

Human Activity and the Environment – Teacher's Kit

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



Release date: September 2014



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Published by authority of the Minister responsible for
Statistics Canada

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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 <i>Statistics Act</i> |
| 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 Statistics 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.

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

<p>Location/name of area:</p>		
<p>Description of ecosystem changes:</p>		
<p>Impacts: The ecosystem change has likely led to more or less of the following EGS:</p>	<p>monetary measures that could be used to quantify changes in the value of this EGS</p>	<p>non-monetary measures that could be used to quantify changes in the value of this EGS</p>
<p>More...</p>		
<p>Less...</p>		
<p>EGS value assessment</p> <p>Overall, the changes in the ecosystem have likely led to a:</p> <p><input type="checkbox"/> decrease in the value of EGS provided by this ecosystem.</p> <p><input type="checkbox"/> increase in the value of EGS provided by this ecosystem.</p>		
<p>Reasons that support this choice:</p>		

Activity sheet #6

Map of Canada



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
<ul style="list-style-type: none"> • <i>Sustainable</i>: Can this strategy or proposal continue over time given the resources that it may require? • <i>Desirable</i>: Is this strategy needed and/or wanted by members of the community or by people knowledgeable in that field? • <i>Feasible</i>: 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.