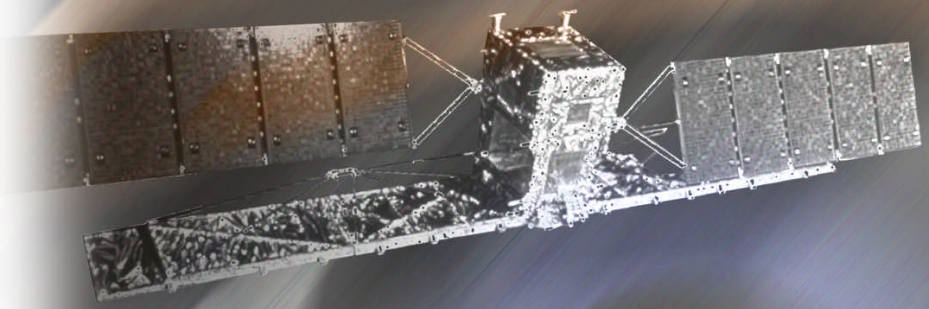
Looking at the Earth's Environment Through the "Eyes" of a Satellite



A Teacher's Guide to Student Research Projects on the Topic of Remote Sensing and the Environment.

Natural Resources Canada
Canada Centre for Remote Sensing

Ressources naturelles Canada
Centre canadien de télédétection

Canada

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Rationale for the content

This student project focuses on two different subjects (remote sensing and the environment) that come together to provide greater knowledge and understanding of our world. Remote sensing is a tool to help scientists monitor the Earth and our impact on it, and when emergencies occur, to help with the management of disasters (floods, fires, oil spills, earthquakes, hurricanes, etc.). Earth observation satellites, which have been in operation since the mid 1970's, have provided scientists in different fields with a new perspective in studying the condition of our planet.

This project was created to encourage young children to understand the role played by remote sensing in dealing with various situations and issues in the Earth's environment and to better manage our Earth's resources.

What follows is a guideline to provide teachers with a field-tested, ready-made enrichment program in the areas of geography, science and related fields.

Application

The program could be used in:

- An Enrichment Program:
  This program is suggested as an enrichment program for Science classes at the grade 5, 6, 7 and 8 levels because of its connection to the Ontario Curricula for Science and Geography.

- A Gifted Program:
  Teachers of grade 5 and grade 6 gifted withdrawal programs may also wish to take advantage of this program.

- The Regular Program:
  Modified, it can also be used in connection with the Grade 9 Geography and Science Curricula.

Duration of the program

Allow 4 - 6 sessions for presentations of introductory material in class.

Allow 6 - 10 sessions for students to do the research and prepare for their presentations. Students should also be prepared to work at home.

Table of Contents

A Project Approach for Upper Elementary and Middle-School Students

Table of Contents

Introduction

From an early age, children become aware of the Earth's environment and the issues and situations that can affect it. Most have heard of the problems of oil spills, the ozone hole and global warming. However, there are many other environmental issues that they don't know about.

In 1999, 28 gifted students in grades 4, 5 and 6 in a school in Nepean, Ontario were introduced to environmental issues in a different way. They were involved in an innovative program entitled "Understanding Our Earth from Space".

This program, which occupied a half-day per week over a 6-month period, included a focus on space and space technology, as well as a look at several environmental situations and issues. It also included several field trips to related sites, and presentations by guest speakers.

The final phase of the unit was the oral presentation given by the students of their own individual research into an environmental situation. In each case the students were required to show that remote sensing was used by scientists for the environmental issue that they had selected as their topic.

Introduction

There were many 'firsts' for these 28 students:

- they were introduced to environmental situations and issues that they had never heard of before, such as desertification, urbanization, population explosion, and abuse by farming.

- they were introduced to remote sensing.

- this was the first time, especially for the grade 4 and 5 students that they were asked to research a topic and write a report.

- for all of the students, it was the first time they were asked to present a report orally to an audience consisting of classmates, parents and invited guests.

Naturally, some students performed better than others. In addition to the challenge of the presentation, the students faced one or more difficulties: in selecting their topic, in finding the right kind of resources, (either textual or visual), in organizing their information and their visual material.

At the conclusion of the program, the students as well as their parents, were asked to comment on their experiences. A selection of this feedback appears in the next section.

Question (to students): In your opinion was the difficult year-end project a worthwhile experience?

Definitely! I learned so much while researching my year-end project

I learned so much on the subject and on presentation skills

Even though it was hard, it made us use valuable work skills

Question (to students): What do you think you learned most from the year-end project? Think about factual knowledge as well as skills (how to approach a big project, presenting).

I learned to practice more and that I should be more prepared. I also learned not to give up in the middle of a project. I learned a lot about floods.

I learned about presenting a project, a lot about hurricanes and how to be a better public speaker.

I learned…how to search for information.

I learned how to present a topic. I learned that remote sensing is a big help in crises and I learned that there are many oil spills per year.

EVERYTHING I talked about in my presentation I didn't know before.

Comments by parents:

I think it is great to expose the young kids to such advanced technologies. It opens doors for them and could influence their career choices. Thank you again.

Congratulations on an excellent unit.

It was a very good program giving children many opportunities to learn new things.

We would like to thank all those involved in the program for their time and expertise. I am very impressed with what [he] has learned. This was really a unique educational experience.

Where to Learn About Remote Sensing

For many people remote sensing is a completely new concept. Teachers, who wish to learn about remote sensing, can refer to the education section of the CCRS website.

Tutorials exist at 2 levels: for elementary and middle school students ***(Watching Over Our Planet from Space)*** as well as a more advanced version for high school students ***(Fundamentals of Remote Sensing)***.

http://www.ccrs.nrcan.gc.ca/ccrs/eduref/educate.html

Curriculum Connections

The content and skills covered by this program are related to The Ontario Curriculum, published by the Ontario Ministry of Education and Training in 1998 and 1999. These publications are available on the Ministry's website at http://www.edu.gov.on.ca

Science and Technology: Grade 6:
pp. 99 - 100 Earth and Space Systems: Space

Science and Technology: Grade 7:
pp. 27 -28 Life Systems: Interactions within Ecosystems
pp. 101 - 102 Earth and Space Systems: the Earth's Crust

Geography: Grade 7:
pp. 56-57 Themes of Geographic Inquiry,
pp. 58-59 Patterns in Physical Geography,
pp. 60-61: Natural Resources: Understanding Concepts, Developing Inquiry/Research and Communication Skills, Developing Map and Globe Skills, Applying Concepts and Skills in Various Contexts

Science and Technology: Grade 8:
pp. 103 -105 Earth and Space Systems: Water Systems

Geography: Grade 8:
pp. 62-63 Patterns in Human Geography: Understanding Concepts, Developing Inquiry/Research and Communication Skills, Developing Map and Globe skills.

Science, Grade 9:
pp. 21 Earth and Space Science: Space Exploration: Relating Science to Technology, Society and the Environment.

Canadian and World Studies: Geography: Grade 9
pp. 8-16 - Academic,
Geography: Grade 9 :
pp. 17 -24 - Applied
Geographic Foundations: Space and Systems, Human-Environment Interactions, Global Connections, Understanding and Managing Change, Methods of Geographic Inquiry

Sequence of Classroom Activities

These are suggestions on how to organize the learning activities.

1. Overview of the condition of the Earth's environment

2. Examples of environmental situations and issues: population explosion, declining biodiversity, climate change, declining resources, pollution. Note inter-connections between problems.

3. Overview of remote sensing

4. Overview of satellite technology

5. Research projects:
   Distribution of student pages "Plan of Attack" (at start of research project).
   Distribution of student pages "Plan of Attack - Check list" (approximately 10 days before presentations are due).

Educational Objectives

The students will:

Conduct research on the nature of an environmental situation or issue.

Areas to be covered will be:
- the causes and effects of the environmental situation or issue;
- remote sensing imagery relevant to the environmental situation or issue;
- a brief technical explanation of remote sensing;
- the benefits gained by the use of remote sensing technology;
- the steps taken to alleviate the environment situation or issue.

Organize information gained from their research under headings.

Present information orally, visually, and to a limited extent, in writing. When this program was presented the first time, the writing component was continually de-emphasized. Students were discouraged from writing detailed notes. Rather, it was insisted that only headings, captions and point form notes accompany visual material, which constitute the main component of the final product. The students' final product will be something similar to a "PowerPoint" presentation.

Prepare an activity to be given to the audience at the end of their presentation; for example, a very brief quiz or questionnaire.

Description of Student Pages

Teachers can download and distribute the necessary pages for the students:

1. **Title Page**

2. **Mission Page**

3. **Plan of Attack** which should be distributed at the beginning of the research project. A step-by-step Plan of Attack is included to guide students through the process of the research phase of the project as well as the preparation for the presentation. The pages can be downloaded and distributed to students as is.

4. **Selection Chart**

5. **Pages to show Example of:**
   - brainstorming questions
   - glossary
   - bibliography

6. **Check List** which might be distributed as necessary approximately 10 days before presentations. The Check List can also be used as a tool for ongoing evaluations.

Description of Plan of Attack for Students

Adaptation to individual teacher needs is also possible. The Plan of Attack pages provide strategies for students as follows

- selecting a topic,
- brainstorming, then prioritizing questions,
- researching the information,
- organizing the information under headings,
- creating a bibliography,
- creating a glossary,
- designing a display with headings and visuals,
- meeting deadlines, and
- on-going evaluation by teachers.

Resource Materials

Text Material

There are several books written for young people on the Earth's environment, the nature of environmental situations and issues, and what is being done and what can be done to alleviate the pressures on the environment. No attempt is being made here to list these books, as there are far too many to mention. The juvenile section of a public library is an excellent resource to supplement what is available in a school library. Periodicals such as Canadian Geographic, National Geographic, National Geographic World, Owl, Equinox, etc. are useful. The following selection of Canadian Geographic contain relevant articles:

2000 Annual The Big Picture, Taking the Measurements of all things, including the carbon sink

Sept/Oct 1999 Eyes in the Skies

May/June 1999 Sea Changes, Eco-Audit 1999

May/June 1998 Fire Works

May/June 1996 “Greening the St. Lawrence”

The following selection of National Geographic contain relevant articles:

May 1998 Unlocking the Climate Puzzle

Jan 1998 Making Sense of the Millennium

Dec 1995 Farming revolution

Oct 1998 Population

Dec 1991 High Frontier of the Rain Forest Canopy

Sept 1990 Will We Save Our Endangered Forests?

Resource Materials

Internet

The World Wide Web can supply a wealth of detailed information but as most web sites target professional and/or adult audiences they can be difficult for elementary students to understand. Where adequate Internet access is available in schools, a selection of websites is provided.

The websites marked with an asterisk will be more appropriate for elementary and middle-school students.

Environment Canada
http://www.ec.gc.ca

Natural Resources Canada http://www.nrcan.gc.ca

Canada Centre For Remote Sensing http://www.ccrs.nrcan.gc.ca

Geological Survey of Canada (Atlantic)
(Educational Resources)
http://agc.bio.ns.ca/schools/school-index.html

Other Canadian websites:

World Wildlife Fund Canada
http://www.wwfcanada.org/

Envirolink
http://www.envirolink.org/

International Year of the Oceans
http://www.oceanscanada.com

Resource Materials

Internet, continued

Environmental Organization WebDirectory http://www.webdirectory.com/

*Discovery Channel http://www.discovery.com
(Earth Alert) (Kids)

*KidSat is a website devoted mostly to space science, but there are reports on environmental projects carried out by kids.
http://kidsat.jpl.nasa.gov/

Threatened and endangered species
http://eelink.net/EndSpp/

*Kids For a Clean Environment (Kids F.A.C.E.)
http://www.kidsface.org

NASA's Classroom of the Future: Exploring the Environment
http://www.cotf.edu

Greater Vancouver Regional District - Climate Change
http://www.gvrd.bc.ca/climate/

Resource Materials

Satellite Imagery

In print format:

- An excellent resource is the recently published Satellite Atlas of the World by National Geographic and Canada From Space published by Camden House, 1995.

- The Canadian Oxford World Atlas 4th Edition published by Oxford University Press is a comprehensive atlas which includes many satellite images.

- These issues of National Geographic contain one or more satellite images:
  Nov 1990
  Feb 1992
  Aug 1992
  Feb 1998

- Checking through the juvenile section of your local public library will likely provide a supply of references, which include satellite images. Here is a selection. Each of the books mentioned has at least one satellite image as an illustration of its subject matter.

- *Image of the globe, see:*

  The Environment, (Series title: World Issues) Adam Markham

  Planet Earth, (Series title: Your World 2000) David Lambert

Resource Materials

Satellite Imagery, continued

- *Image of the biosphere, see:*

  Global Warming, Blashfield and Black

- *Image of the ozone hole over the Arctic, see:*

  Global Warming, Blashfield and Black

  Our Endangered Planet: Atmosphere, Mary Hoff and Mary M. Rodgers

  Our Endangered Planet: Population Growth, S. Winkler and M. Rodgers

  Our Endangered Planet: Oceans, Mary Hoff and Mary M. Rodgers

- *Image of a hurricane, see:*

  Storm Warming, Jonathan D. Kahl

  Hurricane, Christopher Lambton

  Storms, Seymour Simon

  Hurricanes, Peter Murray

- *Image of a forest fire, see:*

  Rainforest Destruction, Tony Hare

Resource Materials

Satellite Imagery, continued

- *Image of volcanoes and/or earthquakes, see:*

  Our Patchwork Planet, H.R. Sattler and G. Maestro

- *Image of a hazardous waste site, see:*

  Land Use and Abuse, Terri Willis (aerial view)

- *Image of the Nile delta, see:*

  Disappearing Wetlands, Helen J. Challand

- *Image of a flood zone, see:*

  Floods, Ann Armbruster

- *Image of El Nino, see:*

  El Nino: Stormy Weather for People and Wildlife, Caroline Arnold

- *Image of uranium deposits, see:*

  Energy Demands, (Series: Green Issues, Thinking of the Future) Brian Gardner

Resource Materials

Posters showing remote sensing images may be available from these sources:

Greater Vancouver Regional District
Pacific Geomatics Ltd.
2817 144 Street
Surrey British Columbia
V4P 1R4 CANADA
Tel: (604) 535-7851
Fax: (604) 535-7852
Contact: Geoff Tomlins (geoff@pacgeo.com)

An AVHRR (Advanced Very High Resolution Radiometer) image of Quebec
Photocartothèque québecoise
5700, 4e Avenue Ouest, bureau B 200
Charlesbourg QC G1H 6R1
Phone: (418) 627-6356
Tollfree: 1 877 803-0613
Fax: (418) 646-6706
Email: photocarto@mrn.gouv.qc.ca
Website: http://www.mrn.gouv.qc.ca/photocartotheque/produits/index.htm
click on: Documents de télédétection
then click on: Image du Québec par satellite

Atlantic Canada
World-View Digital Imagery
Falmouth NS Canada B0P 1L0
Phone: (902) 684-9614
Fax: (902) 684-0226
E-mail: worldvu@istar.ca
World-View Digital Imagery produces satellite images of the earth from space, specializing in Atlantic Canada. There are posters, maps and prints from satellite data and enhanced natural colour images.
Website: http://home.istar.ca/~worldvu/scale5.htm

Resource Materials

Posters, continued

Temperature Rising - Climate Change in Southwestern British Columbia
This poster is available from:

Geological Survey of Canada
Sales and Publications
101 - 605 Robson St.
Vancouver, B.C. V6B 5J3
Tel. (604) 666-0271 Fax (604) 666-1337
Email address: gscvan@nrcan.gc.ca
Website: http://www.gvrd.bc.ca/climate/
This poster explains in graphics and text the science of climate change, the potential impacts on southwestern British Columbia, and some measures that can be taken to reduce greenhouse gas emissions and adapt to a changing climate.

GeoScapes Vancouver
http://sts.gsc.nrcan.gc.ca/page1/urban/geoscape/geoscape.htm

National Atlas also has thematic posters. These are maps, not images, but they are also useful for environmental topics:
http://atlas.gc.ca/english/products/o_posters.html

Posters may be available from the Canada Centre for Remote Sensing. To contact them:
info@ccrs.nrcan.gc.ca
613-947-1216
Canada Centre for Remote Sensing
588 Booth Street
Ottawa ON K1A 0Y7
Canada

The El Nino poster from TOPEX /Poseidon Website http://topex-www.jpl.nasa.gov

Check List for Students

Understanding Our Earth From Space
Plan of Attack – Check List

With 10 days to go before giving your presentation you can use this page to check that all items for your oral presentation and its accompanying visual display are close to completion. You may use index card prompts when delivering your presentation.

What the environmental issue or situation is all about (causes, the effects, etc.)

As the assistant to the Minister of the Environment, what has convinced you that this issue or situation needs her urgent attention?

Are you ready for your oral presentation?	**Is your display material collected? Organized?**
Make sure you understand each question and can explain the answers in some detail. Be sure the sequence is logical. Have you emphasized the causes? The effects?	Write the questions so they stand out well. The information you provide as answers should be in point form only. Visuals (pictures, charts etc.) which you can explain. Headings and/or captions are essential.

Remote sensing as a tool in this environmental issue or situation.

Are you ready for your oral presentation?	**Display:**
Satellite image/s. You must be able to explain the most important features from each image that you have selected.	Map of same area as the satellite image. Label.

What is remote sensing?

Are you ready for your oral presentation?	**Display:**
Explain the term "remote sensing" What satellite made the image? On what principles (optical, thermal or radar) does the sensor on this satellite work? Are there any interesting details about how the image was created?	Visuals which help your explanation. Headings and/or captions are essential.

Alleviating the environmental issue or situation.

Are you ready for your oral presentation?	**Display:**
Explain what has been done, is being done. Prospects for the future. As individuals, what can you and members of your audience do to help?	Your information should be in point form only. Visuals which help your explanation. Headings and/or captions are essential.

Quiz or activity

Glossary

Bibliography

Evaluation

The evaluation will be based on the degree to which the student:

- follows given procedures
- meets deadlines
- displays task commitment
- uses initiative in searching for resource information
- analyses information and applies principles
- organizes and shows concern for appearance of written work
- organizes and shows concern for appearance of display
- uses technical vocabulary
- communicates concepts in writing and spelling is correct
- communicates concepts orally

Evaluation

Understanding Our Earth From Space
Project Evaluation

Name _____ **Grade** ___ **Topic**_____

Preparation

	Mark	Comments
Followed given procedures		
Met deadlines		
Displayed task commitment		
Used initiative in searching for resource information		
Analysed information		

Oral presentation

Communicated concepts at an appropriate level of understanding		
Covered the 3 main sections: 1. the environmental issue		
2. remote sensing		
3. alleviating the issue		
Delivered content effectively		

Display

Communicated concepts at an appropriate level of understanding with headings and point form notes		
Covered the 3 main sections: 1. the environmental issue		
2. remote sensing		
3. alleviating the issue		
Organized material logically		
Used headings and/or captions to explain visuals		
Neatness and overall appearance		
Glossary and Bibliography		

Audience Activity

Content		
Delivery		

Comment: