Human Activity and the Environment – Teacher's Kit

What is the value of an ecosystem?

Release date: September 2014

Statistics Canada   Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

- Statistical Information Service   1-800-263-1136
- National telecommunications device for the hearing impaired   1-800-363-7629
- Fax line   1-877-287-4369

Depository Services Program
- Inquiries line   1-800-635-7943
- Fax line   1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.   not available for any reference period
..   not available for a specific reference period
... not applicable
0   true zero or a value rounded to zero
0^s value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p} preliminary
^{r} revised
x   suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E} use with caution
F   too unreliable to be published
*   significantly different from reference category ($p < 0.05$)

What is the value of an ecosystem? Teacher's Kit for *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*

Introduction

These educational resources provide instructors with innovative materials, lesson plans and case study assignments to accompany the 2013 release of the *Human Activity and the Environment* article, "Measuring ecosystem goods and services in Canada." The materials and activities were developed by the Critical Thinking Consortium, a non-profit, registered association of 55 educational partners—school districts, schools, teacher associations and other educational organizations.

Resources were developed for a junior high school, senior high school and introductory post-secondary audience. Curriculum links include grades 7 to 12 geography, social studies, biology, science and economics, as well as introductory post-secondary geography and environmental science.

The materials introduce and develop critical thinking about the topics of ecosystems, ecosystem goods and services, valuation of ecosystem goods and services and research methods associated with measuring ecosystems and ecosystem goods and services.

All lessons, case studies, assignment sheets and evaluation rubrics are provided in HTML and PDF formats. Three classroom-ready presentations are provided in PowerPoint, PDF and HTML formats.

Lesson # 1: What is an ecosystem?

   Slide set # 1: What is an ecosystem?

Lesson # 2: What are ecosystem goods and services?

   Slide set # 2: What are ecosystem goods and services?

Lesson # 3: How can the value of ecosystem goods and services be measured?

   Slide set # 3: How can the value of ecosystem goods and services be measured?

Detailed lesson plan # 1: Can the value of ecosystems and ecosystem goods and services be measured?

Detailed lesson plan # 2: The value of ecosystem goods and services in changing ecosystems

Case study #1: Thousand Islands National Park case study

Case study #2: Exploring methodologies for measuring ecosystem goods and services

Image collection

Human Activity and the Environment – Teacher's Kit

Lesson # 1: What is an ecosystem?

Release date: September 2014

Statistics   Statistique
Canada   Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

• Statistical Information Service	1-800-263-1136
• National telecommunications device for the hearing impaired	1-800-363-7629
• Fax line	1-877-287-4369

Depository Services Program

• Inquiries line	1-800-635-7943
• Fax line	1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category (p < 0.05)

Lesson #1

What is an ecosystem?

Overview

This PowerPoint lesson describes use of the 9 slides in Set #1 and related learning activities to explore the attributes of ecosystems. Using a series of images, learners recognize three key ecosystem attributes. They use these traits to determine whether or not an area portrayed in an image could represent an ecosystem. Learners discover the differences between ecosystems and habitats. Finally, learners examine a provocative image to determine whether it is an ecosystem or habitat.

Audience

- junior high school
- senior high school
- introductory post-secondary

Learning outcomes

- understand the attributes of ecosystems
- understand the importance of studying ecosystems

Curriculum links

- grades 7 to 12 geography (ecosystems, geographic change), social studies (economics), biology (ecosystems and change), science, economics (accounting, valuation methods)
- post-secondary geography (ecosystems), environmental science (ecosystem accounting, ecosystem change)

Learning materials

- PowerPoint slide set #1: What is an ecosystem?
- Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*
- Activity sheet #1: *Explore the attributes*
- Activity sheet #2: *What is an ecosystem?*
- Activity sheet #3: *Is this an ecosystem?*

Instructions

Think about the task
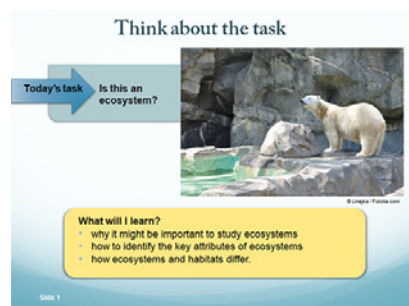
Display or project Slide 1 or provide a provocative image to prompt learner reflection on the question "Is this an ecosystem?"

Guide learners in a discussion of what an ecosystem might be and why it might be important to understand and study ecosystems.

Explore the attributes

Organize learners into small groups and provide each group with a copy of Activity sheet #1: *Explore the attributes*. Display or project Slide 2 and inform learners that it is an image of an ecosystem. Inform learners that their challenge is to identify the attributes that make it an ecosystem.

Remind learners of strategies for making thoughtful observations and encourage learners to record what they observe in the image. Guide learners in using these observations to infer possible attributes of ecosystems.

Invite learners to discuss possibilities with their partner(s) and then share ideas with the class. Record or project learners' suggestions for the attributes.

Identify the attributes
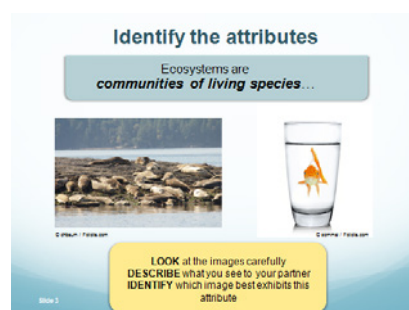
Provide each learner with a copy of Activity sheet #2: *What is an ecosystem?* Inform learners that they will be identifying specific attributes of ecosystems.

Display or project Slide 3 and inform learners that one of the attributes of an ecosystem is that it is a *community of living species*.

It may be helpful to distinguish between *ecological* and *biological.* Remind learners that biological refers to specific organisms and how they function, while ecological refers to the interactions and interrelationships of organisms and their environments.

Guide learners in making observations about each image, then ask learners to select the image that best reflects the attribute. Prompt learners to note their decision on Activity sheet #2: *What is an ecosystem?* Repeat with the additional attributes of an ecosystem (Slides 4 and 5). Inform

learners that some aspects of the attribute may not be immediately apparent in the image. For example, communities of living species include plants, animals and microorganisms. Physical environments include many different abiotic components including air, water, soils, minerals, etc.

Review learner decisions for each image, drawing attention to aspects of the images that clarify each attribute.

After identifying each attribute, guide learners in considering other examples of the attribute. Encourage students to consider different types of ecosystems (e.g., forest, cropland, wetland) and determine what examples of each of the attributes might be found in each. Learners may record additional examples on Activity sheet #2: *What is an ecosystem?*
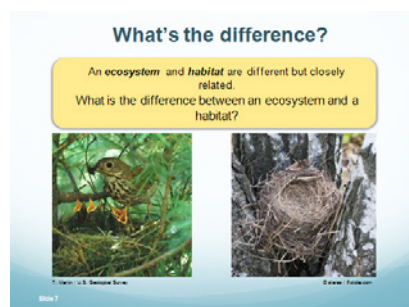
Apply the attributes

Display or project Slide 6 and inform learners that their next task is to consider all of the attributes to determine if an area is an ecosystem.

Guide learners in making observations and identifying the appropriate attributes. Learners may use Activity sheet #3: *Is this an ecosystem?* to guide and record their decisions.

Explore the differences

Display or project Slide 7. Encourage learners to identify what they observe in each of the images. Prompt learners to identify which of the attributes of an ecosystem is present or absent in each of the images. Learners may use Activity sheet #3: *Is this an ecosystem?* to guide and record their decisions.

Ask learners to identify which characteristics distinguish ecosystems from habitat. Prompt learners to share ideas on the most significant differences between an ecosystem and a habitat. Encourage learners to record their ideas. Invite learners to discuss possibilities with a partner and then share ideas with the class.

Inform learners that ecosystems include all the interactions between all the living species and the non-living and environmental factors, while a habitat is an area occupied by a certain species.

Re-examine the image
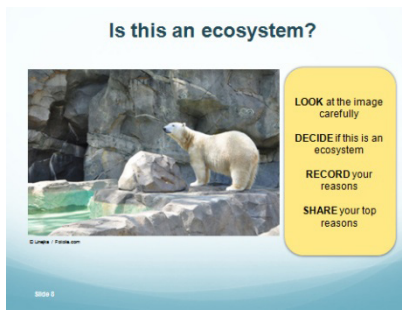
Display or project the provocative image that was used to introduce the activity (Slide 8). Ask learners to reflect on their initial thoughts: given what they now know about the attributes of ecosystems, is this an ecosystem?

Encourage learners to carefully observe the image and to decide if this is an ecosystem, keeping in mind each of the three attributes. Learners may use Activity sheet #3: *Is this an Ecosystem?* to guide and record their decisions. Invite learners to share their ideas with the class.
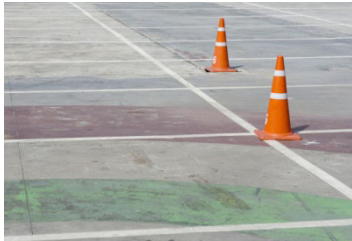
Conclude by posing the question: "Why might it be important to understand and study ecosystems?"

Activity sheet #1

Explore the attributes

Observations	Inferences about ecosystem attributes
Attributes of ecosystems All ecosystems will have…	

Activity sheet #2

What is an ecosystem?

Attributes of an ecosystem	Image 1	Image 2	Additional examples of the attribute
Ecosystems are **communities of living species…** ☐ 1 ☐ 2	© chbaum / Fotolia.com	© sommai / Fotolia.com	
Ecosystems are communities of living species, **together with their environment…** ☐ 1 ☐ 2	© simonjohnsen / Fotolia.com	© sithikorn / Fotolia.com	
Ecosystems are communities of living species, together with their environment, **that interact and function as a unit**. ☐ 1 ☐ 2	© JGade / Fotolia.com	© Not Rich Ritchie / Fotolia.com	

Activity sheet #3

Is this an ecosystem?

Observations	Ecosystem attributes		
(What do I see or not see in the image that is interesting or useful?)	(the attribute that is related to the observation)		
	present	*attribute*	*missing*
		communities of living species	
		with their environment	
		functioning as a unit	
		communities of living species	
		with their environment	
		functioning as a unit	
		communities of living species	
		with their environment	
		functioning as a unit	
		communities of living species	
		with their environment	
		functioning as a unit	
		communities of living species	
		with their environment	
		functioning as a unit	

My decision is that this [   ] is [   ] is not an ecosystem.

The three most powerful reasons supporting this decision are:

1.

2.

3.

Human Activity and the Environment – Teacher's Kit

Slide set #1: What is an ecosystem?

Release date: September 2014

Statistics Canada | Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

• Statistical Information Service	1-800-263-1136
• National telecommunications device for the hearing impaired	1-800-363-7629
• Fax line	1-877-287-4369

Depository Services Program
• Inquiries line	1-800-635-7943
• Fax line	1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

Set #1: What is an ecosystem?

Set #1 of a three-part series, this presentation and related learning materials include the following activities:

- Learners discuss possible understandings of 'ecosystem' and ecosystem attributes.
- Learners identify images that reflect the three attributes of an ecosystem.
- Learners identify the differences between ecosystems and habitats.
- Learners use the attributes to judge whether the various environments are ecosystems.

Key learning outcomes:
- understand the attributes of ecosystems
- understand the importance of studying ecosystems

Intended audience: grades 7 to 12 social studies, geography, science, biology, and environmental education classes; introductory post-secondary

These PowerPoint presentations and corresponding teacher notes and activities accompany and support the learning activities for "What is an ecosystem?" and the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*.

Title slide

© kjay / Fotolia.com

References

kjay, 2014, Douglas Fir Tree Silhouette, http://us.fotolia.com/id/5470456 (accessed May 28, 2014).

Think about the task

Today's task → **Is this an ecosystem?**

© Linejka / Fotolia.com

What will I learn?
- why it might be important to study ecosystems
- how to identify the key attributes of ecosystems
- how ecosystems and habitats differ

Slide 1

References

Linejka, 2014, Polar Bear, http://us.fotolia.com/id/64341859 (accessed May 28, 2014).

Decode the word

What is an *ecosystem?*
What *attributes* of an ecosystem can be identified in the picture?

© sababa66 / Fotolia.com

Slide 2

THINK about the word and the picture

TALK to a partner

SHARE with the class

References

sababa66, 2014, fisherman on the boat, http://us.fotolia.com/id/57707069 (accessed May 28, 2014).

Identify the attributes

Ecosystems are communities of living species, *together with their environment…*

.

© simonjohnsen / Fotolia.com

© sithikorn / Fotolia.com

LOOK at the images carefully
DESCRIBE what you see to your partner
IDENTIFY which image best exhibits this attribute

Slide 4

References

simonjohnsen, 2014, ducks and geese round a frozen pond, http://us.fotolia.com/id/50843084 (accessed July 3, 2014).

sithikorn, 2014, Empty Space in a Parking Lot, http://us.fotolia.com/id/66262262 (accessed July 9, 2014).

Identify the attributes

Ecosystems are communities of living species, together with their environment, *that function and interact as a unit*.

© JGade / Fotolia.com

© Not Rich Ritchie / Fotolia.com

LOOK at the images carefully
DESCRIBE what you see to your partner
IDENTIFY which image best exhibits this attribute

Slide 5

References

JGade, 2014, Common Gull, http://us.fotolia.com/id/24281289 (accessed July 3, 2014).

Not Rich Ritchie, 2014, grizzly cub with fish near mother, http://us.fotolia.com/id/16051947 (accessed July 3, 2014).

R. Whitman / U.S. Geological Survey

Slide 6

References

Whitman, Richard, 2013, Great Lakes Beach Health, U.S. Geological Survey, http://gallery.usgs.gov/photos/05_24_2013_gkb4Erq11X_05_24_2013_3 (accessed April 24, 2014).

What's the difference?

An *ecosystem* and *habitat* are different but closely related.
What is the difference between an ecosystem and a habitat?

T. Martin / U.S. Geological Survey

© staras / Fotolia.com

Slide 7

References

Martin, Tom, 2012, A Hermit Thrush on the Nest in Arizona, U.S. Geological Survey, http://gallery.usgs.gov/photos/01_06_2012_mri7LXw33E_01_06_2012_1 (accessed April 24, 2014).

staras, 2014, Empty bird's nest closeup, http://us.fotolia.com/id/62405797 (accessed May 28, 2014).

© Linejka / Fotolia.com

Slide 8

References

Linejka, 2014, Polar Bear, http://us.fotolia.com/id/64341859 (accessed May 28, 2014).

Human Activity and the Environment – Teacher's Kit

Lesson # 2: What are ecosystem goods and services?

Statistics Canada | Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

• Statistical Information Service	1-800-263-1136
• National telecommunications device for the hearing impaired	1-800-363-7629
• Fax line	1-877-287-4369

Depository Services Program

• Inquiries line	1-800-635-7943
• Fax line	1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category (p < 0.05)

Lesson #2

What are ecosystem goods and services?

Overview

This PowerPoint lesson describes use of the 11 slides in Set #2 and related learning activities to explore ecosystem goods and services (EGS). Beginning with two fictional business advertisements, learners draw distinctions between 'goods' and 'services.' They test their understanding of these concepts by distinguishing images that illustrate examples and non-examples of goods and services. Learners then examine images of ecosystems to try to identify examples of EGS. They are introduced to three categories of EGS, and use these categories to extend their ability to identify goods and services in the images. Finally, they consider the impact of human activity on EGS.

Audience

- junior high school
- senior high school
- introductory post-secondary

Learning outcomes

- understand economic goods and services
- understand ecosystem goods and services
- understand the importance of studying ecosystems

Curriculum links

- grades 7 to 12 geography (ecosystems, geographic change), social studies (economics), biology (ecosystems and change), science, economics (accounting, valuation methods)
- post-secondary geography (ecosystems), environmental science (ecosystem accounting, ecosystem change)

Learning materials

- PowerPoint slide set #2: What are ecosystem goods and services?
- Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*
- Activity sheet #4: *Economic goods and services*
- Briefing sheet #1: *Categorizing ecosystem goods and services*
- Activity sheet #5: *Exploring ecosystem goods and services*

Instructions

Think about the task

Display or project Slide 1 or provide a provocative image to prompt learner reflection on the question "What goods and services does this ecosystem provide?"

Guide learners in a discussion of what an ecosystem might be and why it might be important to understand and study ecosystems. Encourage learners to consider how people benefit from ecosystems.

Explore the ideas
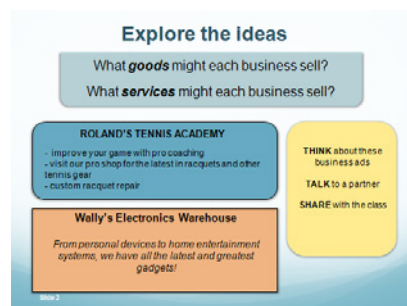
Organize learners into small groups and provide each group with a copy of Activity sheet #4: *Economic goods and services*. Display or project Slide 2 and inform learners that image is of advertising from two businesses. Inform learners that their challenge is to identify the goods and services offered by each business.

Remind learners of the strategies for making thoughtful observations and encourage learners to record what they observe in each ad. Guide learners in using these observations to infer possible goods and services provided by each business.

Invite learners to review the goods and services that they have recorded. Instruct them to develop possible definitions for goods and services. Record or project suggested definitions.

Test the definitions
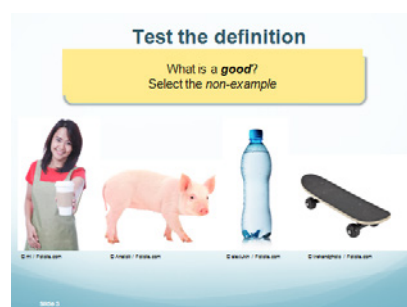
Display or project Slide 3 and inform learners that three of the images are examples of economic goods and one image is a non-example. Prompt learners to reflect on the definition they recorded on Activity sheet #4: *Economic goods and services.*

Encourage learners to consider what services might be associated with the examples of goods. For example, 'skateboard repair' might be a service related to a skateboard.
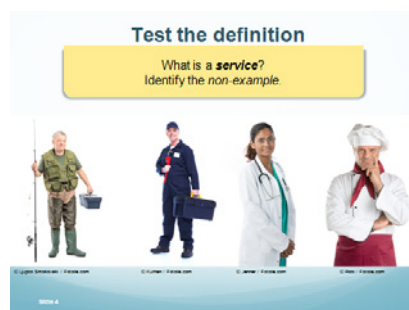
Display or project Slide 4 and challenge learners to determine which of the images are examples of services and which might be non-examples of services. Prompt learners to reflect on the definition they recorded on Activity sheet #4: *Economic goods and services*. Encourage learners to think about the benefit that each service might provide.

Display or project Slide 5 and encourage learners to revise their definitions of goods and services, if required.

Extend the definition

Display or project Slide 6 and inform learners that their next task is to use these definitions to determine what goods and services might be provided by an ecosystem. Invite learners to consider which four EGS pictured are goods and which are services. The images represent (clockwise from top left):

- timber and wood products
- clean air or air purification
- hiking and recreation
- water regulation or flood control.

Learners might suggest that wood products are a good, clean air is a good, air purification is a service, recreation is a service, and water regulation is a service. Prompt learners to consider that some EGS may be less obvious but are still important. Ask them to propose other possible goods and services that may be provided by ecosystems.

Categorizing EGS
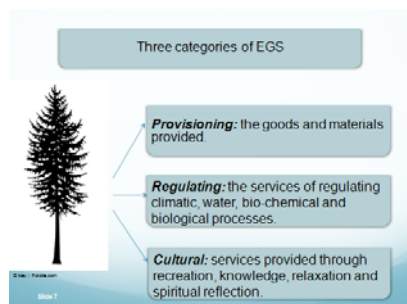
Display or project Slide 7 and provide learners with Briefing sheet #1: *Categorizing ecosystem goods and services.* Review the different categories of EGS, then display or project Slide 8. Inform learners that their challenge is to categorize each of the EGS reflected in the images.

Learners might suggest that wood is a provisioning service, clean air is a provisioning service, air purification is a regulatory service, recreation is a cultural service, and water regulation and flood control are regulatory services.

For more information on the categories of EGS, see the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*, page 20.

Apply the definitions and categories

Display or project Slide 9 and inform learners that their next task is to use the definitions of goods and services to determine what goods and services might be present in the pictured ecosystem.

Provide each learner with a copy of Activity sheet #5: *Exploring ecosystem goods and services*. Guide learners in observing features of the ecosystem and identifying related EGS. Remind learners that less obvious EGS may still be very important. For example, clean air might be a good provided by an ecosystem, and cattails might provide a service by cleaning air and water.

Finally, instruct learners to indicate which of the three categories each EGS might belong to. Prompt learners to record their observations and related EGS on the Activity sheet.

Organize learners into small groups and invite them to review the EGS that they have recorded. Instruct learners to develop possible definitions for EGS. Record or project suggested definitions.

Explore human impacts on ecosystem goods and services
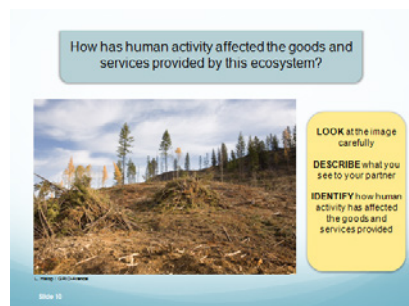
Display or project Slide 10. Ask learners to suggest what has occurred in the pictured ecosystem. Prompt learners to consider how human activity has affected the goods and services provided by this ecosystem. Invite learners to discuss possibilities with a partner and then share ideas with the class.

Possible responses include the production of timber and other forest products, as well as loss of habitat, loss of clean air and increased erosion.

Conclude by prompting learners to respond to the question: "Why might it be important to understand and study ecosystem goods and services?" Possible responses include the importance of knowing about the quantity, quality and value of goods and services provided by Canada's ecosystems in order to guide decisions about development or land use.

For more information on EGS refer to the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*, pages 8 to 10, and 15.

Activity sheet #4

Economic goods and services

ROLAND'S TENNIS ACADEMY -improve your game with pro coaching -visit our pro shop for the latest in racquets and other tennis gear -custom racquet repair		**Wally's Electronics Warehouse** *From personal devices to home entertainment systems, we have all the latest and greatest gadgets!*	
What **goods** do these businesses provide?		What **services** do these businesses provide?	
A clue or detail that I noticed:	The good that this might refer to:	A clue or detail that I noticed:	The service that this might refer to:
After reviewing what these goods have in common, I would define a good as:		After reviewing what these services have in common, I would define a service as:	

Briefing sheet #1

Categorizing ecosystem goods and services

Statistics Canada groups ecosystem goods and services (EGS) into three general categories:

1. *Provisioning services*: the 'goods' in EGS are the material and energy provided by ecosystems; for example, timber, fish, or plants that have a particular socio-economic use.

2. *Regulating services*: the capacity of ecosystems to regulate climatic, hydrological and bio-chemical cycles, as well as biological processes.

3. *Cultural services* are generated from the physical setting and location of ecosystems and give rise to emotional, intellectual and symbolic benefits that people obtain from ecosystems through recreation, knowledge development, relaxation, and spiritual reflection.

For more information on these categories, see the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*, page 20.

Activity sheet #5

Exploring ecosystem goods and services

A feature or detail that I noticed in the image:	The *ecosystem good* that this might be:	The *ecosystem service* that this might be:	Which category of EGS? (provisioning, regulating, cultural)
After reviewing what the goods have in common, I would define an ecosystem good as:		After reviewing what the services have in common, I would define an ecosystem service as:	

Human Activity and the Environment – Teacher's Kit

Slide set #2: What are ecosystem goods and services?

Release date: September 2014

Statistics Canada Statistique Canada

Canada

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
E	use with caution
F	too unreliable to be published
*	significantly different from reference category (p < 0.05)

Set #2: What are ecosystem goods and services?

Set #2 of a three-part series, this presentation and related learning materials include the following activities:

- Learners discuss possible understandings of economic goods and services.
- Learners identify goods and services present in images of ecosystems.
- Learners explore the impact of human actions and ecosystem changes on ecosystem goods and services (EGS).

Key learning outcomes:
- understand economic goods and services
- understand ecosystem goods and services
- understand the importance of studying ecosystems

Intended audience: grades 7 to 12 social studies, geography, science, biology, and environmental education classes; introductory post-secondary

These PowerPoint presentations and corresponding teacher notes and activities accompany and support the learning activities for "What are ecosystem goods and services?" and the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*.

Title slide

© kjay / Fotolia.com

References

kjay, 2014, Douglas Fir Tree Silhouette, http://us.fotolia.com/id/5470456 (accessed May 28, 2014).

Think about the task

Today's task → **What goods and services does this ecosystem provide?**

© sababa66 / Fotolia.com

What will I learn?

- how to identify goods and services
- how to identify goods and services found in ecosystems
- why it might be important to study ecosystem goods and services

Slide 1

References

sababa66, 2014, fisherman on the boat, http://us.fotolia.com/id/57707069 (accessed May 28, 2014).

Explore the ideas

What **goods** might each business sell?

What **services** might each business sell?

ROLAND'S TENNIS ACADEMY

- improve your game with pro coaching
- visit our pro shop for the latest in racquets and other tennis gear
- custom racquet repair

THINK about these business ads

TALK to a partner

SHARE with the class

Wally's Electronics Warehouse

From personal devices to home entertainment systems, we have all the latest and greatest gadgets!

Slide 2

Test the definition

What is a *good*?
Select the *non-example*

© ml / Fotolia.com   © Anatolii / Fotolia.com   © alexlukin / Fotolia.com   © trekandphoto / Fotolia.com

Slide 3

References

ml, 2014, Your Coffee, http://us.fotolia.com/id/47616687 (accessed May 28, 2014).
Anatolii, 2014, Pig on white, http://us.fotolia.com/id/55475672 (accessed May 28, 2014).
alexlukin, 2014, Blue bottle of pure water with drops, http://us.fotolia.com/id/64125231 (accessed May 28, 2014).
trekandphoto, 2014, Skateboard Isolated With Clipping Path, http://us.fotolia.com/id/43721468 (accessed May 28, 2014).

Test the definition

What is a **service**?
Identify the *non-example.*

© Ljupco Smokovski / Fotolia.com   © Kurhan / Fotolia.com   © Jenner / Fotolia.com   © Rido / Fotolia.com

Slide 4

References

Ljupco Smokovski, 2014, Mature fisherman holding a fishing equipment, http://us.fotolia.com/id/39321209 (accessed May 28, 2014).
Kurhan, 2014, Professional plumber, http://us.fotolia.com/id/42525849 (accessed May 28, 2014).
Jenner, 2014, Portrait of a happy Female Doctor, http://us.fotolia.com/id/44089744 (accessed May 28, 2014).
Rido, 2014, Satisfied professional chef, http://us.fotolia.com/id/44776659 (accessed May 28, 2014).

A *good* is a tangible thing that can be used or consumed.

© trekandphoto / Fotolia.com

A *service* is any activity that provides a benefit.

© Kurhan / Fotolia.com

Slide 5

References

trekandphoto, 2014, Skateboard Isolated With Clipping Path, http://us.fotolia.com/id/43721468 (accessed May 28, 2014).

Kurhan, 2014, Professional plumber, http://us.fotolia.com/id/42525849 (accessed May 28, 2014).

Extend the definition

Ecosystems also provide goods and services.
Which are *goods*?

Which are *services*?

L. Hislop / GRID-Arendal

© mahony / Fotolia.com

J. Galloway / U.S. Geological Survey

© wiktor bubniak / Fotolia.com

THINK about these images

TALK to a partner

SHARE with the class

Slide 6

References

Hislop, Lawrence, 2010, Tree stumps, Canada, http://www.grida.no/photolib/detail/tree-stumps-canada_18fd (accessed April 22, 2014).
Galloway, Joel M., 2011, Missouri River, U.S. Geological Survey, http://gallery.usgs.gov/photos/06_28_2011_lpg6Jvu3lD_06_28_2011_18 (accessed April 24, 2014).
mahony, 2014, Man relaxing on the seaside, http://us.fotolia.com/id/63616337 (accessed May 28, 2014).
wiktor bubniak, 2014, Nordic walking in mountains, Young female, http://us.fotolia.com/id/9463965 (accessed May 28, 2014).

Measuring ecosystem goods and services in Canada
Statistics Canada – Catalogue no. 16-507-X
What is the value of an ecosystem?   7

Three categories of EGS

Provisioning: the goods and materials provided.

Regulating: the services of regulating climatic, water, bio-chemical and biological processes.

Cultural: services provided through recreation, knowledge, relaxation and spiritual reflection.

© kjay / Fotolia.com

Slide 7

References

kjay, 2014, Douglas Fir Tree Silhouette, http://us.fotolia.com/id/5470456 (accessed May 28, 2014).

Categorize the EGS

In which categories do these EGS belong:
provisioning, regulating or cultural?

L. Hislop / GRID-Arendal

© mahony / Fotolia.com

J. Galloway / U.S. Geological Survey

© wiktor bubniak / Fotolia.com

Slide 8

References

Hislop, Lawrence, 2010, Tree stumps, Canada, http://www.grida.no/photolib/detail/tree-stumps-canada_18fd (accessed April 22, 2014).
Galloway, Joel M., 2011, Missouri River, U.S. Geological Survey, http://gallery.usgs.gov/photos/06_28_2011_lpg6Jvu3ID_06_28_2011_18 (accessed April 24, 2014).
mahony, 2014, Man relaxing on the seaside, http://us.fotolia.com/id/63616337 (accessed May 28, 2014).
wiktor bubniak, 2014, Nordic walking in mountains, Young female, http://us.fotolia.com/id/9463965 (accessed May 28, 2014).

Do ecosystems have goods and services?

What goods and services might be found in this ecosystem?

© sababa66 / Fotolia.com

Slide 9

References

sababa66, 2014, fisherman on the boat, http://us.fotolia.com/id/57707069 (accessed May 28, 2014).

How has human activity affected the goods and services provided by this ecosystem?

LOOK at the image carefully

DESCRIBE what you see to your partner

IDENTIFY how human activity has affected the goods and services provided

L. Hislop / GRID-Arendal

Slide 10

References

Hislop, Lawrence, 2010, Fallen trees in a plantation, Canada, http://grida.no/photolib/detail/fallen-trees-in-a-plantation-canada_56e1 (accessed April 24, 2014).

Human Activity and the Environment – Teacher's Kit

Lesson # 3: How can the value of ecosystem goods and services be measured?

Release date: September 2014

Statistics Canada / Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

• Statistical Information Service	1-800-263-1136
• National telecommunications device for the hearing impaired	1-800-363-7629
• Fax line	1-877-287-4369

Depository Services Program

• Inquiries line	1-800-635-7943
• Fax line	1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
E	use with caution
F	too unreliable to be published
*	significantly different from reference category (p < 0.05)

Lesson #3

How can the value of ecosystem goods and services be measured?

Overview

This PowerPoint lesson describes use of the 7 slides in Set #3 and related learning activities to explore how the value of ecosystem goods and services (EGS) might be measured. Using the example of two transportation options, learners explore non-monetary methods to quantify and measure benefits. They compare monetary and non-monetary valuations for sample goods and services. Finally, they suggest possible non-monetary measures for determining the value of EGS portrayed in an image of an ecosystem.

Audience

- junior high school
- senior high school
- introductory post-secondary

Learning outcomes

- understand monetary and non-monetary valuation methods
- understand the importance of both valuation methods

Curriculum links

- grades 7 to 12 geography (ecosystems, geographic change), social studies (economics), biology (ecosystems and change), science, economics (accounting, valuation methods)
- post-secondary geography (ecosystems), environmental science (ecosystem accounting, ecosystem change)

Learning materials

- PowerPoint slide set #3: How can the value of ecosystem goods and services be measured?
- Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*
- Image collection: *Image # 8*
- Activity sheet #6: *Exploring non-monetary benefits*
- Activity sheet #7: *Exploring the non-monetary value of ecosystem goods and services*
- Activity sheet #8: *Exploring strengths and weaknesses*

Instructions

Think about the task
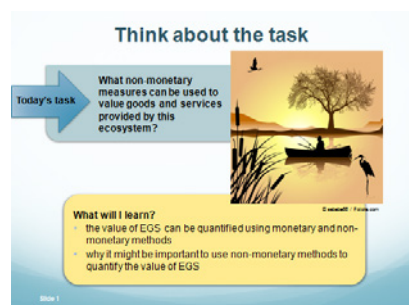
Display or project Slide 1 or provide a provocative image to prompt learner reflection on the question "What non-monetary measures can be used to value goods and services provided by this ecosystem?"

Guide learners in a discussion of how the non-monetary value of EGS might be quantified and measured. Encourage learners to consider why it might be important to find alternatives to monetary measures of valuation when determining the value of EGS.

Explore the ideas

Organize learners into small groups and provide groups with a copy of Activity sheet #6: *Exploring non-monetary benefits.*

Display or project Slide 2 and inform learners that they must decide which transportation option provides the greatest benefits.

Explain that while they could use monetary measures to guide their decision (for example, comparing the cost of the bicycle with the cost of the transit pass), their challenge is to think of non-monetary ways to quantify and measure the benefits of each transportation option. For example, they could compare the fitness benefits of each option by measuring the number of calories expended.

Guide learners in identifying other non-monetary ways of quantifying and measuring benefits. Instruct learners to record their ideas on Activity sheet #6 and then share with the class.

Learn about monetary valuation of ecosystem goods and services
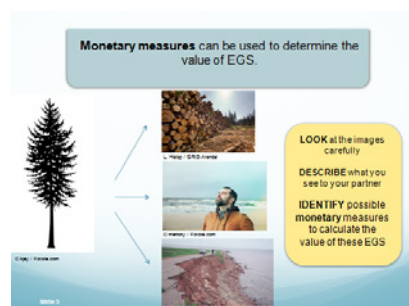
Guide learners in reflecting on the images from Slide 3 and to think of what monetary measures might used to determine the value of trees. Three examples of EGS associated with trees are pictured (from top to bottom):

- timber and wood products
- clean air or air purification
- erosion control.

Consider prompting learners with a question such as: "What monetary measures could be used to determine the value of the goods and services provided by trees?" Remind learners that they are to think of how monetary value might be measured, and not calculate dollar amounts or actual values.

Possible examples include the market prices of timber and wood products, how much someone would be willing to pay to keep a tree, the value of lower health care costs associated with cleaner air, or money not spent on flood mitigation.

For more information on monetary valuation techniques refer to the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*, page 21 and page 86 (Appendix B).

Learn about non-monetary valuation of ecosystem goods and services
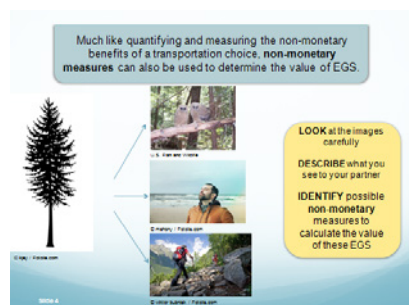
Inform learners that similar to quantifying and measuring the benefits of a transportation choice, non-monetary measures can also be used to determine the value of EGS.

Display or project Slide 4 and ask learners to think of what non-monetary measures might be used to quantify and measure the value of the EGS provided by trees. Three examples of EGS associated with trees are pictured (from top to bottom):

- habitat for endangered species (e.g., spotted owls)

- clean air or air purification

- recreation.

Consider prompting learners with a question such as "What non-monetary measures could be used to determine the value of the goods and services provided by trees?" Possible examples include the number of endangered species that inhabit the trees, a decrease in air pollution or the number of hikers that visit the ecosystem.

Encourage learners to share and record additional suggestions of non-monetary measures. Review these responses and guide learners in grouping the suggestions into categories. Possible suggestions include categories of social, cultural and physical measures. Record and display these grouping suggestions.

For more information on non-monetary valuation techniques refer to the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*, page 9.

Apply non-monetary measures
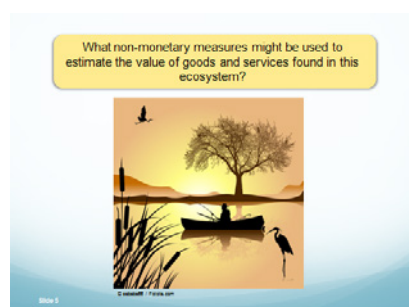
Display or project Slide 5 and inform learners that their next task is to determine what non-monetary measures might be used to determine the value of EGS found in the pictured ecosystem.

Provide each learner with a copy of Activity sheet #7: *Exploring the non-monetary value of ecosystem goods and services* and a copy of Image 8. Guide learners in identifying goods and services that might be found in this ecosystem. Remind learners that some EGS may be less obvious but are still valuable. For

example, clean air might be a good provided by an ecosystem, and cattails might provide a service by cleaning air and water. Prompt learners to record their observations about EGS on Activity sheet #7.

Next, guide learners in identifying non-monetary measures that could be used to estimate the value of each identified good and service. Remind learners that they are to think of the measures, and not calculate actual values. Prompt learners to reflect on the categories of non-monetary measures.

After learners have identified a number of non-monetary measures, inform them that their challenge is to determine the three most valuable EGS from the pictured ecosystem. Instruct learners to consider the measures carefully and to record their reasons. Invite learners to share their decisions with the class, guiding the discussion to explore the similarities and differences.

Explore strengths and weaknesses
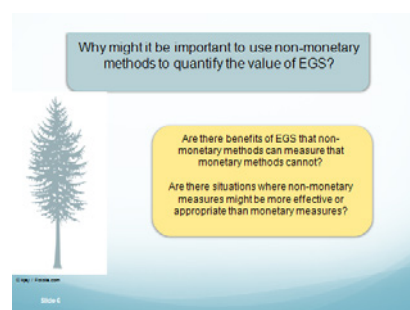
Display or project Slide 6 and distribute Activity sheet #8: *Exploring strengths and weaknesses*. Organize learners into small groups to consider the strengths and weaknesses of both methods of determining the value of EGS.

Prompt learners with questions such as:

- Which measures are easier to develop and use?
- Are there particular groups or perspectives that might favour one form of measures over the other?
- Are there situations where monetary measures might be more effective or appropriate than non-monetary measures?
- Are there situations where non-monetary measures might be more effective or appropriate than monetary measures?
- Are there situations where using both types of measures might be effective and important?

Conclude by posing the question: "Why might it be important to use non-monetary methods to quantify the value of ecosystem goods and services?"

Activity sheet #6

Exploring non-monetary benefits

You are attempting to find the best way to commute to school and work. You can afford either a bike or a bus pass. Are there non-monetary ways to quantify and measure the benefits of each transportation option?

How can the benefits of commuting by bike be quantified and measured?	How can the benefits of commuting by public transit be quantified and measured?
© Dudarev Mikhail / Fotolia.com	© nerthuz / Fotolia.com

The transportation choice that appears to have the greatest non-monetary benefit is:

The top three reasons that support my decision are:

Activity sheet #7

Exploring the non-monetary value of ecosystem goods and services

An *ecosystem good or service* that I noticed in the image:	A *non-monetary measure* that could be used to estimate the value of the good or service

After reviewing the EGS found in this image and non-monetary ways to quantify and measure their value, I think that the three most valuable EGS are:

1.

2.

3.

Activity sheet #8

Exploring strengths and weaknesses

	Monetary measures and methods	Non-monetary measures and methods
Strengths		
Weaknesses		

Human Activity and the Environment – Teacher's Kit

Slide set # 3: How can the value of ecosystem goods and services be measured?

Release date: September 2014

Statistics Canada Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

- Statistical Information Service   1-800-263-1136
- National telecommunications device for the hearing impaired   1-800-363-7629
- Fax line   1-877-287-4369

Depository Services Program
- Inquiries line   1-800-635-7943
- Fax line   1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.   not available for any reference period
..   not available for a specific reference period
...   not applicable
0   true zero or a value rounded to zero
0^s value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p} preliminary
^{r} revised
x   suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E} use with caution
F   too unreliable to be published
*   significantly different from reference category ($p < 0.05$)

Set #3: How can the value of EGS be measured?

Set #3 of a three-part series, this presentation and related learning materials include the following activities:

- Learners discuss possible non-monetary methods of determining the benefits of transportation options.
- Learners identify possible monetary measures of EGS value.
- Learners identify possible non-monetary measures of EGS value.

Key learning outcomes:
- understand monetary and non-monetary valuation methods
- understand the importance of both valuation methods

Intended audience: grades 7 to 12 social studies, geography, science, biology, and environmental education classes; introductory post-secondary

These PowerPoint presentations and corresponding teacher notes and activities accompany and support the learning activities for "How can the value of ecosystem goods and services be measured?" and the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*.

Title slide

© kjay / Fotolia.com

References

kjay, 2014, Douglas Fir Tree Silhouette, http://us.fotolia.com/id/5470456 (accessed May 28, 2014).

Think about the task

Today's task → What non-monetary measures can be used to value goods and services provided by this ecosystem?

© sababa66 / Fotolia.com

What will I learn?
- the value of EGS can be quantified using monetary and non-monetary methods
- why it might be important to use non-monetary methods to quantify the value of EGS

Slide 1

References

sababa66, 2014, fisherman on the boat, http://us.fotolia.com/id/57707069 (accessed May 28, 2014).

Explore the idea

The value of different transportation options can be compared using monetary measures such as cost.
Are there other ways to quantify and measure their benefits?

$500

© Dudarev Mikhail / Fotolia.com

$1050 per school year

© nerthuz / Fotolia.com

THINK of various ways of quantifying the benefits of each option

TALK to a partner

SHARE with the class

Slide 2

References

Dudarev Mikhail, 2014, Bicycle, http://us.fotolia.com/id/49643609 (accessed May 28, 2014).

nerthuz, 2014, Big White Tour Bus, http://us.fotolia.com/id/52937352 (accessed May 28, 2014).

Monetary measures can be used to determine the value of EGS.

L. Hislop / GRID-Arendal

© mahony / Fotolia.com

© kjay / Fotolia.com

LOOK at the images carefully

DESCRIBE what you see to your partner

IDENTIFY possible **monetary** measures to calculate the value of these EGS

Slide 3
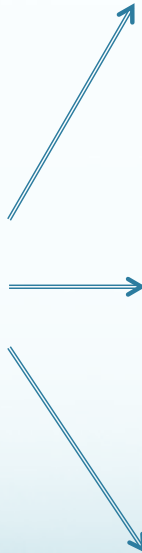
G. MacDougall / Prince Edward Island Department of Agriculture and Forestry

References

kjay, 2014, Douglas Fir Tree Silhouette, http://us.fotolia.com/id/5470456 (accessed May 28, 2014).

Hislop, Lawrence, 2010, Tree stumps, Canada, http://www.grida.no/photolib/detail/tree-stumps-canada_18fd (accessed April 22, 2014).

mahony, 2014, Man relaxing on the seaside, http://us.fotolia.com/id/63616337 (accessed May 28, 2014).

Gerald MacDougall, Coastal Erosion, Brae Harbour, Prince Edward Island, Prince Edward Island Department of Agriculture and Forestry, http://atlanticadaptation.ca/erosion (accessed July 3, 2014).

4   Measuring ecosystem goods and services in Canada

What is the value of an ecosystem?
Statistics Canada – Catalogue no. 16-507-X

Much like quantifying and measuring the non-monetary benefits of a transportation choice, **non-monetary measures** can also be used to determine the value of EGS.

U.S. Fish and Wildlife

© mahony / Fotolia.com

© wiktor bubniak / Fotolia.com

© kjay / Fotolia.com

LOOK at the images carefully

DESCRIBE what you see to your partner

IDENTIFY possible **non-monetary** measures to calculate the value of these EGS

Slide 4

References

kjay, 2014, Douglas Fir Tree Silhouette, http://us.fotolia.com/id/5470456 (accessed May 28, 2014).

U.S. Fish and Wildlife Service, n.d. (no date), Northern Spotted Owls, http://gallery.usgs.gov/photos/04_11_2012_wcs1Vlh77P_04_11_2012_1 (accessed April 24, 2014).

mahony, 2014, Man relaxing on the seaside, http://us.fotolia.com/id/63616337 (accessed May 28, 2014).

wiktor bubniak, 2014, Nordic walking in mountains, Young female, http://us.fotolia.com/id/9463965 (accessed May 28, 2014).

Measuring ecosystem goods and services in Canada
Statistics Canada – Catalogue no. 16-507-X
What is the value of an ecosystem?
5

What non-monetary measures might be used to estimate the value of goods and services found in this ecosystem?

© sababa66 / Fotolia.com

Slide 5

References

sababa66, 2014, fisherman on the boat, http://us.fotolia.com/id/57707069 (accessed May 28, 2014).

Why might it be important to use non-monetary methods to quantify the value of EGS?
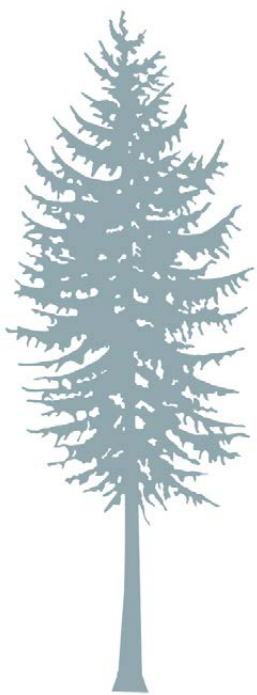
Are there benefits of EGS that non-monetary methods can measure that monetary methods cannot?

Are there situations where non-monetary measures might be more effective or appropriate than monetary measures?

© kjay / Fotolia.com

Slide 6

References

kjay, 2014, Douglas Fir Tree Silhouette, http://us.fotolia.com/id/5470456 (accessed May 28, 2014).

Human Activity and the Environment – Teacher's Kit

Detailed lesson plan #1: Can the value of ecosystems and ecosystem goods and services be measured?

Release date: September 2014

Statistics Canada Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

• Statistical Information Service	1-800-263-1136
• National telecommunications device for the hearing impaired	1-800-363-7629
• Fax line	1-877-287-4369

Depository Services Program
• Inquiries line	1-800-635-7943
• Fax line	1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category (p < 0.05)

Detailed lesson plan #1

Can the value of ecosystems and ecosystem goods and services be measured?

Overview

This lesson explores valuation methods used to determine the value of ecosystems and ecosystem goods and services (EGS). Using the Statistics Canada publication *Human Activity and the Environment 2013: Measuring Ecosystem Goods and Services in Canada* (MEGS), the lesson introduces monetary and non-monetary methods of valuation. Using the example of a coffee shop and applying this example to ecosystems, learners recognize what makes something an asset. Learners identify various environmental assets, goods and services. They explore the concepts of use and non-use values by applying the MEGS 'Total Economic Value Framework.' Finally, learners identify measures that could be used to estimate the value of EGS found within a particular ecosystem.

Audience

- junior high school
- senior high school
- introductory post-secondary

Learning outcomes

- understand ecosystem accounting practices
- explore various ways of estimating the value of EGS
- learn to think critically about 'value' in relation to ecosystems

Curriculum links

- grades 7 to 12 geography (ecosystems), social studies (economics), biology (ecosystems), science, economics (accounting, valuation methods)
- post-secondary geography (ecosystems), environmental science (ecosystem accounting, ecosystem change)

Learning materials

- Lessons #1 to 3
- Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*
- Activity sheet #1: *Defining an asset*
- Activity sheet #2: *Categorizing asset values*
- Image collection

- Activity sheet #3: *Exploring use and non-use values for ecosystem goods and services*
- Briefing sheet #1: *Determining the value of ecosystem goods and services*
- Activity sheet #4: *Estimating the value of ecosystem goods and services*
- Assessment support #1: *Assessing the descriptions*

Instructions

Session one

To develop learner understanding of ecosystems, it may be useful to use the activities found in the Lesson #1: *What is an ecosystem?*

Learn about assets

Provide each learner with a copy of Activity sheet #1: *Defining an asset* and ask learners to imagine that they are owners of a small coffee shop. After reviewing the words at the top and bottom of the diagram, inform learners that the items on the top of the page are examples of assets, while the items at the bottom are not assets. Ask learners to compare the examples to help create a definition for the concept of an asset. Direct learners to write their definition in the middle of the page. Possible definitions include 'a source of wealth,' 'an item of value,' or 'something that provides benefits.'

After reviewing learner responses, explore the basics of accounting by informing learners that all businesses and individuals can accumulate assets. Inform learners that assets are a source of wealth that will provide continuing benefits in the future. Financial assets can include cash, buildings, materials, supplies, land, patents, trademarks and other items. They can be used by businesses to create other valuable goods and services.

Prompt learners to consider what might increase the value of the coffee shop; possible responses might include accumulating more assets or not accumulating liabilities. Conversely, ask learners to consider what might decrease the value of the shop; possible responses include depreciation in the value of machinery, breakage of cups, or running out of coffee beans.

Categorize asset values

Inform learners that assets are of value to people because of the benefits derived from them, whether these benefits are enjoyed directly or indirectly (use value) or even in cases where they are not actually used (non-use value).

Provide each learner with a copy of Activity sheet #2: *Categorizing asset values*. Ask learners to consider which coffee shop assets provide benefits when they are used or consumed and which provide benefits even though they are not consumed. For example, almond milk is an example of an asset that derives its value from its use, while interior decorating creates value even though it is not consumed.

After learners have grouped assets, review their responses by posing the following questions:

- Which assets provide benefits when they are used or consumed (e.g., coffee beans, almond milk)?
- Which assets provide benefits even though they are not used or consumed (e.g., art, goodwill)?
- Do some assets have both use and non-use value?

Learn about ecosystem assets

Guide learners in applying the coffee shop analogy to their thinking about what other organizations or areas, including the environment and ecosystems, might also have assets. Display or project one of the eight photographs of ecosystems in the Image collection, asking learners to carefully observe the image. Provide the following directions:

- Identify ecosystem features (e.g., forests, soils, water, wetlands, vegetation).
- Identify less visible or obvious features of the ecosystem such as micro-organisms, insects and air.
- Identify how these features might be thought of as ecosystem assets and how they might provide benefits to people.

Ask learners to consider what might decrease the value of the ecosystem assets; possible responses include water pollution or soil erosion. Record learner ideas on a whiteboard or flipchart.

Session two

To develop learner understanding of EGS, it may be useful to use the activities found in Lesson #2: *What are ecosystem goods and services?*

Learn about ecosystem goods and services

Display or project an image of an ecosystem (see Image collection). Inform learners that ecosystem assets can provide goods or services, or both. Guide learners in analyzing the types of goods and services that may be provided by the ecosystem displayed in the photograph. Provide the following directions:

- Identify what different types of goods and services might be generated from the ecosystem (e.g., provisioning, regulating, cultural).
- Identify examples of goods and services that might be generated from the ecosystem for each of the different types (e.g., timber, air purification, recreational opportunities).
- Identify less obvious uses (e.g., forests might provide scenery) as well as obvious uses (e.g., forests might provide timber).

Record learner ideas on a whiteboard or flipchart.

For more information on EGS classifications refer to 'Section 2.1.2 Classifying flows' in the MEGS publication (page 20).

Define use and non-use values

Ask learners to develop definitions for 'use value' and 'non-use value' of EGS. Guide learners with questions similar to:

- If cutting down trees, catching fish, and water purification are examples of use values, and scenery enjoyment is not an example of use value, what is the definition of use value?

- If a forest will be harvested in 30, 40 or 50 years, would we consider its value to be derived from use or non-use?

- If a wetland is left undeveloped, should the flood prevention services provided be considered a use or a non-use?

Possible definitions include:

- Use value: a benefit or value is generated from actual consumptive or non-consumptive use (direct use), potential future use (option use), as well as indirect use of a good or service.

- Non-use value: a benefit or value is generated that is independent of actual or potential future use. For example, bequest values may be generated from the satisfaction associated with preserving something for future generations, while existence value may be generated from the satisfaction associated with knowing that something exists, regardless of how it is used.

Review and refine learner suggestions. It may be useful to remind learners of the coffee shop analogy and how benefits can be generated from use or non-use.

Exploring use and non-use values for ecosystem goods and services

Next, provide each learner with a photo of an ecosystem (see Image collection for samples) and a copy of Activity sheet #3: *Exploring use and non-use values for ecosystem goods and services*. Using the previous discussion as a guide, encourage learners to identify obvious and less obvious features of the ecosystem featured in their assigned photo. For example, forests are an example of an obvious ecosystem feature while micro-organisms are less obvious. These features should be recorded in the top box.

Categorize ecosystem goods and services values

Ask learners to use their definitions of use value and non-use value to categorize the various EGS that may be provided by the identified ecosystem features in the appropriate boxes in Activity sheet #3. For example, if 'forests' were noted as a feature of an assigned ecosystem, 'timber' might be an EGS noted in the direct use category, 'air purification' an EGS in the indirect use category, 'preservation of scenery' in the future generations category, and 'enjoyment of biodiversity' in the existence category. Instruct learners to carefully consider each observed ecosystem feature, potential EGS and what type of benefits might be provided. For more information on use and non-use values refer to the 'Total Economic Value framework' in the MEGS publication (Figure 2.1, page 22).

Review learner responses and ask learners to consider whether it is possible for specific EGS to provide both use and non-use benefits. Setting the stage for the next activity, encourage learners to suggest how values of various benefits might be calculated and compared.

Session three

To develop learner understanding of valuation methods it may be useful to use the activities found in Lesson #3: *How can the value of ecosystem goods and services be measured?*

Learn about valuation methods

Begin an exploration of the methods used to determine the value of EGS by informing learners that much like estimating the value of assets found in a coffee shop, there are also methods that can be used to estimate the value of goods and services derived from or produced by ecosystems.

Provide each learner with a copy of Briefing sheet #1: *Determining the value of ecosystem goods and services* while also directing learners to read pages 19 to 23 of the MEGS publication (Section 2, Ecosystem accounting). Provide the following questions to focus reading:

- In what ways might estimating the value of a coffee shop's assets be similar to estimating the value of ecosystem assets and EGS? Possible responses include: both consider the value or contributions that an asset can provide to people; both might be valued in monetary ($) terms.

- In what ways might it be more difficult to estimate the value of ecosystem assets and EGS? Possible responses include: many EGS are not bought or sold, it can be challenging to place a monetary value on EGS.

Invite learners to share their thoughts on the questions and the concept of ecosystem accounting, encouraging them to consider why it is important to understand the value of ecosystems and EGS.

For more information on monetary valuation techniques refer to the MEGS publication, page 21 and page 86 (Appendix B).

For more information on non-monetary valuation techniques refer to the MEGS publication, page 9.

Applying valuation methods

Display or project Image 1 (photo of two small water bodies separated by a strip of terrestrial land, from Image collection) and provide each learner with a copy of Activity sheet #4: *Estimating the value of ecosystem goods and services*. Invite the class to carefully examine the photograph and observe any possible goods and services that the pictured ecosystem might offer or provide. These observations should be recorded in the left hand column ('Observation: what are the potential goods or services?') Possible observations could include timber, fresh water, fish, clean air, scenery, erosion control, habitat and recreation.

Next, guide learners in considering what types of monetary and non-monetary measures might be used to estimate the value of the goods and services identified in the picture. Review the examples of measures that have been provided on the chart, and then work with learners to co-create another example in each category. Guide learners in continuing the process with each of the goods and services identified and noted in the chart. Encourage learners to remember to consider both use and non-use benefits.

Review learner responses by having them consider questions such as the following:

- Can either valuation method be used to produce valid estimates for all EGS?
- Which valuation method might be more appropriate for estimating the value of the EGS in this ecosystem?

After discussing these questions, direct learners to the bottom of the chart and have them consider which EGS might provide the most value for society, whether this value is estimated in monetary or non-monetary terms. Review learner responses, discussing any apparent differences in their assessments.

Session four

Exploring the value of an ecosystem

Provide each learner with an image of an ecosystem (see Image collection) and a copy of Activity sheet #4: *Estimating the value of ecosystem goods and services*. Alternatively, ask learners to find their own images or use a local ecosystem. Instruct learners to use the same process as in Session three and to identify possible measures that could be used to estimate the value of EGS in their selected ecosystems.

After possible measures have been identified, inform learners that their challenge is to develop a thoughtful and plausible description of the value of EGS found in an ecosystem. Work with learners to develop the requirements that correspond to the criteria. For example:

- Thoughtful: the description includes mention of potential monetary and non-monetary measures as well as use and non-use benefits.
- Plausible: the description is supported by evidence in images, maps and/or charts.
- Detailed: the description includes detail of obvious and non-obvious ecosystem features and related EGS.

To assess learner descriptions, consider using Assessment support #1: *Assessing the description.*

Activity sheet #1

Defining an asset

These are assets:

cash in the bank   sound system   website

art on the wall   coffee beans   muffins

delivery bicycle   coffee cups   spoons

coffee grinder   the building   trademarks

muffin recipes   coffee maker   goodwill

My definition of an asset is:

These are not assets:

money the shop owes on the mortgage

the store next door   the barista's pets

money owed on the shop credit card

electricity

Activity sheet #2

Categorizing asset values

Determine whether the following coffee shop assets provide benefits as a result of use or non-use (for example, almond milk provides benefits when it is consumed and used while interior decorating provides benefits even though it does not get used or consumed). Assets might be placed in one or both columns.

<table>
<tr><th colspan="2" align="center">Coffee shop assets</th></tr>
<tr><td colspan="2" align="center">cash in the bank   sound system   website   art on the wall   coffee beans   muffins

delivery bicycle   coffee cups   spoons   coffee grinder   the building   trademarks

muffin recipes   coffee maker   customer goodwill</td></tr>
<tr><th>Provide benefits when used or consumed</th><th>Provide benefits even though they are not used or consumed</th></tr>
<tr><td>almond milk</td><td>interior decorating</td></tr>
</table>

Activity sheet #3

Exploring use and non-use values for ecosystem goods and services

Ecosystem features:

Use value		Non-use value	
Benefit or value is generated from the actual consumptive or non-consumptive use, potential future use, or indirect use of a good or service		*Benefit or value is generated that is independent of actual or potential future use.*	
Direct use value	*Indirect use value*	*Bequest value*	*Existence value*
Ecosystem good or service	*Ecosystem good or service*	*Ecosystem good or service*	*Ecosystem good or service*

Briefing sheet #1

Determining the value of ecosystem goods and services

There are two ways of determining the value of ecosystem goods and services (EGS):

1. **Monetary valuation:** estimating and calculating the dollar value of EGS. There are three main methods of monetary valuation:

   i. *Revealed preference methods* examine the choices people make to identify preferences and priorities. For example, travel costs to desirable locations can be used to estimate willingness to pay for recreational services. Similarly, comparing property values close to and far from parks can be used to measure the value people place on an area or ecosystem.

   ii. *Market based approaches* use market prices of commodities to estimate the value of EGS that are not traded in a market. For example, the value of fish in a stream might be estimated by comparing the value of fish in the stream to the value of fish sold in a market. Similarly, the costs of substitutes, required mitigation or restoration expenses can be used as indicators of the value of EGS.

   iii. *Stated preference valuation* uses information about people's environmental preferences gathered through the use of surveys, questionnaires, or interviews. For example businesses may be willing to pay for air scrubbers or people might accept compensation for a reduction in air quality.

2. **Non-monetary valuation:** social, cultural or physical measures can also be used to assess the value of ecosystems and their benefits. These may include non-monetary values such as lives saved, nutrients processed by wetlands, as well as simply the existence of the EGS.

Both monetary and non-monetary valuation methods can be used to estimate EGS values, whether the benefit enjoyed is through use or non-use. For example, a monetary value of directly using trees could be estimated by using market prices of lumber or other forest products. Similarly a monetary value might be estimated for the enjoyment of scenery provided by a forest, by estimating a community's willingness to pay to preserve it.

Monetary and non-monetary valuation methods can also be used to estimate the value of the same thing. For example, a monetary value of a forest might be the estimated value of future timber harvests. Non-monetary values might include the number of people who use the forest for recreational purposes or the physical size, in square kilometers, of the forest.

For more information on valuation techniques, see pages 21 to 22 and Appendix B (page 86) of the MEGS publication.

10   Measuring ecosystem goods and services in Canada

What is the value of an ecosystem?
Statistics Canada – Catalogue no. 16-507-X

Activity sheet #4

Estimating the value of ecosystem goods and services

Name of area or ecosystem:		
Observation potential goods or services	**Monetary valuation measures**	**Non-monetary valuation measures**
lumber	-the market value of the forest products that could be produced	-the number of board feet of lumber

EGS value assessment
The EGS in this ecosystem that might have the highest value for society is (regardless of whether it is estimated using monetary or non-monetary valuation methods):   Reasons that support this choice:

Assessment support #1

Assessing the descriptions

	Outstanding	**Very good**	**Competent**	**Satisfactory**	**In-progress**
Plausible description	The description is highly plausible and highly justifiable in light of the evidence provided.	The description is clearly plausible and justifiable in light of the evidence provided.	The description is plausible and adequately justifiable in light of the evidence provided.	The description is somewhat plausible but barely justifiable given the evidence provided.	The description is implausible and not justifiable given the evidence provided.
Detailed description	The description is highly detailed and includes thorough details of obvious and non-obvious ecosystem features and related EGS.	The description is detailed and includes thorough details of obvious and some non-obvious ecosystem features and related EGS.	The description is adequately detailed and includes adequate details of obvious and some non-obvious ecosystem features and related EGS.	The description is somewhat detailed and includes basic detail of obvious and some non-obvious ecosystem features and related EGS.	The description is not detailed and is missing details of obvious and non-obvious ecosystem features and related EGS.

Human Activity and the Environment – Teacher's Kit

Detailed lesson plan #2: The value of ecosystem goods and services in changing ecosystems

Statistics Canada
Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

• Statistical Information Service	1-800-263-1136
• National telecommunications device for the hearing impaired	1-800-363-7629
• Fax line	1-877-287-4369

Depository Services Program

• Inquiries line	1-800-635-7943
• Fax line	1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category (p < 0.05)

Detailed lesson plan #2

The value of ecosystem goods and services in changing ecosystems

Overview

This lesson explores ecosystem changes in Canada, the impact of changes on ecosystem goods and services (EGS), and potential strategies for increasing the value of EGS, using the Statistic Canada publication *Human Activity and the Environment 2013: Measuring Ecosystem Goods and Services in Canada* (MEGS). Learners begin by analyzing an image of an ecosystem, looking for changes and inferring potential impacts on human wellbeing. They then consider data sources on changes in various ecosystems across Canada, in order to consider possible impacts on the value of EGS. They consider various monetary and non-monetary valuation measures that might be used to estimate the impact of changes on EGS. Finally, learners generate sustainable, desirable and feasible strategies to increase the value of EGS provided by an ecosystem, and share these with the rest of the class.

Audience

- junior high school
- senior high school
- introductory post-secondary

Learning outcomes

- understand ecosystem accounting practices
- understand how ecosystems across Canada have changed over time
- explore various ways of estimating the value of EGS
- learn to think critically about value in relation to EGS

Curriculum links

- grades 7 to 12 geography (ecosystems, geographic change), social studies (economics), biology (ecosystems and change), science, economics (accounting, valuation methods)
- post-secondary geography (ecosystems), environmental science (ecosystem accounting, ecosystem change)

Learning materials

- Lessons #1 to 3
- Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada*
- Image collection

- Activity sheet #5: *Assessing the effects of ecosystem changes*
- Activity sheet #6: *Map of Canada*
- Activity sheet #7: *Strategies for increasing the value of ecosystem goods and services*
- Assessment support #2: *Assessing the recommendation*

Instructions

Session one

To develop learner understanding of ecosystems, EGS and valuation methods, it may be useful to introduce this activity by first using the three PowerPoint Lessons and related learning materials.

Learn about the impact of ecosystem change

Begin by presenting learners with an image of an ecosystem found in the Image Collection. Reminding learners of the attributes of an ecosystem, prompt learners to consider the changes that may have occurred over the past 30 years. Prompt learners by having them reflect on changes such as:

- changes in the number of people in the area
- reduction or growth in the numbers of trees
- reduction or growth in the numbers of farms
- development of roads, housing, industry or businesses.

Discuss learner responses and record them on a whiteboard or chart paper.

Next, ask learners to consider the question: "Have changes in this ecosystem improved human wellbeing?" Ask learners to determine which ecosystem changes may have improved human wellbeing and which may have caused human wellbeing to deteriorate. Possible responses about changes resulting in improved wellbeing include more trees being planted, more parks, or more businesses providing desired goods and services. Possible responses about changes resulting in decreased wellbeing include more traffic, fewer trees, and fewer natural areas.

Prompt learners to consider why some ecosystem changes might be viewed as both increasing and decreasing wellbeing. Are there examples of where a change in an ecosystem may have led to both an increase and a decrease in human wellbeing? One possible response might be that fewer trees might decrease wellbeing by reducing scenic views and opportunities for recreation, while at the same time leading to economic growth.

This activity may be extended by asking learners to determine whether human wellbeing has improved or declined as a result of changes in a local ecosystem.

2   Measuring ecosystem goods and services in Canada

What is the value of an ecosystem?
Statistics Canada – Catalogue no. 16-507-X

Session two

Learn about the changes in ecosystems across Canada

Remind learners that valuing EGS often focuses on the impact of small changes in an ecosystem or its services. Policy-makers can use this to show how specific changes will impact human well-being.

Inform learners that their challenge will be to analyze changes in ecosystems in different areas of the country and determine what impacts these changes may have had on the value of EGS provided by the ecosystem. Provide small groups of learners with copies of Activity sheet #5: *Assessing the effects of ecosystem changes*. Assign each group one of the following sections from the MEGS publication. Each section describes some population and landscape changes that have occurred in a specific area of the country:

- pages 27 to 29 and Table 3.3 and 3.4 (Greater Golden Horseshoe)
- pages 30 to 34 and Appendix C Tables 1, 2 and 3 – Maritime provinces (Sub-drainage area (SDA) codes 01A to 01F)
- pages 30 to 34 and Appendix C Tables 1, 2 and 3 – St. Lawrence (SDA codes 02A to 02Z)
- pages 30 to 34 and Appendix C Tables 1, 2 and 3 – Nelson River (SDA codes 05A to 05U)
- pages 30 to 34 and Appendix C Tables 1, 2 and 3 – Great Slave Lake (SDA codes 07A to 07U)
- pages 30 to 34 and Appendix C Tables 1, 2 and 3 – Pacific (SDA codes 08A to 08P)

Use the following instructions to guide learners through the first stages of completing the chart:

1. Record the name or location of the area described in the designated section of the activity sheet.

2. Review the assigned text and tables to discover what ecosystem changes have occurred in this area. OPTIONAL: Have learners look for online sources of information on ecosystem changes that occurred in their assigned area.

3. Infer how each change may have increased or decreased the provision of specific EGS. Encourage learners to consider both positive and negative impacts on human wellbeing, even for changes that appear to be negative. For example, if 'deforestation' was identified as a change, learners might note that there may be 'less habitat,' but also 'more timber production.'

4. Identify what monetary and non-monetary measures might be used to quantify the impacts of ecosystem change on the value of the identified EGS. Remind learners that they are to think of how the value of EGS might be measured, not to calculate dollar amounts or actual values. Possible examples include the 'market prices of timber and wood products,' or 'number of species using the area for habitat.'

5. Considering the impact of the ecosystem change on the provision of the identified EGS, learners should infer whether the change in the ecosystem has likely contributed to a decrease or increase in the overall value of the EGS provided by the ecosystem and provide reasons for this choice.

Invite learners to share the results from their charts, identifying which EGS they considered, how the value of these EGS might be measured, and how this influenced their decision on whether the overall value of EGS provided by the ecosystem increased or decreased. Ask learners to reflect on the valuation techniques: which techniques are more appropriate for assessing the value of the different EGS they identified for their assigned area?

OPTIONAL: Ask learners to rank the ecosystem changes from the most to least influential on the value of EGS provided by the ecosystem. Which change might have led to the most significant increase in the value of EGS? Which change might have led to the most significant decrease in the value of EGS?

Picturing ecosystem change across Canada

To build a national picture of changes to ecosystems and the related impact on the general value of EGS, provide each group of learners with Activity sheet #6: *Map of Canada*. Instruct learners to locate their assigned area on the map and, reflecting on the decision made about the overall change in value of EGS, mark the area with a green colour for an increase in value of EGS or a red colour for a decrease in value of EGS.

If available, consider projecting a map using a Smartboard or similar device. Invite learners to replicate the colouring from their individual maps on the large map. After all groups have coloured in their ecosystems, consider the resulting large map image. The following questions might be used to guide a discussion about changing ecosystems and the value of EGS and any identifiable trends:

- What does the resulting colour reveal about the value of EGS in selected areas of the country?
- Are certain types of ecosystems more sensitive to pressures?
- Do certain types of ecosystems provide different EGS?

Session three

Setting criteria

Begin by asking learners to identify a proposed change or development in their community that might impact the ecosystem and the value of EGS. This may include proposals to develop flood mitigation strategies, construct a skate park or build a pipeline. Ask learners to suggest criteria that might be used to evaluate the proposed developments. Encourage learners to consider the following criteria:

- Sustainable: Can this change or proposal continue over time given the resources that it may require?

- Desirable: Is this change or proposal needed and/or wanted by members of the community or by people knowledgeable in that field?

- Feasible: Does the change or proposal draw upon existing and usable techniques, technologies and research? Is the idea 'doable'?

Guide a class discussion using the criteria to assess the suggested proposals and changes. Inform learners that the same criteria could be used to evaluate strategies intended to increase the value of EGS provided by ecosystems across Canada.

Developing recommendations

Provide each learner with a copy of Activity sheet #7: *Strategies for increasing the value of ecosystem goods and services*. Inform learners that their challenge is to recommend sustainable, desirable and feasible strategies to increase the value of EGS provided by an assigned ecosystem (consider using the areas assigned in Session two). Direct learners to use data regarding ecosystem changes from the MEGS publication or from additional online sources. The following resources include some useful information about ecosystem change in Canada:

- Federal, Provincial and Territorial Governments, 2010, *Canadian Biodiversity: Ecosystem Status and Trends 2010*, Canadian Councils of Resource Ministers, www.biodivcanada.ca/ecosystems.

- Parks Canada, 2013, *Ecosystems Management*, www.pc.gc.ca/eng/progs/np-pn/eco/eco2.aspx.

Guide learners to reflect on the changes identified in Session 2 and the discussion about which changes are most responsible for decreasing the value of EGS provided by the ecosystem. After learners have identified which changes are most responsible for decreasing the value of EGS, ask them to recommend strategies that could be used to increase the value of EGS. These strategies should be directly related to the changes. Learners should consider possible monetary or non-monetary measures that could be used to assess changes in the value of the EGS.

Once learners have created a number of potential strategies, guide learners in using the criteria of sustainable, desirable and feasible to evaluate the strategies to determine which may be best.

- Sustainable: Can this strategy continue over time given the resources that it may require?

- Desirable: Is this strategy needed and/or wanted by members of the community or by people knowledgeable in that field?

- Feasible: Does the strategy draw upon existing and usable techniques, technologies and research? Is the idea 'doable'?

To assess learner recommendations, consider using Assessment Support Materials #2: *Assessing the recommendation.*

Presenting recommendations

Based on this activity, learners could develop presentations describing their recommendation for the most sustainable, desirable and feasible strategy to increase the value of EGS of the ecosystem. Encourage learners use the strategies and criteria for selection identified in Activity sheet #7: *Strategies for increasing the value of ecosystem goods and services* to inform the development of their presentations.

To encourage effective presentations, ask the class to brainstorm the criteria for excellent presentations, such as:

- well organized and prepared

- engages the audience (e.g., speaks from an outline instead of reading from notes, speaks in a clear voice)

- includes helpful examples and supporting resources.

Activity sheet #5

Assessing the effects of ecosystem changes

Location/name of area:		
Description of ecosystem changes:		
Impacts: The ecosystem change has likely led to **more** or **less** of the following EGS:	*monetary* measures that could be used to quantify changes in the value of this EGS	*non-monetary* measures that could be used to quantify changes in the value of this EGS
More… *Less…*		

EGS value assessment

Overall, the changes in the ecosystem have likely led to a:

☐   decrease in the value of EGS provided by this ecosystem.

☐   increase in the value of EGS provided by this ecosystem.

Reasons that support this choice:

Activity sheet #6

Map of Canada

8   Measuring ecosystem goods and services in Canada

What is the value of an ecosystem?
Statistics Canada – Catalogue no. 16-507-X

Activity sheet # 7

Strategies for increasing the value of ecosystem goods and services

Changes that decreased the value of EGS	Strategies to increase the value of EGS	Monetary or non-monetary measures to assess changes in the value of EGS	Assessing the strategies			
			low	medium	high	
						sustainable
						desirable
						feasible
						sustainable
						desirable
						feasible
						sustainable
						desirable
						feasible
						sustainable
						desirable
						feasible

- *Sustainable:* Can this strategy or proposal continue over time given the resources that it may require?

- *Desirable:* Is this strategy needed and/or wanted by members of the community or by people knowledgeable in that field?

- *Feasible:* Does the proposal draw upon existing and usable techniques, technologies, and research? Is the idea 'doable'?

Assessment support #2

Assessing the recommendation

	Outstanding	Very good	Competent	Satisfactory	In-progress
Plausible recommendation	The recommendation is highly plausible and highly justifiable in light of the criteria and evidence provided.	The recommendation is clearly plausible and justifiable in light of the criteria and the evidence provided.	The recommendation is plausible and adequately justifiable in light of the criteria and the evidence provided.	The recommendation is somewhat plausible but barely justifiable given the criteria and evidence provided.	The recommendation is implausible and not justifiable given the criteria and evidence provided.
Detailed recommendation	The recommendation is highly detailed and includes thorough description of obvious and non-obvious ecosystem changes and related strategies to increase the value of EGS.	The recommendation is detailed and includes thorough description of obvious and some non-obvious ecosystem changes and related strategies to increase the value of EGS.	The recommendation is adequately detailed and includes adequate description of obvious and some non-obvious ecosystem changes and related strategies to increase the value of EGS.	The recommendation is somewhat detailed and includes basic description of obvious and some non-obvious ecosystem changes and related strategies to increase the value of EGS.	The recommendation is not detailed. Recommended strategies are not related to ecosystem changes.

10   Measuring ecosystem goods and services in Canada

What is the value of an ecosystem?
Statistics Canada – Catalogue no. 16-507-X

Human Activity and the Environment – Teacher's Kit

Case study #1: Thousand Islands National Park case study

Statistics Canada Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

• Statistical Information Service	1-800-263-1136
• National telecommunications device for the hearing impaired	1-800-363-7629
• Fax line	1-877-287-4369

Depository Services Program

• Inquiries line	1-800-635-7943
• Fax line	1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

Case study #1

Thousand Islands National Park case study

Instructor's overview

This case study of the Thousand Islands Ecosystem and Thousand Islands National Park area consists of three related components and supporting learning materials.

First, learners use data and information from the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada* (MEGS) to create summary profiles of each of the two areas, highlighting significant similarities, differences, and relationships between the two areas.

Next, learners explore and assess pressures on the Thousand Islands Ecosystem and Thousand Islands National Park area. Learners also identify pressures not examined in the MEGS publication.

Finally, learners write a letter to Parks Canada recommending sustainable, desirable and feasible actions and strategies designed to provide recreational opportunities for Canadians while also protecting the park's ecological integrity.

This case study directs learners to respond to a number of questions; these questions can be used solely for learner understanding and not be assessed, or they can be developed as discreet assignments. This case study may be used independently or in combination with the other teaching and learning activities from the "What is the value of an ecosystem?" resource.

Audience

- senior high school
- introductory post-secondary

Learning outcomes

- understand key similarities, differences, and relationships between the Thousand Islands Ecosystem and the Thousand Islands National Park area
- understand pressures on the Thousand Islands Ecosystem and the Thousand Islands National Park environment
- understand Parks Canada objectives for the Thousand Islands National Park environment

Curriculum links

- grades 10 to 12 geography (ecosystems, geographic change), social studies (economics), biology (ecosystems and change), science, economics (accounting, valuation methods)
- post-secondary geography (ecosystems), environmental science (ecosystem accounting, ecosystem change)

Learning materials

- Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada* (MEGS)
- Case study activity sheet #1: *Describing the areas*
- Case study activity sheet #2: *Pressures affecting ecosystem goods and services*
- Case study activity sheet #3: *Meeting the objectives*
- Case study assessment support #1: *Assessing recommendations*

Thousand Islands National Park case study

Learner instructions

Imagine you are a consultant hired by Parks Canada to recommend strategies to help Parks Canada and other partners protect the park's ecological integrity.

In preparing your strategies you will undertake three tasks:

1. Examine data and information from the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada* (MEGS) and create summary profiles of each of the two areas, highlighting significant characteristics and relationships.

2. Identify and assess the pressures on the Thousand Islands Ecosystem and Thousand Islands National Park.

3. Prepare a letter to Parks Canada describing sustainable, desirable and feasible actions and strategies designed to help protect the park's ecological integrity.

Learning materials

- Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada* (MEGS)

- Case study activity sheet #1: *Describing the areas*

- Case study activity sheet #2: *Pressures affecting ecosystem goods and services*

- Case study activity sheet #3: *Meeting the objectives*

- Case study assessment support #1: *Assessing recommendations*

Situating and describing the areas

The first component of this case study is to develop summary profiles of the Thousand Islands Ecosystem and the Thousand Islands National Park area. These summary profiles will be based upon descriptive characteristics and relationships between each of the two areas, as well as inferences about potential significance.

First, examine the data and maps from Section 4, pages 61 to 77 of the MEGS publication. Using Case study activity sheet #1: *Describing the areas*, identify characteristics that help describe the Thousand Islands Ecosystem and the Thousand Islands National Park area.

The following aspects may be useful to address:

- location and area
- population
- notable geographic features
- types of EGS
- use of EGS
- value of EGS.

Additional aspects or characteristics from the report or other online sources may also be useful in developing these descriptions.

Each description should be supported by quantifiable measures or data identified in the MEGS publication or other online resources. For example, the size of the Thousand Islands Ecosystem and the Thousand Islands National Park might be compared using measures of area such as km^2, or biological diversity might be explored by identifying the number of species of birds that live in each area. This information should be recorded in the 'Thousand Islands Ecosystem' and the 'Thousand Islands National Park' columns on the Case study activity sheet #1: *Describing the areas* chart.

Use this descriptive information to compare and identify relationships that might exist between the two areas. The following questions might be useful in determining relationships:

- Does one area benefit from the other in any way?
- Does one area negatively impact the other in any way?
- Do the two areas rely upon each other in any way?

Next, explain the significance of key identified characteristics, comparisons and relationships. For example, the small size of the park compared to the population living in the ecosystem might result in heavy pressures on the park from visitor traffic. These inferences should be recorded in the 'Significance' column on the Case study activity sheet #1: *Describing the areas* chart.

Finally, create a summary profile for each of the two areas. Each summary profile should use the descriptions and related data recorded on the Case study activity sheet #1: *Describing the areas* chart.

Assessing the pressures

The second component of this case study is exploring and assessing the pressures on the Thousand Islands Ecosystem and the Thousand Islands National Park area.

First, analyze the maps and data from Section 4 (pages 63 to 70) of the MEGS publication that detail the pressures on the Thousand Islands Ecosystem and the Thousand Islands National Park area. Review the following indicators of the quality and productivity of ecosystems from

Section 3 of the report (pages 24 to 60), to determine whether any might contain data that could be used to describe the pressures and changes in each area:

- land cover change
- landscape modification
- ecosystem service potential
- biomass extraction.

Search for and review online sources to identify other sources of information regarding pressures on this ecosystem.

Using these different sources of information, consider what pressures and changes might be occurring in the Thousand Islands Ecosystem and Thousand Islands National Park. Finally, consider how these changes might affect the provision of EGS and whether they result in a positive or negative impact on EGS values. For example, changes in population might result in more park visitors, which could increase the value of recreational services, but could also decrease other EGS provided by the park. Record relevant and important information in the designated columns of Case study activity sheet #2: *Pressures affecting EGS.*

Finally, respond to the following questions:

- Which pressures might have the most significant impacts on the Ecosystem and the National Park? Are these two areas affected differently by these pressures?
- How might the impacts on the value of EGS be quantified? Suggest feasible monetary or non-monetary valuation measures that could be used to estimate changes in EGS.

Developing recommendations

Your final task is to prepare a letter to Parks Canada with recommendations of sustainable, desirable and feasible actions and strategies designed to help Parks Canada achieve the two objectives developed for the Thousand Islands National Park area:

1. providing recreational opportunities for Canadians
2. preserving and protecting the fragile resources of the park.

Meeting these objectives may be challenging given that "protecting the park's ecological integrity must be pursued on a scale larger than the park itself since environmental stressors come both from within and outside the park boundaries" (page 63 of the MEGS publication).

First, determine which pressures and ecosystem changes may be complicating or challenging Parks Canada's objectives. Reflect on the changes and the impacts on EGS identified in the second component of this case study and identify which are most responsible for complicating or challenging Parks Canada's objectives. Note these on Case study activity sheet #3: *Meeting the objectives.*

After identifying which issues are most responsible for complicating or challenging Parks Canada's objectives, develop strategies to mitigate the challenge and meet the objective. Additionally, identify measures that could be used to evaluate the success of the recommended strategies.

These strategies should be directly related to the objectives. Use the criteria of sustainable, desirable and feasible to assess the strategies to determine which may be best:

- Sustainable: Can this strategy continue over time given the resources that it may require?

- Desirable: Is this strategy needed and/or wanted by members of the community or by people knowledgeable in that field?

- Feasible: Does the strategy draw upon existing and usable techniques, technologies and research? Is the idea 'doable'?

Consider using Case study assessment support #1: *Assessing recommendations* for self-assessment of the recommendations and letter.

Case study activity sheet #1

Describing the areas

Aspects (e.g., location, size, types of EGS…)	Thousand Islands National Park What data can be used to describe this aspect?	Thousand Islands Ecosystem What data can be used to describe this aspect?	Comparisons What differences, similarities, and relationships exist between the two areas?	Significance Why is this important and notable?

Case study activity sheet #2

Pressures affecting ecosystem goods and services

Pressures	Thousand Islands Ecosystem		Thousand Islands National Park	
	Changes What changes are occurring as a result of this pressure?	Impacts What impacts might these changes have on EGS provided by this area?	Changes What changes are occurring as a result of this pressure?	Impacts What impacts might these changes have on EGS provided by this area?

8   Measuring ecosystem goods and services in Canada

What is the value of an ecosystem?
Statistics Canada – Catalogue no. 16-507-X

Case study activity sheet #3

Meeting the objectives

Parks Canada objectives	Changes and impacts	Possible mitigation strategies	Assessing the strategies	
			Rating	Criteria
Providing recreational opportunities for Canadians			☐ low ☐ medium ☐ high	*Sustainable*
			☐ low ☐ medium ☐ high	*Desirable*
			☐ low ☐ medium ☐ high	*Feasible*
			☐ low ☐ medium ☐ high	*Sustainable*
			☐ low ☐ medium ☐ high	*Desirable*
			☐ low ☐ medium ☐ high	*Feasible*
Preserving and protecting the fragile resources of the park			☐ low ☐ medium ☐ high	*Sustainable*
			☐ low ☐ medium ☐ high	*Desirable*
			☐ low ☐ medium ☐ high	*Feasible*
			☐ low ☐ medium ☐ high	*Sustainable*
			☐ low ☐ medium ☐ high	*Desirable*
			☐ low ☐ medium ☐ high	*Feasible*

- *Sustainable:* Can this strategy or proposal continue over time given the resources that it may require?
- *Desirable:* Is this strategy needed and/or wanted by members of the community or by people knowledgeable in that field?
- *Feasible:* Does the proposal draw upon existing and usable techniques, technologies, and research? Is the idea 'doable'?

Case study assessment support #1

Assessing recommendations

	Outstanding	Very good	Competent	Satisfactory	In-progress
Plausible recommendations	Recommendations are highly plausible and highly justifiable in light of the criteria and evidence provided.	Recommendations are clearly plausible and justifiable in light of the criteria and the evidence provided.	Recommendations are plausible and adequately justifiable in light of the criteria and the evidence provided.	Recommendations are somewhat plausible but barely justifiable given the criteria and evidence provided.	Recommendations are implausible and not justifiable given the criteria and evidence provided.
Detailed recommendations	Recommendations are highly detailed and include thorough description of obvious and non-obvious strategies to meet Parks Canada objectives.	Recommendations are detailed and include thorough description of obvious and some non-obvious strategies to meet Parks Canada objectives.	Recommendations are adequately detailed and include adequate description of obvious and some non-obvious strategies to meet Parks Canada objectives.	Recommendations are somewhat detailed and include basic description of obvious strategies to meet Parks Canada objectives.	Recommendations are not detailed. Recommended strategies are not related to Parks Canada objectives.

10   Measuring ecosystem goods and services in Canada

What is the value of an ecosystem?
Statistics Canada – Catalogue no. 16-507-X

Human Activity and the Environment – Teacher's Kit

Case study #2: Exploring methodologies for measuring ecosystem goods and services

Release date: September 2014

Statistics Canada Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

• Statistical Information Service	1-800-263-1136
• National telecommunications device for the hearing impaired	1-800-363-7629
• Fax line	1-877-287-4369

Depository Services Program

• Inquiries line	1-800-635-7943
• Fax line	1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category (p < 0.05)

Case study #2

Exploring methodologies for measuring ecosystem goods and services

Instructor's overview

This case study explores the indicators, measures and methods used to determine the quantity and quality of ecosystems and value of ecosystem goods and services (EGS) in Canada. It has three components:

- First, learners examine the experimental indicators developed for the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada* (MEGS), and propose additional measures that could be used.
- Next, learners identify the limitations and issues associated with the data and methodologies used for the MEGS publication.
- Finally, learners develop a letter to Statistics Canada recommending improvements to address a specific limitation or issue relating to the analysis presented in the MEGS publication.

This case study directs learners to respond to a number of questions; these questions can be used solely for learner understanding and not be assessed, or they can be developed as discreet assignments.

Audience

- senior high school
- introductory post-secondary

Learning outcomes

- understand indictors used to determine the quality and quantity of ecosystems and EGS
- understand the various limitations and issues of research methods associated with ecosystem accounting

Curriculum links

- grades 10 to 12 geography (ecosystems, geographic change), social studies (economics), biology (ecosystems and change), science, economics (accounting, ecosystem accounting, valuation methods)
- post-secondary geography (ecosystems), environmental science (ecosystem accounting, ecosystem change)

Learning materials

- Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada* (MEGS)
- Case study activity sheet #4: *Measuring ecosystems and ecosystem goods and services*
- Case study activity sheet #5: *Identifying limitations and issues*
- Case study activity sheet #6: *Developing improvements*
- Case study assessment support #2: *Assessing improvements and recommendations*

Exploring methodologies for measuring ecosystem goods and services

Learner instructions

Imagine you are a consultant hired by Statistics Canada to recommend improvements to the data and analysis used to measure ecosystems and EGS in Canada.

In preparing your recommendations you will undertake three tasks:

1. Examine the experimental indicators developed for the Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada* (MEGS), and think of additional measures that could be used.

2. Identify the limitations and issues associated with the data and methodologies used for the MEGS publication and ecosystem accounting.

3. Prepare a letter to Statistics Canada recommending improvements to address a specific limitation or issue that you have identified about the data and analysis used by Statistics Canada.

Learning materials

- Statistics Canada publication, *Human Activity and the Environment 2013: Measuring ecosystem goods and services in Canada* (MEGS)

- Case study activity sheet #4: *Measuring ecosystems and ecosystem goods and services*

- Case study activity sheet #5: *Identifying limitations and issues*

- Case study activity sheet #6: *Developing improvements*

- Case study assessment support #2: *Assessing improvements and recommendations*

Explore indicators and measures

Your first task is to explore and develop indicators used to determine the quantity and quality of ecosystems and EGS.

First, examine the indicators and related data and information presented in the MEGS publication (Section 3, pages 24 to 60). The document introduces several indicators designed to provide information on the quantity and quality of ecosystems and EGS (e.g., land cover change, landscape modification, ecosystem services potential, biomass extraction, marine and coastal ecosystems, freshwater wetland ecosystems).

Using Case study activity sheet #4: *Measuring ecosystems and ecosystem goods and services*, identify the measures used to estimate the quantity and quality of ecosystems and EGS for each of these indicators. Information on these indicators can be found in the sections noted below:

1. land cover change (pages 24 to 30)

2. landscape modification (pages 30 to 34)

3. ecosystem services potential (pages 34 to 38)

4. biomass extraction (pages 38 to 40)

5. marine and coastal ecosystems (pages 41 to 52)

6. freshwater wetland ecosystems (pages 52 to 60)

Identify the measures used for each indicator and record these in the appropriate section of the chart. For example, fish harvest (tonnes and $) is used as a measure of the EGS provided by marine and coastal ecosystems.

More information about these indicators and related valuation can be found in Appendices A to F of the MEGS publication.

Next, reflect on the identified measures in light of the following four criteria for effective measures and indicators:

- Is based on available data: there must be readily available data to quantify the measure or the data must be easily and inexpensively obtainable.

- Offers a reasonable approximation: although there will always be a margin of error, data must provide a reasonably accurate estimation of the quality or value of the measured variable.

- Is a valid measure: there must be a demonstrable relationship between the indicator and the measure. For example, salmon catch can be related to the health of marine and coastal ecosystems on the west coast of Canada.

- Is based on reliable data: the data to support the measure must be reproducible on other occasions and not be subject to wild fluctuations.

Finally, use these criteria to generate other measures that could be used to determine the quantity and quality of ecosystems and EGS. For example, changes in the amount of man-made light emitted at night (called night luminosity) is a measure that could be used to quantify conversion to settled landscapes. Record these suggestions in the appropriate section of the chart.

Analyze limitations and issues

Your second task is to analyze limitations and issues relating to the data and analysis presented in the MEGS publication.

First, review some of the limitations and issues identified in the MEGS publication (pages 78 to 80):

1. Spatial datasets

2. Development of indicators

3. Characterization of EGS for marine and coastal ecosystems

4. Case studies

5. Valuation of EGS flows

6. Natural capital asset boundaries

Other limitations and issues are identified in other sections of the MEGS publication (pages 24 to 60, in table and map notes, footnotes, as well as in the appendices).

Using Case study activity sheet #5: *Identifying limitations and issues,* analyze each of the six indicators (pages 24 to 60). Identify at least one limitation or issue identified in the report that may have had a significant effect on the quality of the data, analysis, or presentation of the indicator. For example, limitations and issues with spatial resolution (an aspect of spatial datasets), may have impacted the accuracy of land cover measurement and the usability of this data for local level analyses.

Record the applicable limitations and issues and their corresponding specific impacts in the designated places in the chart.

Finally, use this information to respond to the following questions:

- Which of the six indicators was most affected by a limitation or issue? What evidence supports this?

- Referring to the above criteria, which of the indicators presents the most effective use of data? What evidence supports this?

- Why is it important to consider the effects of these limitations and issues?

- Statistics Canada has indicated that the list of limitations or issues is incomplete; what others might identified? What evidence supports this?

Develop recommendations

Your final task is to prepare a letter to Statistics Canada with recommendations on accessible, reasonable, valid and reliable improvements that address the limitations or issues relating to data or analysis presented in the MEGS publication.

Use the following steps and Case study activity sheet #6: *Developing improvements* to prepare your letter:

1. Identify up to three concerns regarding the indicators and methods used to quantify and value EGS in Canada.

2. Explain why each is a concern. Be sure to include supporting detail and evidence from MEGS or other sources.

3. Recommend a solution for each of the concerns.

4. Explain why each recommendation is an improvement.

Be sure to consider the following criteria when developing improvements:

- Accessible: the improvement must be based upon readily available methods, technology or data.
- Reasonable: the improvement must provide a reasonably accurate estimation of the quality or value of the measured variable.
- Valid: there must be a demonstrable relationship between the improvement and the concern.
- Reliable: the improvement must be reproducible on multiple occasions and not be subject to wild fluctuations.

Finally, compose a letter to Statistics Canada describing the recommended improvements. The letter should include:

- the limitations or issues related to data or analysis being addressed
- details of the effects or challenges related to the limitation/issue
- specific recommendations on improvements with explanation on how they will address the concern.

Consider using Case study assessment support #2: *Assessing improvements and recommendations* for self-assessment of the recommendations and letter.

Case study activity sheet #4

Measuring ecosystems and ecosystem goods and services

Indicators	Measures used in the MEGS publication to assess quantity and quality	Suggestions for other measures to determine ecosystem productivity and quality
Land cover change (pages 24 to 30)		
Landscape modification (pages 30 to 34)		
Ecosystem services potential (pages 34 to 38)		
Biomass extraction (pages 38 to 40)		
Marine and coastal ecosystems (pages 41 to 52)		
Freshwater wetland ecosystems (pages 52 to 60)		
Criteria to guide suggestions of measures: 1) based on available data 2) offers a reasonable approximation 3) is a valid measure 4) based on reliable data		

Case study activity sheet #5

Identifying limitations and issues

Indicators	What is the concern? *Identify the limitations/issues that affect this indicator.*	Why is it a concern? *Identify specific effects on accuracy, reliability, or usability of the data, analysis or presentation of the indicator.*
Land cover change (pages 24 to 30)		
Landscape modification (pages 30 to 34)		
Ecosystem services potential (pages 34 to 38)		
Biomass extraction (pages 38 to 40)		
Marine and coastal ecosystems (pages 41 to 52)		
Freshwater wetland ecosystems (pages 52 to 60)		

Case study activity sheet #6

Developing improvements

Concerns regarding the methods and indicators used to quantify and value ecosystem goods and services	Why is this a concern?	Proposed improvements	How does the proposed improvement address the concern?

Case study assessment support #2

Assessing improvements and recommendations

	Outstanding	Very good	Competent	Satisfactory	In-progress
Plausible improvements	Suggested improvements are highly plausible and highly justifiable in light of the criteria and evidence provided.	Suggested improvements are clearly plausible and justifiable in light of the criteria and the evidence provided.	Suggested improvements are plausible and adequately justifiable in light of the criteria and the evidence provided.	Suggested improvements are somewhat plausible but barely justifiable given the criteria and evidence provided.	Suggested improvements are implausible and not justifiable given the criteria and evidence provided.
Detailed recommendations	Recommendations are highly detailed and include thorough description of obvious and non-obvious improvements.	Recommendations are detailed and include thorough description of obvious and some non-obvious improvements.	Recommendations are adequately detailed and include adequate description of obvious and some non-obvious improvements.	Recommendations are somewhat detailed and include basic description of obvious improvements.	Recommendations are not detailed and improvements are not related to identified limitations or issues.

10   Measuring ecosystem goods and services in Canada

What is the value of an ecosystem?
Statistics Canada – Catalogue no. 16-507-X

Human Activity and the Environment – Teacher's Kit

Image collection: Ecosystem images 1 to 8

Release date: September 2014

Statistics Canada   Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

email at infostats@statcan.gc.ca,

telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following toll-free numbers:

• Statistical Information Service	1-800-263-1136
• National telecommunications device for the hearing impaired	1-800-363-7629
• Fax line	1-877-287-4369

Depository Services Program

• Inquiries line	1-800-635-7943
• Fax line	1-800-565-7757

To access this product

This product, Catalogue no. 16-507-X, is available free in electronic format. To obtain a single issue, visit our website, www.statcan.gc.ca, and browse by "Key resource" > "Publications."

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "The agency" > "Providing services to Canadians."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Standard symbols

The following symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
E	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

Image #1

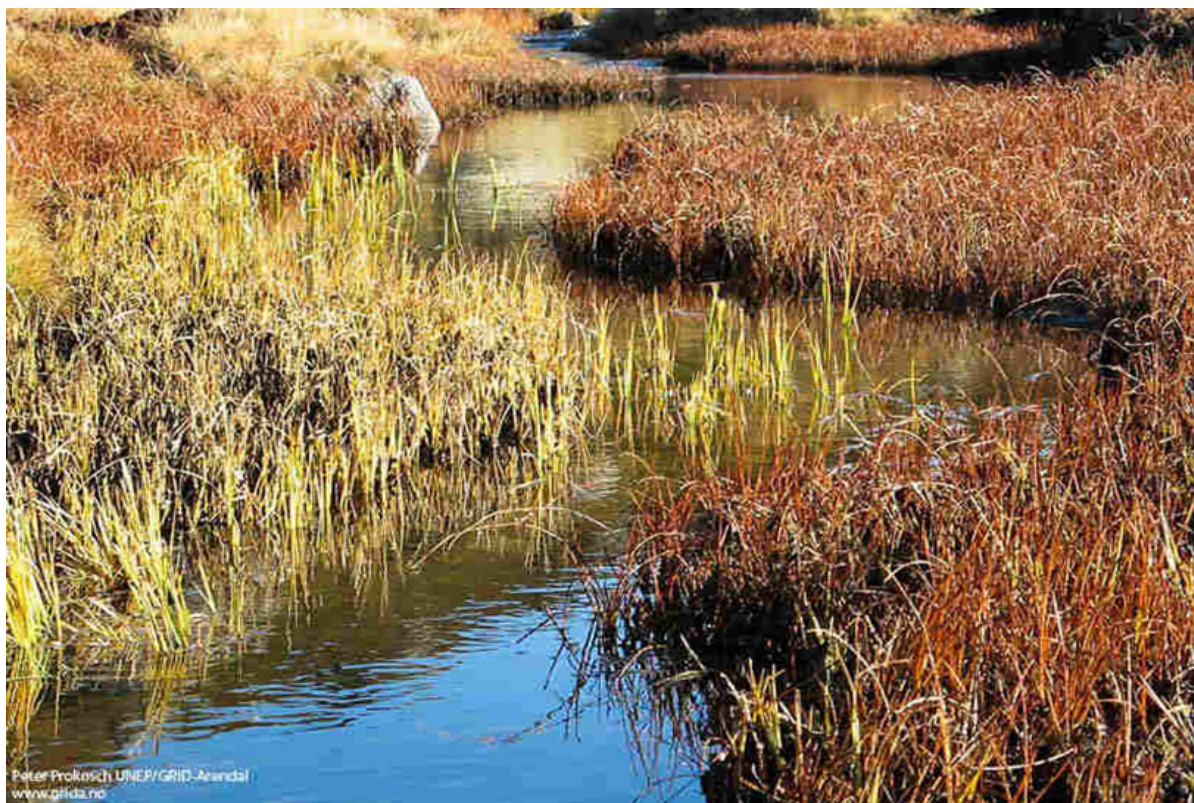© Gail Johnson / Fotolia.com

Image #2

© bgzan / Fotolia.com

Image #3

© am / Fotolia.com

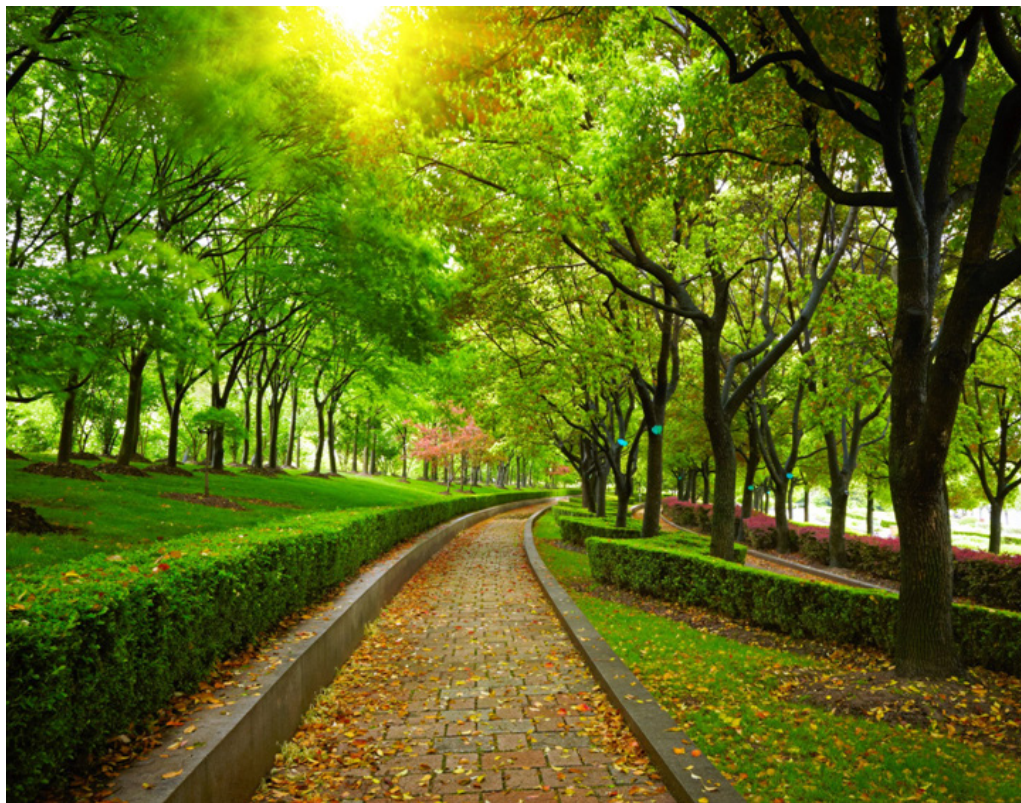## Image #4

Stewart Tomlinson / U.S. Geological Survey

2   Measuring ecosystem goods and services in Canada

What is the value of an ecosystem?
Statistics Canada – Catalogue no. 16-507-X

Image #5

Peter Prokosch / GRID-Arendal

Image #6

© starekase / Fotolia.com

Image #7

© silver-john / Fotolia.com

Image #8

© sababa66 / Fotolia.com

4 Measuring ecosystem goods and services in Canada

What is the value of an ecosystem?
Statistics Canada – Catalogue no. 16-507-X

References

Gail Johnson, 2014, Beaver activity, http://us.fotolia.com/id/33643142 (accessed May 28, 2014).

bgzan, 2014, Stone quarry with excavate, http://us.fotolia.com/id/46644567 (accessed May 28, 2014).

am, 2014, Chimneys and dark smoke over chemical factory at sunset, http://us.fotolia.com/id/60506081 (accessed May 28, 2014).

Tomlinson, Stewart, 2003, Skagit River Near Newhalem, WA, U.S. Geological Survey, http://gallery.usgs.gov/photos/08_17_2010_uApc6GF664_08_17_2010_33 (accessed April 24, 2014).

Prokosch, Peter, 2010, Autumn colors of the Sedges, Setesdal, Norway, http://www.grida.no/photolib/detail/autumn-colors-of-the-sedges-setesdal-norway_d90c (accessed April 24, 2014).

starekase, 2014, Two combine harvesters at work in corn field, http://us.fotolia.com/id/56536418 (accessed May 28, 2014).

silver-john, 2014, Green city park, Shanghai, China, http://us.fotolia.com/id/56869635 (accessed May 28, 2014).

sababa66, 2014, fisherman on the boat, http://us.fotolia.com/id/57707069 (accessed May 28, 2014).