

SCIENCE 7

UNIT A: INTERACTIONS & ECOSYSTEMS

Calgary Roman Catholic Separate School District 2002-2003 Planning Template

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SCIENCE 7 ~ UNIT A OVERVIEW

Interactions and Ecosystems (Social and Environmental Emphasis)

CRCSSD Emphasis: Schoolyard Ecosystems

Overview: “Ecosystems develop and are maintained by natural processes and are affected by human action. To foster an understanding of ecosystems, this unit develops student awareness of ecosystem components and interactions, as well as natural cycles and processes of change. Building on this knowledge, students investigate human impacts and engage in studies that involve environmental monitoring and research. By reflecting on their findings, students become aware of the intended consequences of human activity, and recognize the need for responsible decision-making and action.” *From Alberta Learning Junior High Science Program of Studies 2001.*

Focusing Questions:

Curriculum Reference ~

FQ 1: How do human activities affect ecosystems?

FQ 2: What methods can we use to observe and monitor changes in ecosystems, and assess the impacts of our actions?

Schoolyard Ecosystems Focus ~

FQ 1: What are human activities that impact schoolyard ecosystems? (Ecosystem Impact)

FQ 2: What are schoolyard ecosystems and how do they work? (Ecosystem Processes)

FQ 3: How do we monitor change in schoolyard ecosystems? (Ecosystem Monitoring)

FQ 4: How do we manage schoolyard ecosystems? (Ecosystem Management)

Enduring Understanding/Skills/Attitudes:

1. An understanding that schoolyards, backyards and urban settings are functioning ecosystems (human dominated).
2. A basic understanding of ecosystem management as a process that involves basic ecosystem research, ecosystem monitoring and making management decisions based on current public values (wants and needs) and current evidence from research and monitoring.

Acceptable Evidence: Students will ~

1. Construct a schoolyard map that identifies, and documents over time, examples of human impact on the schoolyard ecosystem(s).
2. Construct a food web that illustrates the flow of energy and cycling of material that occurs in the schoolyard ecosystem(s).
3. Develop, implement and maintain an ecosystem-monitoring program for the schoolyard ecosystem(s).
4. Seek and apply evidence from research and monitoring when assessing alternative management plans for schoolyard ecosystem(s).

Student Preconceptions:

1. Students tend to equate only natural and wilderness areas with fully functioning ecosystems; some will have difficulty in perceiving schoolyards as ecosystems (a vacant lot, or even a parking lot, is still an ‘ecosystem’).
2. Students tend to equate human impact with the destruction or collapse of ecosystems; ecosystems do not ‘collapse’, but do change in function, structure and composition over time due to natural or human disturbance (drought, flooding, mowing, herbicides).

Activating Prior Knowledge: Preparing for Learning

1. **SKETCH:** ask students to sketch a schoolyard ecosystem, indicating what lives there and how does it work. Draw upon prior knowledge regarding ecosystems and issues from: Science 5 ~ Wetland Ecosystems & Science 6 ~ Trees & Forests to also discuss: What is an ecosystem? Can our schoolyard be considered an ecosystem? Why or why not?
2. **DISCUSSION:** Our schoolyards actually present us some of the most intriguing questions, and dilemmas, of ecosystem function and management in an urban setting. What are schoolyards used for? Are all schoolyards the same? Have schoolyards changed over time? How are schoolyards managed, for whom, and for what purpose? Has schoolyard management changed over time?

Continuum of Understanding Prior Conceptions for Environment, Ecosystems & Interactions

<u>GRADE</u>	<u>TOPIC</u>	<u>PRIOR CONCEPTS</u>
1	Needs of Animals and Plants	<ul style="list-style-type: none"> • Living and non-living things; adaptations • Needs and value of local plants, animals, pets • Relationship between plants and animals
2	Small Crawling & Flying Animals	<ul style="list-style-type: none"> • Local invertebrates; needs, role and adaptations • Relationship to other living things • Conditions for care and value to humans
3	Animal Life Cycle	<ul style="list-style-type: none"> • Life cycles; growth and development • Parental care, needs and adaptations • Environmental conditions, habitat, preservation
4	Waste and Our World	<ul style="list-style-type: none"> • Plant, animal and human waste; cycling & disposal • Biodegradable, recycling, waste stream • Individual, group action and monitoring
5	Wetland Ecosystems	<ul style="list-style-type: none"> • Types of wetland ecosystems; living & non-living components • Producer, consumer, decomposers, food chain, webs • Human impact and management of wetlands
6	Trees and Forests	<ul style="list-style-type: none"> • Classification, growth, function and role of trees • Interaction of living things in forest ecosystems • Human impact, use, value and management of forests

What to Expect in the “New” Unit (Comparison to Science 8 ~Interactions & Environments)

Science 7: Interactions & Ecosystems

Emphasis: Nature of Science

STS and Knowledge Outcomes:

- Relationships between humans and their environments.
- Flow of energy and materials within an ecosystem.
- Local ecosystem monitoring and assessment of impacts.
- Relationships among environmental knowledge, decisions and actions.

Science 8: Interactions & Environments

Emphasis: Social and Environmental

Specific Learner Expectations:

- Not addressed.
- Interactions of organisms with each other and their environment.
- Adaptations, niches and effects of change.
- Intended/unintended consequences of interventions.

Comments on Change

More applied (i.e. management)

More emphasis on assessment

The Science 7 units uses a ‘sandwich’ approach; starting with social context, addressing scientific concepts needed to understand issue, and then applying knowledge to issue or action.

The Change in Emphasis (What does this mean?)

The Science 8 unit engaged students in the scientific study of living things in relationship to each other and their environment. The Science 7 unit will engage students in monitoring and assessing impact of human activity on ecosystems. The emphasis has moved from simply understanding how ecosystems work, but to also understanding what knowledge, skills and attitudes are required for ecosystem management.

SCIENCE 7: UNIT A ~ PLANNING FRAMEWORK

ENDURING CONCEPTS

Emphasis:
Concepts

Skills

Students will demonstrate a basic understanding of:

future
ECOSYSTEM MANAGEMENT

ECOSYSTEM MONITORING

ECOSYSTEM PROCESSES

ECOSYSTEM IMPACT (HUMAN)

MAJOR FOCAL QUESTION

How are schoolyard ecosystems managed?

4

3

2

1

OBJECT of STUDY

Schoolyard Ecosystem

ENDURING SKILLS

Emphasis:
Research & Monitoring

Students will demonstrate to:

Investigate past, present and ecosystem management options.

Develop & implement ecosystem monitoring program.

Analyze & describe energy flow and cycling of matter.

Explore & describe evidence of human impact.

What do we know, what do we need to know, and what have we learned in order to answer this focal question?

Adapted from: Novak, JD and Gowin, DB. 1984. Learning How To Learn. Cambridge University Press. Cambridge, UK.

Reference Documents for Program and Student Assessment:

- CCSD Science Program Assessment Instrument, Instructional Services, September 2001.
- Alberta Assessment Consortium: A Framework for Student Assessment ~ pp. 20 - 21.
- Schoolyard Ecology Leaders' On-Line Handbook: Assessing Student Learning ~ <http://www.ecostudies.org/syefest/ap1res11.htm>

PLANNING TEMPLATE 1 ~ ECOSYSTEM IMPACT (5-6 Lessons)

Focus Question 1: What human activities impact schoolyard ecosystems?

G.L.O. 1: Investigate and describe relationships between humans and their environments, and identify related issues and scientific questions.

<p>SCHOOLYARD ECOSYSTEM CONTEXT: Students will ~</p>	<ul style="list-style-type: none"> • Investigate and describe different human uses or values (wants & needs) of, and resulting impacts on, schoolyard ecosystems. • Identify issues arising from those differing uses, values and impacts, and related scientific knowledge and questions required to address those issues.
<p>ASSESSMENT STRATEGIES (Products): What evidence is acceptable to determine student understanding of the outcomes?</p>	<ul style="list-style-type: none"> • Schoolyard Scavenger Hunt: Observe and document all examples on datasheet. • Schoolyard Map: Accuracy of observations and initial insights on effect of impact. • Journal Reflections: Identified issues arising from differing uses, values and impacts; and identified questions to investigate.
<p>INSTRUCTIONAL STRATEGIES: What learning experiences will help students to explore the big ideas and essential questions?</p>	<ul style="list-style-type: none"> • Lesson 1: Schoolyard Scavenger Hunt (Directed exploration & observation skills.) • Lesson 2: Basic Needs & Adaptations of Living Things (Investigating how living things in the schoolyard meet their basic needs and are adapted to schoolyards.) • Lesson 3, 4, 5: Schoolyard Mapping (Identifying human impact on living things.) • Lesson 6: Introduction to Ecosystem Management (What do we need to know and learn about in order to understand how schoolyard ecosystems work and are managed?)
<p>KEY REFERENCES & RESOURCES: (Related to Schoolyard Ecosystems)</p>	<ul style="list-style-type: none"> • Science in Focus ~ <ul style="list-style-type: none"> ○ Related Reading: Topic 1 ~ Interactions Within Ecosystems: pp. 6-17. ○ Topic 2 ~ Human Impacts on Ecosystems: pp. 18-28. ○ Related Activities: Just the Basics: pg. 9. & Mapping Home: pg. 36. ○ Science Log Book: Pause & Reflect: pp. 7, 13, 16 (Research Assignment). • Science in Action ~ <ul style="list-style-type: none"> ○ Related Reading: Topic 1 ~ Relationships between living things and environment: pp. 8-25. ○ Related Activities: Your Schoolyard: pg. 10. ○ Science Log Book: Check & Reflect: pg. 15. • Other Resources ~ <ul style="list-style-type: none"> ○ Schoolyard Ecology Treasure Hunt: http://www.ecostudies.org/syefest/ap1hunt.htm ○ Schoolyard Wonders: http://www.ecostudies.org/syefest/ap1res22a.htm (&22-25.htm) ○ Schoolyard Mapping: OBIS <i>Mapping a Study Site</i> and <i>Terrestrial Hi-Lo Hunt</i>

	<ul style="list-style-type: none"> ○ Ecosystem Management Protocol (From KFS Programs ~Attached)
<p>COMMENTS & INSIGHTS:</p>	<ul style="list-style-type: none"> • Schoolyard Scavenger Hunt: Will serve as an introduction to initiating, planning and recording inventories of schoolyard ecosystems; and to introduce class to outdoor boundaries, procedures, protocol and safety requirements for schoolyard investigations. • Schoolyard Mapping: Take the time to introduce concepts of accuracy and scale at beginning; and provide grid lines and show buildings on the blank map for students. Discuss types of human impact, at different scales, prior to searching for evidence in schoolyard (e.g. litter, recreation, walkways, mowing, watering, introduced trees, urban/regional smog, climate change, etc.) The schoolyard map will serve as a central reference document for further investigations in this unit and to compare with other schools across the District.

PLANNING TEMPLATE 2 ~ ECOSYSTEM PROCESSES (5-6 Lessons)

Focus Question 2: What are schoolyard ecosystems and how do they work?

G.L.O. 2: Trace and interpret flow of energy and materials within an ecosystem.

<p>SCHOOLYARD ECOSYSTEM CONTEXT: <i>Students will analyze schoolyards to ~</i></p>	<ul style="list-style-type: none"> • Identify biotic (organisms) and abiotic (resources: light, water, nutrients) components within the schoolyard and describe the interactions between these components. • Identify organisms, and their function (producers, consumers, decomposers), within schoolyard food webs and describe processes controlling energy flow the food web. • Describe .the carbon and water cycles present in schoolyard ecosystems. • Relate this learning back to what affect the identified human impacts (and management) may have on these resources and consequent changes in food webs over time.
<p>ASSESSMENT STRATEGIES (Products): What evidence is acceptable to determine student understanding of the outcomes?</p>	<ul style="list-style-type: none"> • Schoolyard Map: systematically survey biotic and abiotic components in schoolyard and construct a voucher collection or key of organisms found in the schoolyard. • Schoolyard Food Web: construct the food web present in the schoolyard, either in diagram or as part of a simulation game. • Schoolyard Investigation (Extension): design independent field studies that investigate relationships between where (distribution), how many (abundance), and why (processes)? • Journal Reflections: Hypothesize effect of human impacts on food webs.
<p>INSTRUCTIONAL STRATEGIES: What learning experiences will help students to explore the big ideas and essential questions?</p>	<ul style="list-style-type: none"> • Lesson 1: Schoolyard Map (Identification of biotic and abiotic components.) • Lesson 2, 3: Schoolyard Investigation (Directed study of “Who Eats What”). • Lesson 4: Schoolyard Food Webs (‘Animal game’ based on schoolyard organisms.) • Lesson 5, 6: Ecosystem Processes (Energy flow and cycling of materials.)
<p>KEY REFERENCES & RESOURCES: (Related to Schoolyard Ecosystems)</p>	<ul style="list-style-type: none"> • Science in Focus ~ <ul style="list-style-type: none"> ○ Related Reading: Topic 4 ~ How Organisms Interact: pp. 38-48. <li style="padding-left: 20px;">Topic 5 ~ Cycles in the Environment: pp. 49-55. ○ Related Activities: Investigation 1-F: Don’t Waste It (using schoolyard soil): pg.46. <li style="padding-left: 20px;">Activity: Checking the pH (using schoolyard water): pg. 52. ○ Science Log Book: Topic Reviews (put into Schoolyard Context): pp. 48, 54. • Science in Action ~ <ul style="list-style-type: none"> ○ Related Reading: Topic 2 ~ The flow of energy and cycling of matter: pp. 26-49. <li style="padding-left: 20px;">Topic 3-1 ~ Investigating distribution of living things: pp. 51-54 ○ Related Activities: Inquiry Activity ~ Energy Pathway (of Schoolyard): pg. 37. <li style="padding-left: 20px;">Inquiry Activity ~ Food Web (Schoolyard) Chain Reaction: pg.40. <li style="padding-left: 20px;">Inquiry Activity ~ Human Impact in the Schoolyard: pp. 53-54. ○ Science Log Book: Research (Earthworms): pg. 42 & Focus On (Impacts): pg. 48.

	<ul style="list-style-type: none"> • Other Resources ~ <ul style="list-style-type: none"> ○ Module 1: Who Eats What? Pp. 46-168. Hogan, K. 1994. IES Eco-Inquiry. Kendall/Hunt Pub. Co. ○ Beat Sampling, Density, Litter Bags: http://www.ecostudies.org/syefest/ap1hunt.htm ○ Investigations: OBIS Plant Patterns, Super Soil, Food Chain Game.
<p>COMMENTS & INSIGHTS:</p>	<ul style="list-style-type: none"> • Schoolyard Investigations: Focus on surveys & inventories of producers, consumers and decomposers using transects in order to assist students in developing their schoolyard food webs systematically. • Food Chain Games: There are diversity of 'Animal Games' including OBIS "Food Chain Game", Science Is "Ecosystem Jobs" or "Web of Life", or Project Wild's " Shrinking Habitat". In addition students could re-design these games using organisms found, or believed to visit, their schoolyards.

PLANNING TEMPLATE 3 ~ ECOSYSTEM MONITORING (5-6 Lessons)

Focus Question 3: How do we monitor change in schoolyard ecosystems?

G.L.O. 3: Monitor local ecosystems and assess impacts of environmental factors on the growth, health and reproduction of organisms within those environments.

<p>SCHOOLYARD ECOSYSTEM CONTEXT: Students will ~</p>	<ul style="list-style-type: none"> • Investigate and interpret distribution patterns of living things and evidence of change over time in the schoolyard. • Design and implement long-term physical, environmental, chemical, or biological monitoring programs to assess rate of change due to succession or human disturbance.
<p>ASSESSMENT STRATEGIES (Products): What evidence is acceptable to determine student understanding of the outcomes?</p>	<ul style="list-style-type: none"> • Schoolyard Map: identify patterns in distribution and abundance of organisms in schoolyard and relate to resource and disturbance gradients (light, water, nutrients, human impact). • Schoolyard Monitoring: develop monitoring program that is easy to implement, addresses interesting issues and is comparable to other schoolyards (e.g. earthworms or dandelions). • Journal Reflections: Identified issues arising from monitoring & questions to investigate.
<p>INSTRUCTIONAL STRATEGIES: What learning experiences will help students to explore the big ideas and essential questions?</p>	<ul style="list-style-type: none"> • Lesson 1 &2: Schoolyard Patterns (Distribution of living things and evidence of change.) • Lesson 3: Ecosystem Monitoring (Introduction and choosing a program.) • Lesson 4, 5: Schoolyard Monitoring (Designing and implementing a program.) • Lesson 6: Agents of Change (Impact of invasive or introduced species).
<p>KEY REFERENCES & RESOURCES: (Related to Schoolyard Ecosystems)</p>	<ul style="list-style-type: none"> • Science in Focus ~ <ul style="list-style-type: none"> ○ Related Reading: Topic 6 ~ Succession and Change in Ecosystems: pp. 56-67. <li style="padding-left: 20px;">Topic 7 ~ Environmental Monitoring: pp. 68-81. ○ Related Activities: What is the Change? pg. 71 & Monitoring Amphibians: pg. 72. <li style="padding-left: 20px;">Comparing Ecosystems. Pg.76 ○ Science Log Book: Topic 6 & 7 Review (in a schoolyard context): pp.67. • Science in Action ~ <ul style="list-style-type: none"> ○ Related Reading: Topic 3 ~ Changes in ecosystems: pp. 50-65. ○ Related Activities: Inquiry Activity: The Schoolyard: pg. 52. ○ Science Log Book: Check & Reflect: pp. 54, 60; Research: Non-native species, pg.57. <li style="padding-left: 20px;">Focus On: Designing monitoring project, pg. 65. • Other Resources ~ <ul style="list-style-type: none"> ○ Impacts of Schoolyard Traffic: http://www.ecostudies.org/syefest/ap1res6.htm ○ Dandelion Determinations: http://www.ecostudies.org/syefest/ap1res2.htm

	<ul style="list-style-type: none"> ○ Out of Control (Succession Study of Lawn): OBIS
<p>COMMENTS & INSIGHTS:</p>	<ul style="list-style-type: none"> • Monitoring Projects: Abiotic (physical & environmental) monitoring data can be used from Weather Stations maintained in Elementary science, or obtained from Environment Canada websites. It is suggested for 'average' schoolyards to focus on commonplace biological indicators such as distribution of weed species, dandelions or earthworms; of which the latter two are actually invasive, non-native species introduced to the area. • Successional Studies: If at all possible check to see if grounds will allow the class to release a portion of the schoolyard from human control; a minimum of one-by-three meter section is required for an 'out of control' plot, with larger areas even better. This will bring up very interesting discussions and plans for identifying nuisance and noxious weeds and the reasons why noxious weeds need to be controlled.

PLANNING TEMPLATE 4 ~ ECOSYSTEM MANAGEMENT (5-6 Lessons)

Focus Question 4: How are schoolyard ecosystems be managed?

G.L.O. 4: Describe the relationships among knowledge, decisions and actions in maintaining life-supporting environments.

<p>SCHOOLYARD ECOSYSTEM CONTEXT: <i>Students will analyze schoolyards to ~</i></p>	<ul style="list-style-type: none"> • Identify the intended and unintended consequences of human activity and management of schoolyard ecosystems. • Describe & interpret science investigations, research and policy used to inform schoolyard management plans. • Analyze issues arising from and consequences of actions such as: introduced species, paved schoolyards, schoolyard restoration projects, or no use of herbicides and pesticides, from scientific and ethical perspectives.
<p>ASSESSMENT STRATEGIES (Products): What evidence is acceptable to determine student understanding of the outcomes?</p>	<ul style="list-style-type: none"> • Schoolyard Map: review intended and unintended consequences of human activity on schoolyard ecosystem patterns and processes. • Schoolyard Model: design a model of an “ideal” schoolyard ecosystem. • Schoolyard Management Plan (Extension): develop, present and debate an “ideal” management plan for the schoolyard (e.g. taking into account ecosystem processes, economic realities, safety and human needs). • Journal Reflections: reflect on and differentiate between the role of scientific and ethical debate in informing ecosystem management and decision-making.
<p>INSTRUCTIONAL STRATEGIES: What learning experiences will help students to explore the big ideas and essential questions?</p>	<ul style="list-style-type: none"> • Lesson 1: Schoolyard Map (Review of human impact on ecosystem patterns & processes.) • Lesson 2,3: Schoolyard Model (Research and design model schoolyard ecosystem.) • Lesson 4,5: Schoolyard Management (Research and debate with invited guests.) • Lesson 6: School Management Plan (Develop ideal management plan.)
<p>KEY REFERENCES & RESOURCES: (Related to Schoolyard Ecosystems)</p>	<ul style="list-style-type: none"> • Science in Focus ~ <ul style="list-style-type: none"> ○ Related Reading: Topic 3 ~ Environmental Choices: pp. 29-37. ○ Related Activities: Find Out Activity: Mapping Home (using schoolyard): pg. 36. ○ Unit 1 Issue ~ A Debate (Adapt to Schoolyard): pp. 82-83. ○ Science Log Book: Pause & Reflect (put into Schoolyard Context): pg. 87. • Science in Action ~ <ul style="list-style-type: none"> ○ Related Reading: Topic 4 ~ Maintaining Sustainable Environments: pp. 66-87. ○ Related Activities: Project ~ Design a Land-Use Plan (for a Schoolyard): pp.86-87. ○ Science Log Book: Check & Reflect: pp. 75, 77 & Focus On (Planning): pg. 83.

	<ul style="list-style-type: none"> • Other Resources ~ <ul style="list-style-type: none"> ○ Module 1.9: Environmental Impact Statement: pp. 156-162. Hogan, K. 1994. IES Eco-Inquiry. Kendall/Hunt Pub. Co. ○ Nature Preserves: Is Bigger Better?: http://www.ecostudies.org/syefest/ap1hunt.htm ○ Investigations: OBIS Trail Impact Study & Trail Construction.
<p>COMMENTS & INSIGHTS:</p>	<ul style="list-style-type: none"> • Schoolyard Ecosystem Management: Focus on a current issue that can be investigated and monitored scientifically, and yet has some ethical dilemma students can relate to (e.g. spraying for dandelions). This presents an opportunity to invite guests, research and debate issues surrounding control and impact of nuisance and/or noxious weeds. • Schoolyard Projects: There is a diversity of resources available for schoolyard gardening or restoration projects. Please research carefully; reviewing scientific, ethical, economic and long-term impacts (and responsibility) for projects of this nature.