then cook pizza, prepare for a multi-day lesson. Use one day for building and the next day for cooking. You will need a hot, sunny day for optimal cooking conditions.

Hook

Show the National Geographic video *Solar Cooking*, demonstrating the use of solar cookers: video.nationalgeographic.com/video/solar-power

What you do

Part A: Classroom

1. Assign materials so you know you've got them all covered. Have back-up materials on hand in case students forget any items.
2. Share the video *How to Turn a Pizza Box into a Solar Oven* with students to demonstrate what they will be doing: youtube.com/watch?v=xbwliZJiHe8.
3. Display one or both of the following websites and spend a few moments exploring them: shop.solarcookers.org and solarcooking.org/plans
4. Have students build the solar cookers using the instructions found in the **Lesson 8 handout: How to Make a Solar Cooker.** This process will take time. Use the morning as construction time.

Part B: Outdoors

1. Have students create a data collection sheet for their fieldwork based on the information they think is important to collect. (Do this step outdoors if weather permits.) For an example, refer to **Lesson 8 handout: Data Collection Sheet for Solar Cookers**. Develop the data collection sheet by consensus. The same data collection sheet should be used for all groups so students can accurately compare results.
2. Measure the temperature. Consider using thermometers as a concrete way of measuring or try using a modified graphic organizer as an abstract way of measuring (see the example below). Have the students go outside with pencil and paper and record the temperature (by thermometer or by touch) of the ground. Test various places, like the sand box, exposed dirt, grass, tarmac, and black asphalt. The goal is to determine the best place to put the solar cookers.
3. Once students have determined the best locations for their solar ovens, they can begin cooking.

Reflection questions

1. What are the advantages of cooking with the sun's rays versus a gas or electric stove? What are the disadvantages?
2. How could you improve solar cookers to overcome the disadvantages?
3. Based on your cooking results, is there enough evidence to use solar energy to power your school?

Taking it further

Community/home engagement activities

- Students can make solar cookers at home with their families. They might even try cooking a family meal.

Optional Class Activities

- Map the locations of students' solar cookers.
- Conduct energy audits (see the **Lesson 8 handout: Home Energy Audit**) as homework, then compare the results.

> "I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that."
>
> — *Thomas Edison*

Teacher tip

- Research several solar cooker designs before class and attempt to build and test one. This way you'll understand and anticipate the students' questions.

How to make a solar cooker

1. Clean any crumbs out of your pizza box and close the lid. Place a piece of black construction paper on top, lining up the long side with the flapping edge of the box. Then trace a rectangle about 1 inch away from each side of the construction paper. Use the utility knife to cut the three edges. (The fourth edge is the flap which needs to open and close.)
2. Lift the flap and glue the tin foil onto the inside of the flap. Now glue tin foil onto the inside of the box, facing up. Glue the black construction paper in the centre of the pizza box (where the flap was cut).
3. Glue plastic wrap over the window in the pizza box so that you can close the box, lift the smaller flap with the foil facing toward the sun, and have the window air-sealed by the plastic wrap. This step can vary depending on your chosen design, but the goal is to seal in heat. The solar cooker is now complete.
4. Place a foil pie plate into the pizza box and cook using the sun. For maximum efficiency, the foil must face the sunlight. Hot days with intense sunlight work well for these ovens.

Find more instructions at hometrainingtools.com/build-a-solar-oven-project/a/1237/

PHOTO COURTESY SUZIE'S FARM/FLICKR

Data collection sheet for solar cookers

Location	Duration	Temperature	Ready to eat (circle best option)	Photo documentation	Modifications
Example: Sand box	*20 minutes*	*93.3°C*	*Yes/No*	*Picture 1*	*Add more tin foil*
Exposed dirt					
Grass					
Sidewalk					
Asphalt					

Record as much activity as possible that involved you and electricity/energy.

Home energy audit

Time started: _____ Time ended: _____

I watched TV for _____ (minutes/hours)

I played videogames for _____ (minutes/hours)

I used the computer for _____ (minutes/hours)

We drove for _____ (minutes/hours)

I opened my fridge door _____ times

I had the lights on in the bathroom for _____ (minutes/hours)

I had the lights on in my room for _____ (minutes/hours)

I had the lights on the living room for _____ (minutes/hours)

I had _____ lamps turned on for _____ (minutes/hours)

My mobile device was on for _____ (minutes/hours)

I spoke on the phone for _____ (minutes/hours)

I also used... (check each one used and list any extras in the blank spaces)

Washing machine	Dryer	Microwave	Toaster	Alarm clock
Fan	Stereo	Stove	Freezer	Blender
Iron	Coffee maker	Vacuum	Hair dryer	Curling iron
Dishwasher	Kettle	Cookers	Ipod	Tablet device

Go around the house and count how many things are plugged in and not being used.

Total: _____

Reflection questions

1. Was any of the usage above wasteful? Why?

2. What could be done to use less energy?

David Suzuki Foundation

About us

Over 60 staff in offices across Canada work to help further the foundation's goals. We work with government, business, and individuals to conserve our environment by providing science-based education, advocacy, and policy work, and act as a catalyst for the social change that today's situation demands.

Our mission and vision

Our mission is to protect the diversity of nature and our quality of life, now and for the future.

Our vision is that within a generation, Canadians act on the understanding that we are all interconnected and interdependent with nature.

Our top goals

Protecting our climate — ensure that Canada is doing its fair share to avoid dangerous climate change and is on track to achieve a safe level of greenhouse gas emissions.

Transforming the economy — make certain that Canadians can maintain a high quality of life within the finite limits of nature through efficient resource use.

Protecting nature — work to protect the diversity and health of Canada's marine, freshwater, and terrestrial creatures and ecosystems.

Reconnecting with nature — ensure that Canadians, especially youth, learn about their dependence on a healthy environment through experiential education outside.

Building community — engage Canadians to live healthier, more fulfilled, and just lives with tips on building Earth-friendly infrastructure, making smart energy choices, using efficient transportation, and being mindful of the products, food, and water we use.

davidsuzuki.org

Download other education guides in the *Connecting With Nature* series at **getbackoutside.ca**