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Earth and environmental sciences

Branches of science that study, in time and space, the series of living and non-living factors that are likely to affect organisms and their surroundings.

Agrobiology

The study of plant nutrition and growth especially as a way to increase crop yield.

Project ideas

Are hydroponic crops more promising for the future?

Is organic produce really better?

What does “certified organic” really mean?

Tomatoes and basil—companion planting in the garden

Helping farmers decide whether or not to choose genetically modified rapeseed

Agrochemistry

The application of industrial chemistry to agricultural production (e.g. chemical fertilizers, pesticides, etc.).

Project ideas

Organic or chemical fertilizer, or both?

The relationship between minerals and plant biomass

Mushrooms and their CO₂

Are pesticides harmful or helpful?

Agriculture

The art, science and industry of plant growth and animal farming.

Project ideas

Drawing up a plan for an ecological farm

Developing a simple means of growing fruits or vegetables in limited space

Community sustained agriculture: a relationship between economy, ecology and social development

Pollution from fish farming

The organic microbial processes of composting

Finding effective means of fighting farm pollution

Uses of pork manure

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Agronomy

The scientific study of problems (biological, chemical, economic) resulting from the practice of agriculture.

Project ideas

How is soil created and maintained?

How is crop rotating beneficial for plants?

The uses of GMOs in agronomy and the controversy that they raise

What are the impacts of intensive farming following deforestation in developing countries?

Soils and crops: the properties of clay, sandy and organic soils

Botany

A branch of the biological sciences which embraces the study of plants and plant life.

Project ideas

How can we improve some plants' resistance to cold?

Creating a new variety of apple

Decontamination using plant life

Exotic and invasive plants (e.g. wild parsley, loosestrife)

Why use hybridization techniques with crops?

Water purification chemistry

Chemistry applied to natural bodies of water and water treatment processes.

Project ideas

Eliminating chemical pollutants in water

A filter to make water safe for drinking

Effective mud treatment used in treatment plants

Ecology

The study of the interrelation of living organisms and their environment.

Project ideas

Life after rain

The butterfly bush and monarch butterflies—a matter of co-evolution?

Beluga autopsy

Biodiversity in an urban environment

Creating an ecological antifreeze

Creating an ecological fuel

The ecosystem of hot springs: myth or reality?

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Envisat: the European satellite dedicated to the environment
 Are there biological processes that can help break down waste in landfill sites more quickly?
 The biological activity of soils
 Is there an endless supply of energy?
 The effects of fishways on water oxygenation
 Communication among plants
 Why are amphibian populations decreasing?
 Stagnant pools in the desert and the appearance of short-lived ecosystems
 Are migratory birds affected by air transportation?
 Exotic and invasive plants (e.g. wild parsley, loosestrife)
 Companion plants and ecology in the garden
 Is acid rain a thing of the past?
 Is ecological produce really ecological?
 Plant succession
 What forest areas should be protected?

Forestry

The science of conserving, developing and managing forests and forest lands for the continuing use of their resources.

Project ideas

Developing a new model for forest exploration
 Should forest species be grown intensively (intensive silviculture)?
 The effectiveness of reforestation after cutting
 Studying the short- medium- and long-term effects of the ice storm
 The forest behind the trees
 Quebec forests: a renewable or non-renewable resource?
 What forest areas should be protected?
 Should forests be fertilized with pork manure?

Geography

The science that deals with the Earth's surface.

Biogeography

The study of the geographical distribution of the various species living on the Earth's surface.

Project ideas

Mapping or classifying types of plants in accordance with their use in a given region.
 Environmental contamination by "exotic" and invasive plants

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Maple syrup: an exclusive Quebec resource
 Why are certain species found only in a given area (e.g. in Quebec: the copper redhorse)?
 What is the equilibrium responsible for life on an island?

Cartography

Science of expressing graphically, using maps and charts, the known physical features of the Earth or other celestial bodies.

Project ideas

Mapping Quebec's non-renewable resources and suggesting a method of evaluating the health of the environment
 Can the world be described through sound (geography of sound)?

Health geography

Analyses of the disparities in the health of different regional populations.

Project ideas

Determining the percentage of breast milk contamination by organochlorines and their impact on the population
 Evaluating the degree of exposure to contaminants in different area of a city or in different cities
 Who suffers the most from acid rain?
 Do some populations suffer from pollution more than others?

Human geography

The study of the evolution of human populations and the impact on their activities.

Project ideas

Improving commuting between home and work on the island of Montreal
 The historical evolution of land occupation in a given region
 Ideal distribution of ambulance centres in a large city

Physical geography

Description and analysis of relief and natural phenomena (e.g. climate, ocean currents, atmospheric variations).

Project ideas

How can we predict the weather using regional relief?
 The effect of the Gulf Stream on Europe's climate

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Geopolitics

The integration of geography in national and international politics.

Project ideas

Strategies for cultivating and using native territories
How do municipal planning policies affect urban ecosystems?

Geology

The science that relates to the study of the structure, origin, history, and developments of the Earth and its inhabitants.

Geological cartography

The creation of maps dealing with surface geology, the characteristics of a given terrain.

Project ideas

Creating geological maps using information about a given terrain

Crystallography

The study of the properties (shape, structure) of crystals.

Project ideas

Do all crystals have the same shape?
What is the secret behind coloured diamonds?
What are the criteria for obtaining “large crystals”?

Geochemistry

The study of chemical behaviours of elements, especially in rocks, but also in water and the atmosphere.

Project ideas

Identifying minerals through geochemical analysis
The geochemistry of drinking water: hard water, soft water

Geomorphology

The science that treats the general configuration of the Earth's surface.

Project ideas

Identifying high-risk zones (e.g. landslides) through photointerpretation
Pingos: Arctic geological formations

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Mineralogy

The science of minerals that make up the Earth's crust.

Project ideas

Calculating the speed of continental drift
 Rocks that emit colours when exposed to UV rays
 How far can we go to explore mines?
 Quebec's mineral potential
 Will Quebec become a diamond capital?

Orography

The study of the relief of the Earth's surface and the representation of such relief on a map or model.

Project ideas

Are the Appalachians older or younger than the Rockies?
 How old are the Appalachians?

Paleontology

The science that treats plant and animal fossil remains.

Project ideas

Fossils in Quebec?
 The fossiliferous paradise of Miguasha

Petrography

The study of the texture and composition of rocks.

Project ideas

Is the Earth's interior solid or liquid?
 Is the black granite of the Lac-Saint-Jean region real granite?

Petrology

The study of the description, classification and interpretation of rock formations.

Project ideas

The study of the evolution of primitive magma

Soil physics

Science that applies physics methods to soil analysis.

Project ideas

The study of clay
 The effect of the concentration of sand on the drainage of water-laden clay
 The effect of the concentration of water on clay

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Sedimentology

The study of sedimentary rock and the phenomena that led to their formation.

Project ideas

Sedimentology—a time travel machine

What is the distribution and sedimentation speed of contaminants?

Stratigraphy

The study of the succession of sedimentary deposits on the Earth's surface.

Project ideas

Stratigraphic interpretation of geological maps

Tectonics

The study concerned with rock deformation of the Earth's crust.

Project ideas

Modelling rock deformation with plasticine by modifying constraints

Earthquakes

Geomatics

Science of spatial or geographical data.

Project ideas

How does GPS work?

Geophysics

Study of the Earth using physics methods (seismology, volcanology, etc.).

Project ideas

How do animals sense upcoming earthquakes?

Determining the location and force of earthquakes.

Can the Moon affect the frequency or amplitude of earthquakes?

The study of magnetic declination over time

Can cities be protected from volcanic eruptions?

Why are volcanoes not all of the same type?

Why are all the Earth's volcanoes aligned?

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Horticulture

The branch of agriculture dealing with fruits, vegetables and flowers.

Project ideas

- The secret of landscape architecture
- The debate between native plants and horticultural plants
- Developing a cactus nursery
- The importance of naturalizing available spaces in cities

Limnology

The study of freshwaters, especially lakes and ponds.

Project ideas

- The daily dynamics of the microscopic life of a lake
- Eutrophication—the future of our lakes depends on it
- The effect of acid shock after the snow melts
- The importance of watersheds
- Pollution from fish farming
- Aquatic life and black flies
- Handy larvae—casebearing Trichoptera

Pedology

The study of the formation, properties and mechanics of soils.

Project ideas

- Where does the earth beneath our feet come from?

Atmospheric science

Science that measures air pollutants and establishes quality standards.

Project ideas

- Interior air and allergies
- Measuring air quality inside buildings
- Are there bioindicators to evaluate air quality?
- The greenhouse effect
- Do thermal inversions increase pollution?
- Does smog affect health?
- Transportation choices and air quality
- The beneficial effects of green spaces on environmental quality indicators in urban settings
- Synthesis materials and interior air quality
- Plants and air quality inside buildings

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What is quality air and how can it be measured?
Tobacco and air quality

Climatology

The study of climate over a long period of time.

Project ideas

Measuring climate change over the millennia
Sequestering CO₂—an antidote to the greenhouse effect
Will global warming lead to catastrophe?
Sources of greenhouse gases and means of reducing them

Meteorology

The study of atmospheric phenomena with a view to forecasting weather.

Project ideas

Do popular beliefs (e.g. the groundhog seeing its shadow, the height of wasp nests) have any scientific basis?
Is it possible to predict the frequency of major meteorological catastrophes (e.g. hurricanes, tidal waves, tornados)?
Is it really possible to predict the weather?

Water sciences

Water quality monitoring

Science that measures water quality and establishes quality standards.

Project ideas

How can analysis and monitoring of water be more reliable?
Macroinvertebrates that determine water quality in rivers
Is drinking water a non-renewable resource?
Is bottled water really better?
What is the best bottled water?
A systemic approach through the study of watersheds

Glaciology

The study of glaciers.

Project ideas

“Prehistoric” bacteria in ice

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Is it possible to identify and recreate glacial drift?
Following the voyage of a glacier and its transformation

Hydraulics

The science and laws pertaining to liquid flow.

Project ideas

Water and hydroelectric turbines
Soil irrigation
Soil drainage

Hydrogeology

The study of groundwater.

Project ideas

Solving the problem of groundwater contamination from landfill sites
The study of groundwater
The water table and deforestation
Calculating groundwater lowering from pumping
Can Quebec sell its water to other provinces or countries?

Hydrology

Science that deals with water and its properties.

Project ideas

Mapping areas that are hydrological risks and suggesting a new way of fortifying banks
Climate change and water balance
Demonstrating the effects of waves on the size of a plume (a pool resulting from the mixing of fresh water and salt water)
The formation of meanders
The impact of the drying out of wetlands
Possible disruptions to the various “links” of the water cycle (air, groundwater or runoff pollution)
Is it possible to predict the development of a waterway?
What is the future of the St. Lawrence River?

Oceanography

The study of every facet of oceans and seas.

Project ideas

Beluga autopsy
Learning about populations of fish and shellfish in order to determine fishing efforts

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The ecosystem of hot springs: myth or reality?
 The role of ocean plankton in regulating greenhouse gases
 Strategies for protecting coral reefs

Remote sensing

Science involving the analysis of images taken by various means (e.g. airplanes, helicopters, satellites, etc.) at different wavelengths.

Project ideas

The use of old photographs for studying changes in landscape
 Following schools of fish by satellite

Toxicology

The study of toxic substances and fish in the environment.

Project ideas

Beluga autopsy
 Establishing emergency procedures in the event of an accident involving chemical contaminants
 Eliminating ice on roads using ecological means
 Decontamination using plant life
 Is acid rain a thing of the past?
 Do gas stations pollute the environment?
 Lead, mercury, soap, etc.: Are fish fit for human consumption?
 What is the distribution and sedimentation speed of contaminants?