STEWARDSHIP OF GOD'S CREATION

Pope Benedict XVI: *"Human beings legitimately exercise a responsible stewardship over nature, in order to protect it, to enjoy its fruits and to cultivate it in new ways …"*

Catholic tradition insists that we show our respect for the Creator by our stewardship of creation. We are called to protect people and the planet, living our faith in relationship with all of God's creation. In this context, the common good should be conceived as sustenance and flourishing of life for all beings and for future generations. The preferential option for the poor can be extended to include a preferential option for the planet made poorer by human abuse. This environmental challenge has fundamental moral and ethical dimensions which cannot be ignored.

Sample Lessons Using the Stewardship of God's Creation Framework

Grade, Subject, Code Lesson Topic	Lesson Summary
Grade 10 Dance ATC2O Canticle of the Sun	This lesson will introduce students to the Catholic Social Teaching, Stewardship of God's Creation, and will provide continued learning opportunities for students to deepen their understanding of this teaching through the creation of a dance art work.
Grade 10 Science SNC2D Understanding The Greenhouse Effect	This lesson will introduce students to the Catholic Social Teaching, Stewardship of God's Creation. Students will learn about the natural greenhouse effect, and through critical thinking, determine how to respond in light of the Catholic Social Teaching of Stewardship.
Grade 12 Mathematics MDM4U Which country is a good steward?	This lesson allows students to collaboratively analyze data sets on stewardship variables for four countries. Students will analyze the data from one variable and prepare a report for the class. The class will decide which variables are most effective to measure a country's stewardship.

NOTE: These lessons are provided as cross-curricular examples of how our Catholic Social Teachings can guide our teaching and bring the lens of faith to Equity and Inclusion in our classroom. These exemplars are only a beginning. The framework can be used by teachers to develop lessons of their own by selecting guiding questions with their students while addressing and assessing other curriculum expectations.

Guiding Questions: Stewardship of God's Creation

"With her social doctrine the Church proclaims God and the mystery of salvation in Christ to every human being" (Compendium of Social Doctrine 67)

The Catholic Social Teachings

- If we believe that all creation is good and sacred, and we are called to be stewards of the earth, what does this lesson call us to do?
- In what ways have we tried to counter the negative impact of human activity on creation with purposeful planning and stewardship in our school, community and the world?
- How is the ecological crisis also profoundly a religious crisis?
- What alliances/supports do you need to implement your stewardship plan?
- What does good stewardship of creation look like?

The Equity and Inclusive Education Strategy

- How do we make everyone in our classroom feel respected, safe, and included to provide the best opportunity for growth and student achievement?
- What gifts do you bring to share with your classmates and how will you use these gifts to support your learning and the learning of others?
- How can we recognize and value the gifts of others?
- How do you see yourself as a valued and contributing member of this class, school, community, and society?
- In building a welcoming learning environment, what words and actions demonstrate respect for the dignity of all?

STEWARDSHIP OF GOD'S CREATION

Critical Literacy

- What kinds of issues of equity, power and social justice are relevant to the topic?
- How can we analyze the information presented for bias, reliability, fairness, and validity?
- How can we challenge our assumptions?
- What types of actions and/or responses are appropriate in the subject?
- How does our faith (age, culture, life experiences, values, etc.) influence how the message is interpreted?
- How might the text be changed to offer alternative perspectives or recognize and include missing voices, such as the marginalized?

The Ontario Catholic Graduate Expectations

- What scriptural reference might guide our thinking in this Catholic Social Teaching?
- How does the Catholic Social Teaching, Stewardship of God's Creation, call us to respond or act:
  - As a discerning believer?
  - As an effective communicator?
  - As a reflective, creative, holistic thinker?
  - As a self-directed responsible life-long learner?
  - As a collaborative contributor?
  - As a caring family member?
  - As a responsible citizen?

GRADE 10

Equity and Inclusive Education: **From the Lens of the Catholic Social Teachings**	**Subject:** Dance **Code:** ATC2O **Lesson Title:** The Canticle of Brother Sun and Sister Moon Suggested length of time: 75-225 Minutes
	Lesson Overview: This lesson will introduce students to the Catholic Social Teaching, Stewardship of God's Creation, and will provide continued learning opportunities for students to deepen their understanding of this teaching through the creation of a dance art work.

CURRICULUM CONNECTIONS	CATHOLIC SOCIAL TEACHINGS & ONTARIO CATHOLIC SCHOOL GRADUATE EXPECTATIONS
Dance ATC20 **Strands:** A. Creating, Performing and Presenting B. Reflecting Responding, and Analyzing C. Foundations **Overall and Specific Expectation:** A1. The Creative Process: use the creative process, the elements of dance, and a variety of sources to develop movement vocabulary A1.1 use the elements of dance to create and perform a variety of movement	The **Catholic Social Teaching** evident in this lesson: **Stewardship of God's Creation** The **Ontario Catholic School Graduate Expectations** evident in this lesson include: **An Effective Communicator Who:** 2 (c) Presents information and ideas clearly and honestly and with sensitivity to others. 2 (e) Uses and integrates the Catholic faith tradition, in the critical analysis of the arts, media technology and information systems to enhance the quality of life.

	phrases inspired by sources A1.2 create and perform phrases that manipulate three or more elements of dance A2. Choreography and Composition: combine elements of dance in a variety of ways in composing individual and ensemble dance creations A2.2 construct a dance composition inspired by a source B2. Dance and Society: demonstrate and understanding of how societies present and past use or have used dance, and of how creating and viewing dance can benefit individuals, groups, and communities B2.2 explain how dance exploration can contribute to personal growth and self-understanding C3.Responsible Practices: demonstrate an understanding of safe, ethical, and responsible personal and interpersonal practices in dance C3.2 demonstrate problem solving skills during rehearsal and performance	**A Collaborative Contributor Who:** 5 (a) Works effectively as an interdependent team member. 5 (b) Thinks critically about the meaning and purpose of work. 5 (e) Respects the rights, responsibilities and contributions of self and others.

	Guiding Questions from the Framework
	These guiding questions have been selected from the framework focusing on: Equity and Inclusive Education: • What gifts do you bring to share with your classmates and how will you use these gifts to support your learning and the learning of others? Catholic Social Teaching: • If we believe that all creation is good and sacred, and we are called to be stewards of the earth, what does this lesson call us to do?

Equity and Inclusion: Through the Lens of the Catholic Social Teachings

Ontario Catholic Graduate Expectations:

- How does the Catholic Social Teaching, Stewardship of God's Creation, call us to respond or act:
  - As an effective communicator?
  - As a collaborative contributor?

Critical Literacy:

- How does our faith influence how the message is interpreted?

Teachers and students may select additional questions from the framework to guide their learning inquiry.

LEARNING GOALS

At the end of this lesson, students will know, understand and/or be able to:

- Use the elements of dance to create and perform movement phrases;
- Create a dance composition in collaboration with others, inspired by the sacred writing, *The Canticle of Brother Sun and Sister Moon*.

Success Criteria, based on the Learning Goals, can be co-constructed as a class in language meaningful to students. The success criteria help students understand what to look for during the learning and what it looks like once they have learned. They identify the significant aspects of student performance that are assessed and/or evaluated (i.e., the "look-fors") in relation to curriculum expectations.

Sample Success Criteria

I can:

- Work collaboratively in a group to convey a message inspired by the writing of St. Francis.
- Articulate the Catholic Social Teaching, Stewardship of God's Creation, and explain how my dance composition conveys this teaching.
- Identify my dance gifts/strengths and use them to do my best and to help others to do their best.

INSTRUCTIONAL COMPONENTS AND CONTEXT

Prior Learning: Students should have experience with the Creative Process**.** Students should also have an understanding of the elements of dance: body, space, time, energy, relationship.	**Materials:** Appendix A Environmental Quotes Appendix B Stewardship of God's Creation Appendix C Canticle of Brother Sun and Sister Moon

	Teacher Readiness: Prior to this lesson, the teacher will have: Printed Appendix A and Appendix B, selected appropriate music to accompany the dance work. *(See suggestions under Continued Learning Opportunities.)* **Student Readiness:** Prior to this lesson, students will have experience in creating movement phrases and constructing dance compositions. **Terminology:** sequencing, canticle, conveying a message This lesson is inspired by the sacred writing: *The Canticle of Brother Sun and Sister Moon*, by St. Francis of Assisi and by the words of Pope Francis: *"Man is not in charge today; money is in charge, money rules. God our Father did not give the task of caring for the earth to money but to us, to men and women we have this task."* **Note:** Sometimes The Canticle of Brother Sun and Sister Moon is also called, The Canticle of the Sun.	Music for rehearsal and final dance work **Internet Resources:** http://www.edugains.ca/resourcesLIT/AdolescentLiteracy/AL_Resources/ALG_FacilitatorsGuide.pdf www.vatican.va/holy_father/francesco/homilies/2013/documents/papa-francesco_20130319_omelia-inizio-pontificato_en.html www.pzartfulthinking.org www.dramasound.com **Resources for Canticle of the Sun:** http://www.catholic.org/clife/prayers/prayer.php?p=183 http://www.youtube.com/watch?v=DoJsMPwufUs

	MINDS ON	**CONNECTIONS**
	Print Appendix A, Environmental Quotes, making sure to use a different piece of coloured paper for each page of the appendix. Cut the quotes into strips. Have students select one of the quotes and find their group by locating others who have the same coloured paper. Have students set quote aside for now.	

	Whole Group Instruction- Survey Questions This activity is designed to set the context for the new learning that is about to come and to determine student background knowledge and learning attitudes. For each group, assign one student to be the scorekeeper and one student to be the reporter. Ask students the following series of questions: *a) What do you know about environmental issues?* Have students rate themselves from: **1 Know Very Little----------10 Know Lot** Have the scorekeeper from each group take the group's scores and average them. Have the reporter report back to the large group on the group score result when prompted by teacher. *b) What importance do you place on understanding environmental issues in your life?* Have students rate themselves from: **1 Little Importance----------10 Very Important** Have the scorekeeper from each group take the group's scores and average them. Have the reporter report back to the large group on the group score result when prompted by teacher. *c) How open are you to learning more about environmental issues?* Have students rate themselves from: **1 Not Very ----------10 Totally Open** Have the scorekeeper from each group take the group's scores and average them. Have the reporter report back to the large group on the group score result when prompted by teacher. Teacher to debrief the survey by highlighting student background knowledge and attitudes. **Group Activity – Appendix A Environmental Quotes** Have students refer now to their quote and read it over. Invite students, one at a time, to read the quote to their group and then share their understanding of the quote. Once each student has had a chance to share their quote and their understanding, ask each group to discuss the quotes and then identify the emerging themes about the environment they see as common amongst their quotes.	Assessment **for** learning: — Survey Questions Assessment **as** learning: — Survey Questions — Cooperative learning Differentiation of learning:

	(For example, what do the quotes say about the environment or about our role in being stewards of the environment?) Invite the reporter in the group to report out the commonalities to the large group when prompted by the teacher. Teacher to record responses on black/smart board or chart paper.	Strategies: — Thinking Routine: Environmental Quotes — Entry Point: Environmental Quotes

	ACTION	**CONNECTIONS**
	Whole Group: **Discussion followed by Individual Work** Introduce the topic of Stewardship of God's Creation. Use Definition from Appendix B Stewardship of God's Creation. Discuss what it means to be a steward (care taker, protector, someone who looks after something) and make the point that we are called not only to be stewards of the earth but stewards of one another. Distribute Appendix B. Allow time for students to complete individually. **Group Work**: **Let's Get Moving! Creating and Sharing** Have each student select one word or phrase from Appendix B and create a movement phrase to go with it that manipulates one or two elements of dance. Invite students to return to their group and share their movement phrase. Group members should provide feedback to one another regarding the use of the elements of dance while recognizing and affirming the gifts that each brings to their work. Invite the group to sequence the individual movements and to connect them in some way. Allow time to rehearse and revise. Teacher to circulate and provide feedback. Have each group present to the class for further feedback. Use the following questions to guide the discussion: *a) What kind of mood was conveyed through the movements?* *b) How did the sequencing affect the flow?* *c) How are the elements of dance being used?* Let student knows that these movement phrases have served as a warm up to a dance composition assignment for the next class.	Assessment **for** learning: — Observation Assessment **as** learning: — Teacher and peer feedback on movement phrases

Option: Teacher may wish to allow students additional time to revise and present movement phrases for evaluation.

Group Work- Canticle of Brother Sun and Sister Moon

Introduce St. Francis of Assisi and convey the story of how Francis came to write The Canticle of Brother Sun and Sister Moon. For information on this, view the first 1:46 of the following: http://www.youtube.com/watch?v=DoJsMPwufUs .

It is worth noting that while this video was prepared for a hospital setting, the background information provided can be used for our purposes in creating a dance inspired by the writing of St. Francis.

Provide each group with Appendix C, The Canticle of Brother Sun and Sister Moon.

Have each group use the Interesting-Connections-Questions Protocol (ICQ) for Appendix C. (This protocol provides a structure for students to connect new ideas to prior knowledge and to raise questions about the text.) This protocol has been adapted from the Facilitators' Guide for the Adolescent Literacy Guide. See link under Internet Resources.

In groups of 3-4:

a) Individually read the text. Record your answers to the questions below:
   - What did you find **interesting** about the text?
   - What **connections** do you make with the text?
   - What **questions** do you have about the text?

b) Small Group Discussion:
Round One- students take turns presenting one interesting point that he or she identified from the text and explains why he or she chose the point (max 1 minute). Continue until each group member has a turn.
Rounds Two and Three: repeat using the next question.

c) Whole Group Discussion Questions*: (Teacher or student from each group may record the responses for further reference.)*
   - *What have you learned from this text?*
   - *What do you wonder about this text?*
   - *What elements of dance come to mind when you think about translating the text into movement?*

Assessment **of** learning:

— Movement phrases

Differentiation of Learning:
Strategies:
— setting objectives, providing feedback
— reinforcing effort and providing recognition
— -use of Interesting-Connections-Questions (ICQ) Protocol

	d) Whole Group Discussion: Debrief the Protocol • *How did the protocol help your understanding of the text?* • *How did the protocol help your discussion about the text and translating the text into movement?* Once students have completed the protocol, let students know that they will be using the text of The Canticle of Brother Sun and Sister Moon as their source of inspiration to create a group dance composition that will be shared with the class.	

	CONSOLIDATION	**CONNECTIONS**
	Thinking Routine: Headline (This thinking routine helps students to capture the core of the matter being studied and is a good routine for summation. This thinking routine is taken from Project Zero Artful Thinking.) See link under Internet Resources. **Teacher Prompt:** *Think about all that we have been reading and discussing today in class. If you were to write a headline for a newspaper right now that captured the most important aspect that should be remembered, what would your headline be?* Allow students time to think and respond. *Share your headline with an elbow partner.* Direct students to turn to a neighbour. *Who heard a headline from someone else that they thought was particularly good at capturing the heart of our work today?* Have student(s) share with whole class. Option: Student responses can be written down and recorded so that a class list of headlines is generated which can then be revisited.	Assessment **for** learning: — Observation Assessment **as** learning: — Observation, — Cooperative Learning  Differentiation of Learning: Strategy: — Thinking Routine: Headline — Cooperative learning Assessment **of** learning: — Dance Composition

	CONTINUED LEARNING OPPORTUNITIES
	Further extensions to this lesson might include: Option: instead of beginning the lesson with survey questions, have students take turns in their group responding to the following questions when prompted: a) Recall a time when you were impacted by the power/beauty of nature? b) Recall a time when you were saddened by the destruction of nature or the disregard for nature. c) How does the earth echo the voice of God? • Have students use the Creative Process to create a group dance composition based upon Appendix D, Canticle of Brother Sun and Sister Moon. Teacher may assign one stanza to each group or have each group address the entire piece of writing. • Consider having students keep a Creative Process Log to further address Overall Expectation B2.2. • Recommended music soundtrack: a) any sounds of nature soundtrack such as: rain sounds, ocean sounds, etc. b) Fantasy Vol. 1 , and Fantasy Vol. 2 Anthology from dramaSound library www.dramasound.com/cfantasy.cfm • Have students research other musical compositions and recordings for Canticle of the Sun • Have students use the Critical Analysis Process to view each other's work. • Have students present dance works for: another class, a school assembly/liturgy/prayer service or Earth Day celebrations. • Video performances and have students do a voice over or fly in words from St. Francis text for a media presentation that can be used as a prayer.

Equity and Inclusion: Through the Lens of the Catholic Social Teachings

Environmental Quotes **Appendix A**

Never doubt that a small group of thoughtful committed citizens can change the world: indeed it's the only thing that ever has	Margaret Mead
God has cared for these trees, saved them from drought, disease, avalanches and a thousand tempests and floods. But he cannot save them from fools.	John Muir
Thank God men cannot fly, and lay waste the sky as well as the earth.	Henry David Thoreau
I did not become a vegetarian for my health; I did it for the health of the chickens.	Isaac Bashevis Singer
By polluting clear water with slime you will never find good drinking water.	Aeschylus
When a man wantonly destroys one of the works of man we call him a vandal. When he destroys one of the works of God we call him a sportsman.	Joseph Wood Krutch
We assume that everything's becoming more efficient, and in a sense that's true our lives are better in many ways. But that improvement has been gained through a massively inefficient use of natural resources.	Paul Hawken
I'm very concerned for the future of the earth and its amazing creatures. We've got to be careful and make sure we don't foul our own nest.	John Lithgow
I have a private plane, but I fly commercial when I go to environmental conferences.	Arnold Schwarzenegger
Raising awareness on the most pressing environmental issues of our time is more important than ever.	Leonardo DiCaprio
I really believe in the environmental movement right now- it only takes a little effort to make a big difference.	Brooke Burke
All I can say is that 50 years ago, there was no such thing as environmental policies.	David Attenborough

Environmental concern is a little like dieting or paying off a credit-card debt – an episodically terrific idea that burns brightly and then seems to fade when we realize there's a reason we need to diet or pay down our debt. The reason is that it's really, really hard and too many of us in too many spheres of life choose the easy over the hard.	John Meacham
If we want to address global warming, along with the other environmental problems associated with our continued rush to burn our precious fossil fuels as quickly as possible, we must learn to use our resources more wisely, kick our addiction , and quickly start turning to sources of energy that have fewer negative impacts.	David Suzuki
At every turn, when humanity is asked the question, "Do you want temporary economic gain or long-term environmental loss, which one do you prefer," we invariably choose the money.	Ethan Hawke
The main environmental challenge of the 21st century is poverty. When you do not know where your next meal is coming from, it's hard to consider the environment 100 years down the line.	Bjorn Lomborg
There is no question that photography has played a major role in the environmental movement.	Galen Rowell
The environment crisis is all the result of rushing.	Ed Begley, Jr.
And I know that the younger generation is doing things that are so ingenious. And for them it's not a matter of a political belief or an environmental stance. It's really just common sense.	Daryl Hannah
My idea of an amusement park story is getting adventurers to go tour environmental disaster areas. After all, if the entire Great Barrier Reef gets killed, which seems like an extremely lively possibility, what are you going to do with all that rotting limestone?	Bruce Sterling

It is extremely important to me that the social and environmental issues associated with the production of fashion clothing are addressed.	Bonnie Wright
Religious and spiritual leaders should be held accountable for environmental activism not only because they have access to large communities and can influence votes, but because service in integral to religious and spiritual life.	Radhanath Swami
It is the greatest scam in history. I am amazed appalled and highly offended by it. Global Warming: It is a scam. Some dastardly scientists with environmental and political motives manipulated long term scientific data to create an illusion of rapid global warming.	John Coleman
Keep close to Nature's heart…break clear away, once in a while, and climb a mountain or spend a week in the woods. Wash your spirit clean.	John Muir
Christians, in particular, realize that their responsibility within creation and their duty toward nature and the creator are an essential part of their faith.	Pope John Paul II
If the sight of the blue skies fills you with joy, if the simplest things of nature have a message that you understand, rejoice, for your soul is alive.	Eleonora Duse
I love to think of nature as an unlimited broadcasting station, through which God speaks to us every hour, if only we will tune in.	George Washington Carver
Throwing away food is like stealing from the table of those who are poor and hungry. I encourage everyone to reflect on the problem of thrown away food and wasted food to identify ways and means that, by seriously addressing this issue, are a vehicle of solidarity and sharing with the needy.	Pope Francis
Man is not in charge today; money is in charge, money rules. God our Father did not give the task of caring for the earth to money but to us, to men and women we have this task.	Pope Francis
God moves in a mysterious way, His wonders to perform: He plants footsteps in the sea, And rides upon the storm.	William Cowper

Equity and Inclusion: Through the Lens of the Catholic Social Teachings

Appendix B

Stewardship of God's Creation

Catholic tradition insists that we show respect for the Creator by our stewardship of creation. We are called to protect people and the planet, living our faith in relationship with all of God's creation. In this context, the Common Good should be conceived as the sustenance and flourishing of life for all beings now and for future generations. This presents fundamental moral and ethical dimensions which cannot be ignored.

Pope Francis on Protecting Creation:

The vocation of being a "protector", however, is not just something involving us Christians alone; it also has a prior dimension which is simply human, involving everyone. It means protecting all creation, the beauty of the created world, as the Book of Genesis tells us and as Saint Francis of Assisi showed us. It means respecting each of God's creatures and respecting the environment in which we live. It means protecting people, showing loving concern for each and every person, especially children, the elderly, those in need, who are often the last we think about. It means caring for one another in our families: husbands and wives first protect one another, and then, as parents, they care for their children, and children themselves, in time, protect their parents.

Read the following points about Stewardship of God's Creation and select one phrase and one word from each point that speaks to you in some way and record them here.			
By learning about this Catholic Social Teaching it is hoped that students will…	**One Phrase**	**One Word**	**How can your one phrase or one word be turned into movement phrase?**
-demonstrate an understanding of all that is good			
-recognize that the goods of the earth are loving gifts from God			
-treat all humans with respect because they are known and loved by God			
-work to preserve the gifts of creation for creation			
-recognize the spiritual and the sacramental dimension of the created world			

The Canticle of Brother Sun and Sister Moon by St Francis of Assisi **Appendix C**

Most High, all-powerful, all-good Lord,
All praise is Yours, all glory, honor and blessings.
To you alone, Most High, do they belong;
no mortal lips are worthy to pronounce Your Name.

We praise You, Lord, for all Your creatures,
especially for Brother Sun,
who is the day through whom You give us light.
And he is beautiful and radiant with great splendor,
of You Most High, he bears your likeness.

We praise You, Lord, for Sister Moon and the stars,
in the heavens you have made them bright, precious and fair.

We praise You, Lord, for Brothers Wind and Air,
fair and stormy, all weather's moods,
by which You cherish all that You have made.

We praise You, Lord, for Sister Water,
so useful, humble, precious and pure.

We praise You, Lord, for Brother Fire,
through whom You light the night.
He is beautiful, playful, robust, and strong.

We praise You, Lord, for Sister Earth,
who sustains us
with her fruits, colored flowers, and herbs.

We praise You, Lord, for those who pardon,
for love of You bear sickness and trial.
Blessed are those who endure in peace,
by You Most High, they will be crowned.

We praise You, Lord, for Sister Death,
from whom no-one living can escape.
Woe to those who die in their sins!
Blessed are those that She finds doing Your Will.
No second death can do them harm.

We praise and bless You, Lord, and give You thanks,
and serve You in all humility.

GRADE 10

Equity and Inclusive Education:

From the Lens of the Catholic Social Teachings

Subject: Grade 10 Academic Science
Code: SNC2D

Lesson Title: Understanding The Greenhouse Effect

Suggested length of time: 75 minutes

Lesson Overview

This lesson will introduce students to the Catholic Social Teaching, Stewardship of God's Creation. This will provide students learning opportunities to understand environmental and ecological issues from a scientific understanding. After learning of the natural greenhouse effect and the human enhancement of this process, the students are asked to respond critically to one's own actions, their community and the industrial world and whether they are also being challenged by Catholic Social Teaching. Then the integration of their Faith into Action by an understanding of the renewing and strengthening of the "covenant between human beings and the environment, which should mirror the creative love of God, from whom we come and towards whom we are journeying.[1]

Benedict XVI, Message for the World Day of Peace (January 1, 2008) 7.

CURRICULUM CONNECTIONS	CATHOLIC SOCIAL TEACHINGS & ONTARIO CATHOLIC SCHOOL GRADUATE EXPECTATIONS
Science SNC 2D **STRAND:** D. Earth and Space Science: Climate Change **Overall Expectations:** D2. investigate various natural and human factors that influence Earth's climate and climate change; D3. demonstrate an understanding of natural and human factors, including the greenhouse effect, that influence Earth's climate and contribute to climate change. **Specific Expectations:** D2.5 investigate their personal carbon footprint, using a computer simulation or numerical data D3.3 describe the natural greenhouse effect, explain its importance for life, and distinguish it from the anthropogenic greenhouse effect	The **Catholic Social Teachings** evident in this lesson: **Stewardship of God's Creation** The **Ontario Catholic School Graduate Expectations** evident in this lesson include: **An Effective Communicator Who:** 2 (b) Listens actively and critically to understand and learn in light of gospel values. **A Reflective, Creative and Holistic Thinker Who:** 3 (c) Thinks reflectively and creatively to evaluate situations and solve problems. **A Responsible Citizen Who:** 7 (i) Respects the environment and uses resources wisely.

Guiding Questions from the Framework
These guiding questions have been selected from the framework focusing on: Equity and Inclusive Education: • How do you see yourself as a valued and contributing member of this class, school, community, and society? Catholic Social Teaching: • If we believe that all creation is good and sacred, and we are called to be stewards of the earth, what does this lesson call us to do?

Equity and Inclusion: Through the Lens of the Catholic Social Teachings

Ontario Catholic Graduate Expectations:

- How does this Catholic Social Teaching, Stewardship of God's Creation, call us to respond or act:
  - as an effective communicator who listens actively and critically to understand and learn in light of gospel values?
  - as a reflective, creative and holistic thinker who thinks reflectively and creatively to evaluate situations and solve problems?
  - as a responsible citizen who respects the environment and uses resources wisely?

- Ecclesial resource that inspires this lesson:

  "The ecological crisis is a moral issue" and "the responsibility of everyone," says Pope John Paul II. "Care for the environment is not an option. In the Christian perspective, it forms an integral part of our personal life and the life of society. Not to care for the environment is to ignore the Creator's plan for all of creation and results in an alienation of the human person."
  Pastoral Letter, Canadian Conference of Catholic Bishops, 2003

Critical Literacy:

- How can we analyze the information presented for bias, reliability, fairness, and validity?

Teachers and students may select additional questions from the framework to guide their learning inquiry.

LEARNING GOALS

By the end of this lesson, we will:

- Understand the Catholic Social Teaching of Stewardship of God's Creation;
- Understand the complex issue of the greenhouse effect and our call to be responsible stewards.

Success Criteria, based on the Learning Goals, can be co-constructed as a class in language meaningful to students. The success criteria help students understand what to look for during the learning and what it looks like once they have learned. They identify the significant aspects of student performance that are assessed and/or evaluated (i.e., the "look-fors") in relation to curriculum expectations

Equity and Inclusion: Through the Lens of the Catholic Social Teachings

Sample Success Criteria

I can:

- Explain how the greenhouse effect works
- Give examples of how human actions contribute to the greenhouse effect
- Explain how the Catholic Social Teaching, Stewardship of God's Creation calls us to be responsible and respond to environmental destruction.

INSTRUCTIONAL COMPONENTS AND CONTEXT

Prior Learning

- Experience the Critical Analysis Process
- Some understanding of chemical terms
- Difference between weather and climate
- The atmosphere model and the balance of energy in systems

Teacher Readiness: Prior to this lesson, the teacher should review chemicals and relate this lesson to their textbook section on the greenhouse effect.

Student Readiness: Prior to this lesson, students will be able to read and interpret perspectives on scientific literature and theological literature.

Terminology: climate, weather. Infrared radiation, ultraviolet radiation, visible light, absorbed, reflected, CO_2 , CH_4 ,H_2O, N_2O and CFCs.

Materials:

Appendix A The Greenhouse Effect (1/2 class set)
Appendix B David Suzuki Article (1/2 class set)
Appendix C The Greenhouse Effect Diagram (one copy)
Appendix D Responsible Stewardship (one copy)
Appendix E Simulator Questions on the Greenhouse Effect (one copy of entire Appendix E: class set of last page)

Continued Learning Opportunities:

Appendix F Critical Analysis Process(class set)
Appendix G CST: Stewardship of God's Creation (class set)

Internet Resources:

http://phet.colorado.edu/en/contributions/view/3079

http://phet.colorado.edu/en/simulation/greenhouse

Print Resources:

All Thinking Routines are taken from:
Making Thinking Visible, by Ritchhart, Church, Morrison, Jossey-Bass, 2011

MINDS ON	CONNECTIONS
Small Group-Matching Activity Divide the class in half. Distribute Appendix A The Greenhouse Effect to one half and Appendix B The David Suzuki Article to the other half. Have each student complete the first part of Appendix F. Once complete, students can share their responses in their small group. Have one person in each group designated as the spokesperson for the group for sharing back to the large group. Introduce the Guiding Question from the Stewardship Framework: *If we believe that all creation is good and sacred, and we are called to be stewards of the earth, what does this lesson call us to do?* Through teacher-led discussion for Appendix C The Greenhouse Effect Diagram and Appendix D Responsible Stewardship ask the students to be thinking about how we can respond to the Guiding Question. Students can think-pair –share their ideas. To assist with their understanding students are encouraged to visit any websites that talk about global warming. Three options: The National Geographic http://environment.nationalgeographic.com/environment/global-warming/gw-causes David Suzuki link on global warming http://www.davidsuzuki.org/issues/climate-change/ The Catholic Church and Climate Change http://www.yaleclimatemediaforum.org/2012/02/the-catholic-church-and-climate-change/ Revisit Appendix F and Complete the Analysis & Interpretation sections.	Assessment **for** learning: — Appendix A or B — Observation — Jigsaw — Synthesize and present — Appendix F Assessment **as** learning: — Teacher led discussion with whiteboard, overhead or PowerPoint — Think-Pair-Share — Teacher can read aloud and stress the students to be think of the meaning of Stewardship and how does it directly relate to greenhouse gases Assessment **as** learning: — Appendix F: Initial Reaction - Students complete questions for evaluation — Appendix F: Analysis & Interpretation

	ACTION	CONNECTIONS
	To describe how the "greenhouse effect" affects temperature on the earth and to use evidence to support whether the "greenhouse effect" is good or bad for the earth. http://phet.colorado.edu/en/contributions/view/3079 This could be done in a lab setup or as a class demonstration (SMART board). Go to the website: http://phet.colorado.edu/en/simulation/greenhouse And download the applet to run. Work through Appendix E Simulator Questions on the Greenhouse Effect.	Assessment **as** learning: — Think-Pair-Share — Teacher can read aloud the first parts of Appendix E and monitor student responses and understanding providing feedback — Students complete four questions on the last page of Appendix E for evaluation

	CONSOLIDATION	CONNECTIONS
	Group Work: Have the students run a simple lab where they simulate the amount of carbon dioxide in the water. The students will need to do the required math. Fill a beaker with water. Add blue food colouring (CO_2) to the water (atmosphere) slowly Stir so that the drops are all mixed in. Observe and Answer: *1. How did the food colouring affect the visibility of the water?* *2. How is this related to the way our greenhouse gases trap infrared radiation released by the earth.* *3. Is there an easy way to remove this food colouring from the water? Is this similar to our ability to remove CO2 from the atmosphere?*	Assessment **for** learning: — Monitor student responses to questions

	4. Based on what you have read in Appendix D, in what ways are the Church's statements rooted in Scientific information? *5. Do you think that the Church teachings are "fuzzy warm feeling" statements about care for the environment?* **Individual Seat Work:** One Phrase Distribute Appendix G Stewardship of God's Creation individually. Also revisit Appendix F and complete the Ongoing Reflection section. **Individual:** Exit Card I Used to Think…, Now I Think… This thinking routine allows students to reflect on their thinking and explore how and why that thinking has changed. Have students write and respond to the following on a slip of paper and hand in at the end of class: *About Stewardship of God' Creation*: - I used to think… - Now I think… - This new learning will influence my words and actions in educating others about global warming by… - Many politicians state that global warming is not happening! How could we analyze these political statements for bias, reliability, fairness, and validity? - As a contributing member of the class, school and community what could be your effort and actions to help eliminate carbon emissions? Collect and review exit cards responses. Look for patterns in student responses that indicate how the students' thinking has deepened, shifted or changed. Use this student learning to plan for the next lesson. Consider using responses from the third statement to create a class vision that can be posted.	Assessment **of** learning: — Appendix G CST: Stewardship of God's Creation Assessment **as** learning: — Appendix F: Ongoing Reflection — Exit Card

	CONTINUED LEARNING OPPORTUNITIES
	The students will be introduced to this in greater detail when they look at the anthropogenic sources of greenhouse gases. The students can look at websites which ask them to calculate their carbon footprint: http://treeswaterpeople.org/get_involved/reduce_your_impact/carbon_offsets/carbon_offsets.html?gclid=CKSJooS_srgCFaFFMgodRG8Arg You could invite your chaplain into your class to talk about the Patron Saint of ecology St. Francis. A helpful website with introductory questions: http://www.uscatholic.org/church/2010/09/st-francis-patron-ecology

Appendix A

The Greenhouse Effect

In a greenhouse, energy from the sun passes through the glass as rays of light. This energy is absorbed by the plants, soil, and other objects in the greenhouse. Much of this absorbed energy is converted to heat, which warms the greenhouse. The glass helps keep the greenhouse warm by trapping this heat.

The earth's atmosphere acts somewhat like the glass of a greenhouse. About 31 % of the incoming radiation from the sun is reflected directly back to space by the earth's atmosphere and surface (particularly by snow and ice), and another 20 % is absorbed by the atmosphere. The rest of the incoming radiation is absorbed by the earth's oceans and land, where it is converted into heat, warming the surface of the earth and the air above it. Particular gases in the atmosphere act like the glass of a greenhouse, preventing the heat from escaping.

These greenhouse gases absorb heat and radiate some of it back to the earth's surface, causing surface temperatures to be higher than they would otherwise be. The most important naturally occurring greenhouse gas is water vapour and it is the largest contributor to the natural greenhouse effect. However, other gases, although they occur in much smaller quantities, also play a substantial and growing role in the greenhouse effect. These include carbon dioxide, methane, and nitrous oxide.

Without this natural greenhouse effect, the earth would be much colder than it is now - about 33 °C colder - making the average temperature on the planet a freezing -18 °C rather than the balmy 15 °C it is now. The warmth of our climate is crucial because on earth and in the atmosphere, water can exist in all three of its phases - frozen as snow or ice, liquid as water, and gaseous as water vapour. The cycling of water from one phase to another is critical to sustaining life since it is this cycling of water through the land-ocean-atmosphere system that replenishes the water available to life on earth. The water cycle is also an important part of what drives our weather and the climate system generally.

http://www.climatechange.gc.ca/default.asp?lang=En&n=1A0305D5-1

Appendix B

The David Suzuki Article

Much like the glass of a greenhouse, gases in our atmosphere sustain life on Earth by trapping the sun's heat. These gases allow the sun's rays to pass through and warm the earth, but prevent this warmth from escaping our atmosphere into space. Without naturally-occurring, heat-trapping gases—mainly water vapour, carbon dioxide and methane—Earth would be too cold to sustain life as we know it.

The danger lies in the rapid increase of carbon dioxide and other greenhouse gases that intensify this natural greenhouse effect. For thousands of years, the global carbon supply was essentially stable as natural processes removed as much carbon as they released. Modern human activity—burning fossil fuels, deforestation, and intensive agriculture—has added huge quantities of carbon dioxide and other greenhouse gases.

Today's atmosphere contains 42 per cent more carbon dioxide than it did at the start of the industrial era. Levels of methane and carbon dioxide are the highest they have been in nearly half a million years.

The Kyoto Protocol covers six greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. Of these six gases, three are of primary concern because they are closely associated to human activities.

Carbon dioxide is the main contributor to climate change, especially through the burning of fossil fuels.

Methane is produced naturally when vegetation is burned, digested or rotted without the presence of oxygen. Large amounts of methane are released by cattle farming, waste dumps, rice farming and the production of oil and gas.

Nitrous oxide, released by chemical fertilizers and burning fossil fuels, has a global warming potential 310 times that of carbon dioxide.

http://www.davidsuzuki.org/issues/climate-change/science/climate-change-basics/greenhouse-gases/

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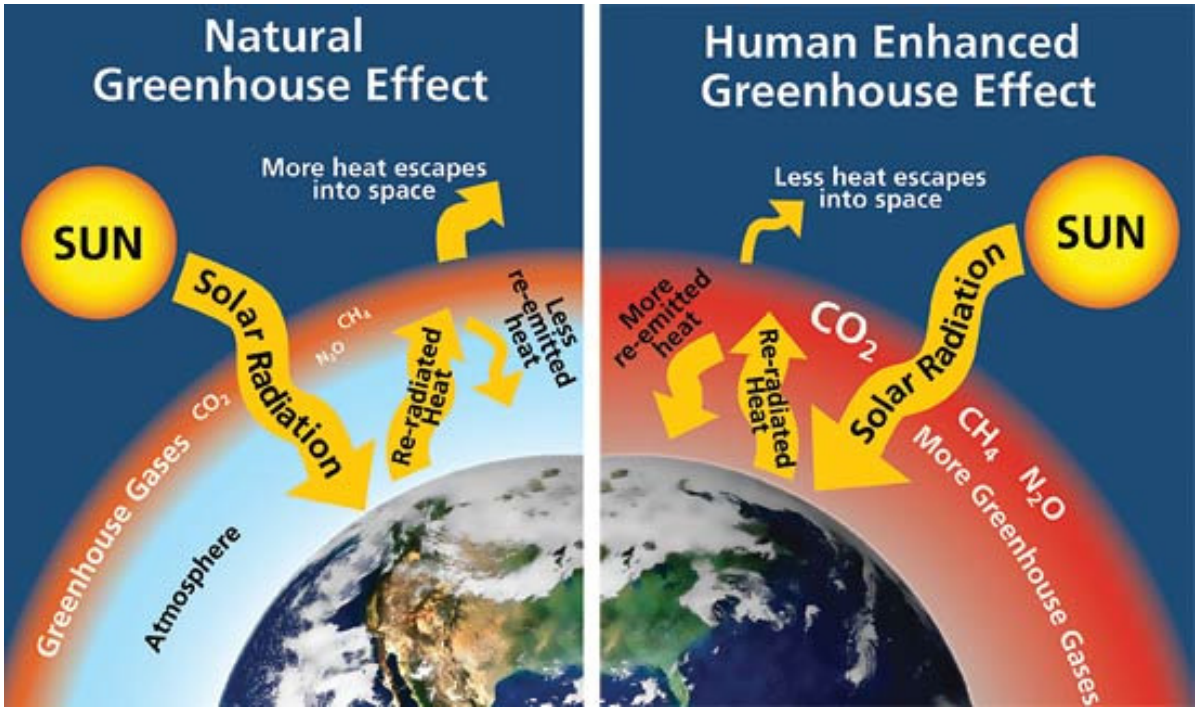
Appendix C

The Greenhouse Effect Diagram



http://www.google.ca/imgres?q=what+is+the+greenhouse+effect&sa=X&biw=1366&bih=592&tbm=isch&tbnid=nYnpoEO2cLxGIM:&imgrefurl=http://seedtofeedme.blogspot.com/2012/05/what-is-greenhouse-effect.html&docid=YSlzqSIesAeBmM&imgurl=http://1.bp.blogspot.com/-6ybybLjnom4/T6QsnUl2wCI/AAAAAAAABN4/QVCq50OSOdw/s400/Greenhouse_effect.jpg&w=467&h=350&ei=q2LkUYLoNOfdyAHR2oGoBQ&zoom=1&ved=1t:3588,r:2,s:0,i:92&iact=rc&page=1&tbnh=180&tbnw=259&start=0&ndsp=10&tx=80&ty=60#imgdii=nYnpoEO2cLxGIM%3A%3BNmslNjY57rHK1M%3BnYnpoEO2cLxGIM%3A

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Appendix D

Responsible Stewardship

Nature has attained its fulfillment in human beings, who have received the task of giving thanks for it and caring for it. This care, identified as "subduing" (Gn 1.28) in the Bible, is not domination but rather "responsible stewardship." As stewards, human beings recognize that the environment does not belong to them but is a gift entrusted to them which demands responsibility in action. Human beings discern the role granted to them by God by exercising their intelligence and ethical judgment. [1]

The created world, structured in an intelligent way by God, is entrusted to our responsibility and though we are able to analyze it and transform it we cannot consider ourselves creation's absolute master. We are called, rather, to exercise responsible stewardship of creation, in order to protect it, to enjoy its fruits, and to cultivate it, finding the resources necessary for everyone to live with dignity. Through the help of nature itself and through hard work and creativity, humanity is indeed capable of carrying out its grave duty to hand on the earth to future generations so that they too, in turn, will be able to inhabit it worthily and continue to cultivate it. [2]

Human beings legitimately exercise a responsible stewardship over nature, in order to protect it, to enjoy its fruits and to cultivate it in new ways, with the assistance of advanced technologies, so that it can worthily accommodate and feed the world's population. [3]

If we examine carefully the social and environmental crisis which the world community is facing, we must conclude that we are still betraying the mandate God has given us: to be stewards called to collaborate with God in watching over creation in holiness and wisdom. [4]

These quotes were taken from:

January 28, 2013 Feast of St. Thomas Aquinas

Episcopal Commission for Justice and Peace of the Canadian Conference of Catholic Bishops

1 Building a New Culture: Central Themes in Recent Church Teaching on the Environment (Episcopal Commission for Justice and Peace of the Canadian Conference of Catholic Bishops)

2 Benedict XVI, General Audience (August 26, 2009).

3 Benedict XVI, *Caritas in Veritate* (2009) 50.

4 John Paul II and Ecumenical Patriarch Bartholomew I, Common Declaration of John Paul II and the Ecumenical Patriarch Bartholomew I (June 10, 2002).

Appendix E

Simulator Questions on the Greenhouse Effect

You ask the questions in BOLD type.

1) ****Hypothesize why the inside of a car feels so much warmer than its surroundings on sunny days.**
2) Go to http://phet.colorado.edu/en/simulation/greenhouse

Part I: A Greenhouse Simulation

3) Select the "Glass Layers" tab.
4) **What do the yellow stars represent?**
5) **What do the red stars represent?**
6) Both the yellow and red stars represent forms of energy in the form of photons: the yellow are visible light, the red are heat.
7) **Record the approximate temperature "inside the greenhouse" before adding glass panes.**
8) Add one glass pane.
9) ****What do the sunlight photons do when they hit the glass from the top?**
10) ****What do the infrared photons do when they hit the glass from the bottom? Be specific.**
11) **What is the new temperature "inside the greenhouse?"**
12) ****Based on the observations of the photons, why does the temperature go up so much?**
13) **What happens to the temperature as additional glass panes are added?**
14) ****Explain why this happens by observing the photons.**
15) ****Before proceeding to the earth, predict how what you have discovered regarding greenhouses might apply to the earth and its atmosphere.**

Part II: The Earth Simulation

16) Select the "Greenhouse Effect" tab.
17) **Which greenhouse gases are considered by the simulation?**
18) **Which time period do the default conditions represent?**
19) The thermometer represents the average global temperature.
20) **What is the average global temperature for the "today" simulation?**
21) **Is the behavior of the photons more similar to the greenhouse simulation with or without glass panes?**
22) Reduce the greenhouse gas concentration to "None".

23) Is the behavior of the photons more similar to the greenhouse simulation with or without glass panes?

24) What is the average global temperature?

25) **Considering the behavior of the photons, why does the temperature drop so much?

26) Increase the greenhouse gas concentration to "Lots."

27) What is the average global temperature?

28) **Considering the behavior of the photons, why does the temperature increase?

29) Experiment with other periods in earth's history or add clouds and record interesting observations.

Part III: **THIS IS THE MOST IMPORTANT PART OF THE LAB!!**

Write a paragraph that answers the following questions:

1. How does the "greenhouse effect" affect temperature on the earth?

2. How is the "greenhouse effect" similar to blankets on a bed?

3. Is the "greenhouse effect" good or bad for the earth?

YOU MUST USE EVIDENCE FROM YOUR OBSERVATIONS OF THE SIMULATION TO SUPPORT YOUR ANSWERS.

These questions were taken from http://phet.colorado.edu/en/contributions/view/3079 which is attached to the initial page of http://phet.colorado.edu/en/simulation/greenhouse

4. Given the quotes below, write a paragraph describing whether you think we are respecting God's plan for creation? You may want to address whether you think the Church supports or condones abuse of our natural resources? Be sure to reflect on your role as a responsible citizen who respects the environment and uses resources wisely.

The Church has a responsibility towards creation and she must assert this responsibility in the public sphere. In so doing, she must defend not only earth, water and air as gifts of creation that belong to everyone. She must above all protect mankind from self-destruction. There is need for what might be called a human ecology, correctly understood. The deterioration of nature is in fact closely connected to the culture that shapes human coexistence: *when 'human ecology' is respected within society, environmental ecology also benefits*. Just as human virtues are interrelated, such that the weakening of one places others at risk, so the ecological system is based on respect for a plan that affects both the health of society and its good relationship with nature.[1]

[1] Benedict XVI, *Caritas in Veritate* (2009) 51.
"The ecological crisis is a moral issue" and "the responsibility of everyone," says Pope John Paul II.

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Appendix F

The Critical Analysis Process	
Initial Reaction Appendix A Appendix B	**What is a greenhouse? How does it work? How does this relate to the earth and our current temperature? Do we need the greenhouse effect for our survival?**
	What gases are primarily responsible for the warming? Are these gases increasing or decreasing? Why?
Analysis & Interpretation Appendix A Appendix B Appendix C	**What has modern human activity caused?**
	Do you know what the Kyoto Protocol is? Explain what the enhanced (anthropogenic) greenhouse effect is.

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Cultural Context	**What do you know about Canada's role towards being a contributor towards greenhouse gases?**
Ongoing Reflection Appendix D Consolidation Activity	**What is responsible stewardship? What generations does it apply to and why?**
	State why or why not you think that our current economic practices betrays " the mandate God has given us; to be stewards called to collaborate with God in watching over creation in holiness and wisdom. "

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Appendix G

Catholic Social Teaching: Stewardship of God's Creation

Student Name_____ Date: _____

Catholic tradition insists that we show our respect for the Creator by our stewardship of creation. We are called to protect people and the planet, living our faith in relationship with all of God's creation. This environmental challenge has fundamental moral and ethical dimensions which cannot be ignored.

Read the following points from ***The Catholic Coalition for Climate Change*** ***http://catholicclimatecovenant.org/catholic-teachings/.*** For each of the four points, highlight one phrase that speaks to you in some way and record them here.

By learning about this Catholic Social Teaching, it is hoped that students will understand that …	One Phrase	How is this phrase connected to what you already know or think? What question or wonderings do you have about this phrase?
"Preservation of the environment, promotion of sustainable development and particular attention to climate change are matters of grave concern for the entire human family."[1]		
"Can we remain indifferent before the problems associated with such realities as climate change, desertification, the deterioration and loss of productivity in vast agricultural areas, the pollution of rivers and aquifers, the loss of biodiversity, the increase of natural catastrophes and the deforestation of equatorial and tropical regions? Can we disregard the growing phenomenon of "environmental refugees", people who are forced by the degradation of their natural habitat to forsake it – and often their possessions as well – in order to face the dangers and uncertainties of forced displacement? Can we remain impassive in the face of actual and potential conflicts involving access to natural resources? All these are issues with a profound impact on the exercise of human rights, such as the right to life, food, health and development." [2]		

"Global climate is by its very nature a part of the planetary commons. The earth's atmosphere encompasses all people, creatures, and habitats. The melting of ice sheets and glaciers, the destruction of rain forests, and the pollution of water in one place can have environmental impacts elsewhere. As Pope John Paul II has said, " We cannot interfere in one area of the ecosystem without paying due attention both to the consequences of such interference in other areas and to the well being of future generations." Responses to global climate change should reflect our interdependence and common responsibility for the future of our planet." [3]		
"At its core, global climate change is not about economic theory or political platforms, nor about partisan advantage or interest group pressures. It is about the future of God's creation and the one human family. It is about protecting both "the human environment" and the natural environment. It is about our human stewardship of God's creation and our responsibility to those who come after us." [4]		

1 (Pope Benedict XVI, Letter of His Holiness Benedict XVI to the Ecumenical Patriarch of Constantinople on the Occasion of the Seventh Symposium of the Religion, Science and the Environment Movement , 2007 http://www.vatican.va/holy_father/benedict_xvi/letters/2007/documents/hf_ben-xvi_let_20070901_symposium-environment_en.html)

2 (Pope Benedict XVI, 2010 World Day of Peace Message, No. 4, http://www.vatican.va/holy_father/benedict_xvi/messages/peace/documents/hf_ben-xvi_mes_20091208_xliii-world-day-peace_en.html)

3 (USCCB, Global Climate Change: A Plea for Dialogue, Prudence, and the Common Good, 2001, http://www.nccbuscc.org/sdwp/international/globalclimate.shtml)

4 (USCCB, Global Climate Change: A Plea for Dialogue, Prudence, and the Common Good, 2001, http://www.nccbuscc.org/sdwp/international/globalclimate.shtml

Grade 12

Equity and Inclusive Education: **From the Lens of the Catholic Social Teachings**	**Subject: Mathematics** **Code: MDM4U** **Lesson Title:** Which country is a good steward? Suggested length of time: 75-225 minutes
	Lesson Overview This lesson allows students to collaboratively analyze data sets on stewardship variables for four countries. Students will analyze the data from one variable and prepare a report for the class. The class will decide which variables are most effective to measure a country's stewardship.

CURRICULUM CONNECTIONS	CATHOLIC SOCIAL TEACHINGS & ONTARIO CATHOLIC SCHOOL GRADUATE EXPECTATIONS
Mathematics MDM4U **Strands:** C. Organization of Data for Analysis D. Statistical Analysis **Overall and Specific Expectations:** C2. Describe the characteristics of a good sample, some sampling techniques, and principles of primary data collection, and organize data to solve a problem. C2.5 collect data from secondary sources and organize data with one or more attributes to answer a question or solve a problem	The **Catholic Social Teaching** evident in this lesson: **Stewardship of God's Creation** The **Ontario Catholic School Graduate Expectations** evident in this lesson include: **An effective communicator who:** 2 (c) presents information and ideas clearly and honestly and with sensitivity to others. **A reflective, creative and holistic thinker who:** 3 (c) thinks reflectively and creatively to evaluate situations and solve problems. **A responsible citizen who :** 7 (f) respects and affirms the diversity and interdependence of the world's peoples and cultures.

	D2. Analyze, interpret, and draw conclusions from two-variable data using numerical, graphical and algebraic summaries. D2.1 recognize that the analysis of two-variable data involves the relationship between two attributes, recognize the correlation coefficient as a measure of the fit of the data to a linear model, and determine, using technology, the relevant numerical summaries. D2.2 recognize and distinguish different types of relationships between two variables that have a mathematical correlation D2.3 generate, using technology, the relevant graphical summaries of two-variable data D2.4 determine, by performing a linear regression using technology, the equation of a line that models a suitable two-variable data set, determine the fit of an individual data point to the linear model D2.5 interpret statistical summaries to describe the characteristics of a two variable data set and to compare two related two-variable data sets; describe how statistical summaries can be used to misrepresent two-variable data; and make inferences, and make and justify conclusions, from statistical summaries of two-variable data orally and in writing, using convincing arguments.	

Guiding Questions from the Framework

These guiding questions have been selected from the framework focusing on:

Equity and Inclusive Education:

- What gifts do you bring to share with your classmates and how will you use these gifts to support your learning and the learning of others?
- How can we recognize the gifts of others and value them?
- How do you see yourself as a valued and contributing member of this class, school, community, and society?

Catholic Social Teaching:

- If we believe that all creation is good and sacred, and we are called to be stewards of the earth, what does this lesson call us to do?
- What alliances/supports do you need to implement your stewardship plan?
- How can we express our understanding that as stewards we are our brother and sister's keeper?
- What does good stewardship of creation look like?

Ontario Catholic Graduate Expectations:

- How does the Catholic Social Teaching, Stewardship, call us to respond or act:
  - as an effective communicator who presents information and ideas clearly and honestly and with sensitivity to others?
  - as a reflective, creative and holistic thinker who thinks reflectively and creatively to evaluate situations and solve problems?
  - as a responsible citizen who respects and affirms the diversity and interdependence of the world's peoples and cultures?

- A scripture reading that inspired this lesson: "As each has received a gift, use it to serve one another, as good stewards of God's varied grace", 1 Peter 4:10.

Critical Literacy:

- What kinds of issues of equity, power and social justice are relevant to the topic?
- How can we analyze the information presented for bias, reliability, fairness, and validity?

Teachers and students may select additional questions from the framework to guide their learning inquiry.

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LEARNING GOALS

At the end of this lesson, students will know, understand and/or be able to:

- Collaboratively analyze a dataset for four countries using technology;
- Collaboratively create convincing arguments to be shared with the class;
- Determine effective indicators to measure a country's stewardship.

Success Criteria, based on the Learning Goals, can be co-constructed as a class in language meaningful to students. The success criteria help students understand what to look for during the learning and what it looks like once they have learned. They identify the significant aspects of student performance that are assessed and/or evaluated (i.e., the "look-fors") in relation to curriculum expectations.

Sample Success Criteria

I can:

- Create using technology appropriate statistical summaries to analyze the relationship between two variables
- Based upon the analysis, choose which country is the most effective at being a steward of God's creation
- Orally make convincing arguments to the class using appropriate terminology
- Determine effective measures of a country's stewardship

INSTRUCTIONAL COMPONENTS AND CONTEXT

Prior Learning

Teacher Readiness: Prior to this lesson, the teacher will have:

- Familiarity with Literacy strategies such as Frayer models
- Familiarity using technology to create scatter plots, lines and curves of best fit
- Comfort with students working in heterogeneous groups and facilitating whole group discussions where students share and debate

Materials:

Appendix A Frayer Model: Stewardship
Appendix B Which County is a Good Steward?
Appendix C Data Sets
Appendix D Data Values for 2010

Handheld graphing technology (TI 83/84 or Nspire) or computer access (Fathom or Excel)

Quad-ruled chart paper and markers for each group

Coloured self-adhesive dots

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	Student Readiness: Prior to this lesson, students will have: • Created scatter plots, lines of best fit and quadratic curves of best fit using technology • Determine the equation of the line of best fit from a graph with technology • Make predictions using the regression equation • Prepare and share convincing arguments **Terminology** Stewardship, Correlation, Correlation coefficient, Regression equation	**Internet Resources:** www.gapminder.org/data http://data.worldbank.org www.nationmaster.com See appendix E for Teacher resources to support function modeling using technology **NOTE:** This lesson is good preparation for the culminating project described in strand E of the curriculum document.

	MINDS ON	**CONNECTIONS**
	Form heterogeneous groups of four students. If there are more than 24 students it is preferable to have extra groups than make larger groups. Assign roles to the members of each group (recorder, reporter, technology expert, encourager/time keeper) **Groups of 4 → Frayer Model** Distribute Appendix A Frayer Model: Stewardship. Groups complete the Frayer Model and brainstorm variables to measure a country's stewardship. **Whole Class → Sharing** Reporters from each group share one part of their Frayer Model. Synthesize shared work on blackboard /whiteboard/ chart paper. Lead a class discussion on variables to measure a countries stewardship (air pollution, percent of energy coming from green sources, water conservation, etc.) Record the variables for later use.	

	ACTION	CONNECTIONS
	Whole Class → Setting the Context Distribute Appendix B Which Country is a Good Steward? Explain how each group will analyze data on one variable for the four countries. They must apply their statistical skills and recommend which country is a good steward of God's creation and which are not. **Groups of 4 → Data Analysis** Distribute the data sets in Appendix C Data Sets so that each of the 6 groups has a different data set. Each group will follow the method on Appendix B. When they have analyzed all four countries analysis, distribute Appendix D Data Values for 2010 so that they can judge the validity of their predictions. Remind groups of the requirements for their report. **Groups of 4 → Group reports** Have groups make their reports in the order of the data sets. Encourage other groups to comment and ask questions. Have groups post their chart paper reports. **Whole Class → Gallery Walk** Have students visit the other 5 group reports.	 Differentiation of Learning based on interest since environmental issues are of keen interest to most students.  Differentiation of Learning based on readiness since some data sets have fewer numbers (5 & 6) and some data sets can me modelled using linear relations (2, 4, & 6) Assessment **for** learning: — Monitor groups during activity to check for application of statistical skills — Provide descriptive feedback as necessary

	CONSOLIDATION	CONNECTIONS
	Whole Class → Discussion Lead a discussion on which of the data sets best indicates a country's good stewardship. How does Canada fare as a steward of God's creation? (Not very well!)	Ensure that students understand that this numerical analysis is limited in scope. There are many quantitative variables such as

	Whole Class → Dotmocracy Place the names of the four countries on the blackboard/whiteboard/chart paper. Provide each student with 3 coloured dots. Ask them to vote for the country that is the best steward. Students can place all dots on one country or distribute them as they see fit. **Individual → Reflection/Exit Ticket** Students can reflect on one of the following: 1. Mahatma Ghandi said "Live simply, so others can simply live". How can this guide you to become a better steward of God's creation? 2. Looking at the variables discussed in the Minds On, which variable would you like to collect data on for further study? Why? 3. Which countries should we have included in the data analysis? Provide reasons for your choice.	political system, economic challenges, history as a colony, natural factors and so on to consider when determining if a country is a good steward. Assessment **as** learning: — Students reflect on how they can become a better steward of God's creation.  Differentiation of Learning based on interest since by providing choice students can reflect on an area of personal interest.

	CONTINUED LEARNING OPPORTUNITIES
	Further extensions to this lesson might include: • Collect and analyze data on other countries to determine their stewardship. • Cultivate interest in stewardship projects in the school, community or internationally. • Continue analysis of the data for the culminating project for the course. .

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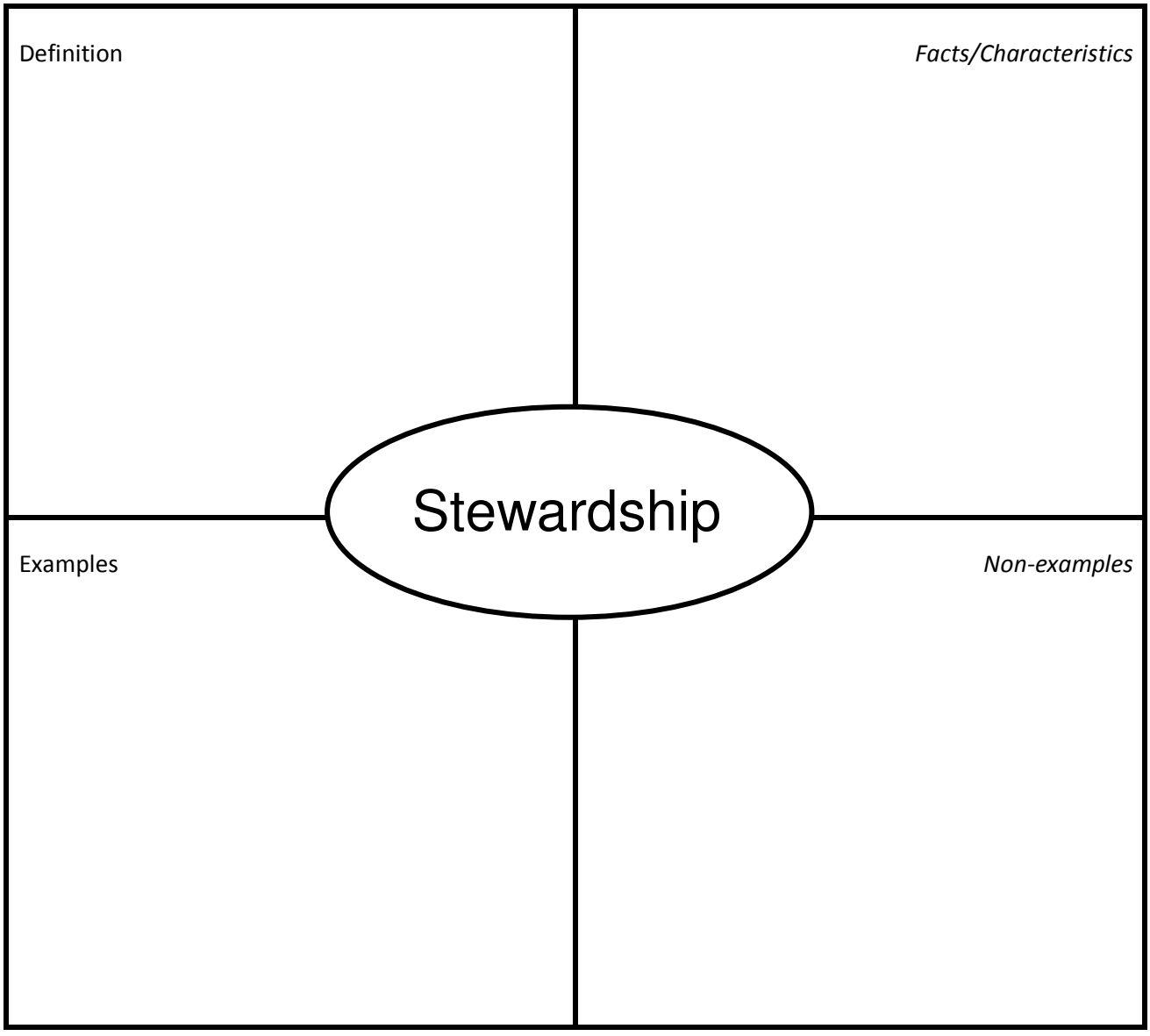
Appendix A

Frayer Model: Stewardship

Your group is asked to complete the following Frayer Model to activate your knowledge on Stewardship.
Be prepared to share with the class.



How can we measure a country's stewardship? Be prepared to share what data variables or statistics your group determine with the class.

Equity and Inclusion: Through the Lens of the Catholic Social Teachings

Appendix B

Which Country is a Good Steward?

Your group of four will be provided with some data on one variable for four countries: Australia, Canada, China and India. Your task is to apply your statistical skills to analyze the data and make recommendations about which of the four countries is a good steward of God's creation. Each of the 6 groups has a different data set to analyze. Once your analysis is complete, your group will be asked to make a report to the class.

Method:

1. Using technology, create a scatter plot for all four countries on the same plot.
2. For each country, determine an appropriate algebraic model (linear, quadratic, exponential,…) for the relationship between the two variables. Use technology to determine the regression equations. Include measures such as correlation coefficient.
3. Make a prediction for each country for 2010 using your algebraic models.

Once you have completed the method above, your teacher will provide you with actual data collected for 2010 for your group to judge the validity of your prediction.

Create on a chart paper a report that will include:

- A description of the variables in your data set.
- Trends you observed in the scatter plot.
- The algebraic models you calculated and your confidence in the accuracy of the model.
- The predictions you calculated with your algebraic models.
- How accurate the predictions were. Offer possible reasons for any discrepancies.
- Based on your data analysis, which country was a good steward of God's creation? Which one is not being a very good steward?

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Data Sets **Appendix C**

Data Set 1: Total Carbon Dioxide Emissions over Time

This table contains total CO_2 emissions from fossil fuels measured in thousands of metric tonnes over the twentieth century.

Total CO2 Emissions (Thousands of Metric Tonnes)	**1900**	**1910**	**1920**	**1930**	**1940**	**1950**
Australia	10175	17750	26242	26704	36553	54784
Canada	20643	51660	84440	94424	108706	154257
China	14675	18762	26789	37950	86163	78705
India	13061	26609	39585	49493	57739	66627

Total CO2 Emissions (Thousands of Metric Tonnes)	**1960**	**1970**	**1980**	**1990**	**2000**
Australia	88194	147605	220726	287305	329575
Canada	192878	341455	428509	450036	534435
China	780655	771547	1467059	2460520	3404870
India	120571	195125	348550	690514	1186555

Source: GapMinder (http://www.gapminder.org/data/)

Data Set 2: Carbon Dioxide Emissions per Capita over Time

This table contains CO_2 emissions from fossil fuels per capita measured in metric tonnes over the twentieth century.

CO2 Emission per Capita (Metric tonnes)	1900	1910	1920	1930	1940	1950
Australia	2.72	4.06	4.90	4.13	5.19	6.70
Canada	3.78	7.19	9.60	9.00	9.30	11.23
China	0.03	0.04	0.06	0.08	0.17	0.14
India	0.05	0.11	0.15	0.18	0.18	0.18

CO2 Emission per Capita (Metric tonnes)	1960	1970	1980	1990	2000
Australia	8.57	11.60	15.01	16.81	17.20
Canada	10.77	15.72	17.48	16.25	17.43
China	1.19	0.95	1.49	2.15	2.68
India	0.27	0.35	0.50	0.79	1.13

Source: GapMinder (http://www.gapminder.org/data/)

Data Set 3: Total Energy Use over Time

This table contains total energy use measured in metric tonnes of oil equivalent (TOE) since 1960. (TOE has other forms of energy converted into an equivalent amount of oil.)

Total Energy Use (TOE)	1960	1965	1970	1975	1980
Australia	31482545	39439099	50821086	60377192	69603086
Canada	76134958	101419082	138102509	165946829	192608778
China	342634190	397426525	418975000	481694510	598340330
India	87657456	98245674	138765498	177729528	205154559

Total Energy Use (TOE)	1985	1990	1995	2000
Australia	72824350	86226020	92558819	108109901
Canada	192997918	208542479	230773318	251439673
China	692403757	872118625	1046182765	1182687596
India	254787758	316743223	384284782	457214205

Source: GapMinder (http://www.gapminder.org/data/)

Data Set 4: Energy Use per Capita over Time

This table contains total energy use per capita measured in metric tonnes of oil equivalent (TOE) since 1960. (TOE has other forms of energy converted into an equivalent amount of oil.)

Energy Use per Capita (TOE)	1960	1965	1970	1975	1980
Australia	3.06	3.46	4.06	4.35	4.74
Canada	4.25	5.15	6.48	7.15	7.83
China	0.51	0.56	0.52	0.53	0.61
India	0.20	0.20	0.25	0.29	0.29

Energy Use per Capita (TOE)	1985	1990	1995	2000
Australia	4.62	5.05	5.12	5.64
Canada	7.44	7.50	7.86	8.17
China	0.66	0.77	0.87	0.94
India	0.32	0.36	0.40	0.43

Source: GapMinder (http://www.gapminder.org/data/)

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Data Set 5: Total Water Use over Time

This table contains total water use in millions of cubic meters since 1980.

Total Water Use (Millions of Cubic Meters)	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**
Australia	12600	14600	19875	24070	21700	18770
Canada	31750	42380	43890	47250	42214	42060
China	443700	481100	500000	525400	550960	561100
India	438300	497400	500000	517500	610400	613400

Sources:

1. GapMinder (http://www.gapminder.org/data/)
2. World Bank Data Indicators (http://data.worldbank.org/indicator)
3. AquaStat (http://www.fao.org/nr/water/aquastat/main/index.stm)

Data Set 6: Water Use per Capita over Time

This table contains total water use in millions of cubic meters since 1980.

Water Use per Capita (Cubic Meters)	1980	1985	1990	1995	2000	2005
Australia	878	913	958	1198	1152	963
Canada	1291	1589	1579	1610	1372	1314
China	452	457	440	436	436	439
India	626	634	572	536	579	501

Sources:

1. GapMinder (http://www.gapminder.org/data/)
2. World Bank Data Indicators (http://data.worldbank.org/indicator)
3. AquaStat (http://www.fao.org/nr/water/aquastat/main/index.stm)

Appendix D

Data Values for 2010

This table contains the values for 2010 for all of six data sets.

Country	**Total CO2 Emissions (Thousands of Metric Tonnes)** (Data Set 1)	**CO2 Emission per Capita (Metric tonnes)** (Data Set 2)
Australia	361902	16.25
Canada	523837	15.40
China	8287717	6.18
India	2099870	1.71

Country	**Total Energy Use (TOE)** (Data Set 3)	**Energy Use per Capita (TOE)** (Data set 4)
Australia	124727715	5.59
Canada	251838454	7.38
China	2417125926	1.81
India	692689009	0.57

Total Water Use (Millions of Cubic Meters)	**Total Water Use (Millions of Cubic Meters)** (Data Set 5)	**Water Use per Capita (Cubic Meters)** (Data Set 6)
Australia	14100	890
Canada	37250	1092
China	593400	443
India	623600	509

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Appendix E

Teacher Resources to Support Function Modeling using Technology

TI 83/84 Graphing Calculator

http://education.ti.com/en/us/pd/online-learning/tutorials#navigation-tab-contents=navigation-element-tab-contents-1
See Atomic Learning videos in C. Working with Lists

http://mthsc.clemson.edu/ug_course_pages/view_item.py?id=82

http://fym.la.asu.edu/~tturner/MAT_117_online/Regression/Linear%20Regression%20Using%20the%20TI-83%20Calculator.htm

http://www.pstcc.edu/facstaff/jahrens/calculator/stats83.pdf

http://www.online.math.uh.edu/GraphCalc/ (See videos 17-20)

TI Nspire Handheld (Non-CAS or CAS version)

http://education.ti.com/en/us/pd/online-learning/tutorials#navigation-tab-contents=navigation-element-tab-contents-0
See Atomic Learning videos in "C. Lists and Spreadsheets"

http://mathbits.com/MathBits/TINSection/Statistics2/ExponentialModel.html

Computer Software (Fathom, Excel & Graphmatica)

http://www.keycurriculum.com/products/fathom

http://www.edugains.ca/resources/LearningMaterials/TechnologySupports/SoftwareSupport/FathomResources.pdf

http://staff.district87.org/powelln/Calculus/Chapter1/modeling_howto.doc