



Chapter 6: Global Climate Change

Science, Ethics, Spirituality, Action

<http://healingearth.ijep.net/climate>

Introduction

The *Healing Earth* team asks that when you use any aspect of this teacher guide or the lesson modules that you please send an email sharing: 1) how you used the resource, 2) how your students responded to the resource, activity, or lesson, and 3) what changes you would recommend for future versions of the guide. Please email Dr. Michael Schuck (mschuck@luc.edu) and Dr. Nancy Tuchman (ntuchma@luc.edu). The information that you share will help improve these resources for your and others' use. We appreciate your feedback.

Overview

This chapter presents the science behind global climate change in connection with ethical decisions, an environmental spirituality, and actions throughout the world. Global climate change may be a politicized or distant topic for some students, so it is especially important to integrate the topics in this chapter to students' lives. Connecting the rigorous scientific methods of data collection and the idea of scientific evidence with moral decision-making will help to illuminate both areas of climate science. Discussing deeply held beliefs and the notion of truth or beliefs in science will emphasize the ways in which science and spirituality influence each other. Finally, investigating tangible actions that address these planet-wide issues can help make the sheer magnitude of global climate change less daunting. This integrated approach can help to connect students with the material and hopefully take actions to mitigate the negative impacts of global climate change on our planet.

By the end of the chapter, students should understand the terms behind climate, weather, and atmosphere; the detection methods and evidence for climate change; the anthropogenic and natural causes for climate change; and specific examples of the impact of global climate change. Additionally, students should learn some tools for ethical decision-making in regard to climate change. They should

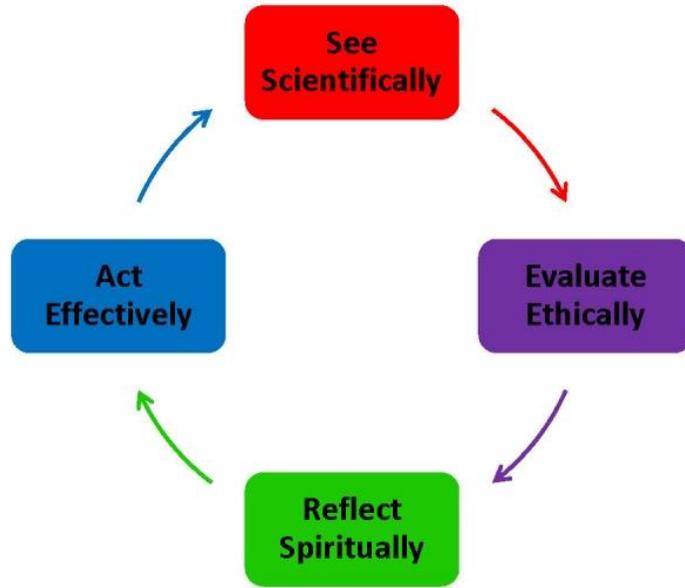
be able to connect their spirituality with the natural world and the ideas of change and seasonality. Finally, students should become aware of actions that communities around the world are taking in regard to climate change and identify possible actions in their own life or communities.

Learning Objectives

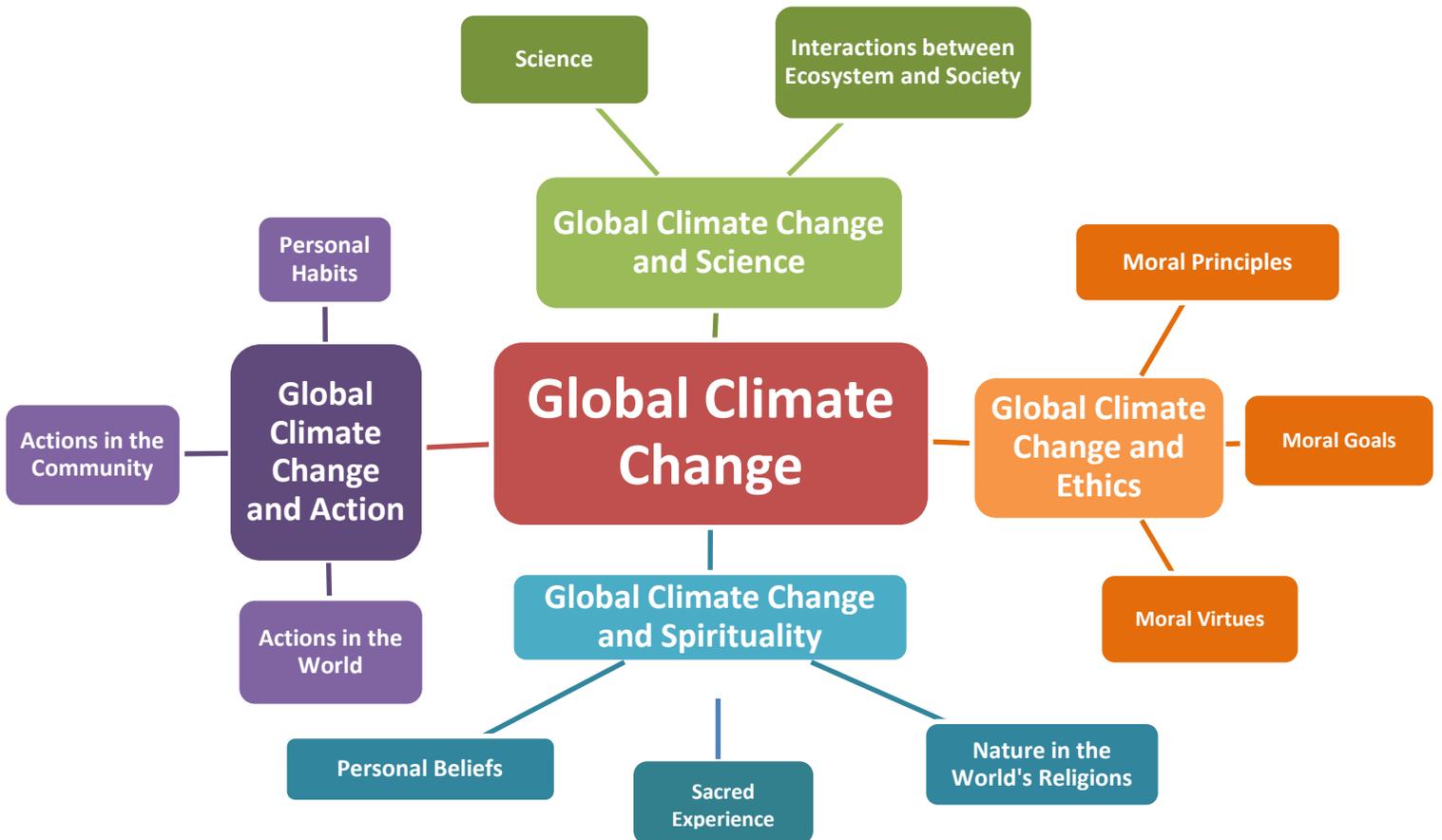
1. Investigate a **case study** that illustrates the impact of climate change on a community of our human population.
2. Understand the key scientific **concepts** of global climate change.
3. Explain the major **symptoms** of global climate change.
4. Analyze the **causes** of climate change and see how human activities affect the climate.
5. Show the **consequences** of global climate change for ecosystems and human society.
6. Recognize the **moral** principles, goals, and virtues needed for making sound policy and lifestyle responses to global climate change.
7. Describe why and how the challenge of global climate change is raising **spiritual** questions.
8. Plan and execute an environmental **action** that addresses climate change in their community.

Connection of this Chapter to Ignatian Pedagogy

As stated above, an integrated understanding of global climate change engages students more fully because it engages *them* more fully as subjects, as *whole human beings* invited to connect their scientific curiosity, their moral lives, their deepest beliefs, and their energy to act. This follows the spirit of Ignatian Pedagogy, the method at the heart of *HE*. In *HE*, you are first invited to “see scientifically” and relate what you see to your own experience. Next, you are asked to reflect on the values (“evaluate ethically”) and meaning (“reflect spiritually”) that emerge in the study of environmental science. Finally, you are challenged to take the knowledge you have gained and act to heal the Earth (“act effectively”).



When we elaborate this Ignatian Pedagogy figure with the major topics covered in the Global climate change Chapter, the following graph emerges.



As teachers, we should be sensitive to the ‘entry point’ into the subject of global climate change that attracts student attention. Possibly that entry point is science, or maybe a local environmental action linked to global climate change is a better point of departure. In these cases, we can capitalize on local events and, from there, guide students to global climate change science. The same can be true of a moral issue in global climate change. Possibly students have an interest in natural disaster frequency, from which we can bring students to the science of global climate change. The point to keep in mind is that the major topic areas in each *HE* chapter are movable; you can enter the chapter at any topic area and move along to the remaining topics in the order you find most helpful.

Lesson Outline and Suggested Activities

Please keep in mind that while the activities below are presented in a linear outline form, *Healing Earth* emphasizes an integrated approach that encompasses science, ethics, spirituality, and action. It is important that students do not see these as separate topics but as mutually reinforcing, interconnected dimensions of each subject, whether that be biodiversity, natural resources, energy, water, food, or global climate change.

I. Case Study: Mongolian Herders	<i>Raises scientific, ethical, spiritual, and action questions.</i>
	<p>The chapter opens with a case study to peak students’ interests in the causes and effects of global climate change around the world. Topics that are introduced include but are not limited to:</p> <ul style="list-style-type: none"> • Indigenous knowledge of seasonality • Effects of average temperature changes over time • Weather cycles • Spiritual and personal connections to weather and climate • Moral responsibility for the causes of climate change • Political action <p>The Mongolian Herder case study gives specific examples of the effects of Global Climate Change, a topic that might be disconnected from your students’ personal experiences. Because global climate change produces effects over long periods of time, dramatic examples like the ones presented here might help to emphasize the seriousness of climate change issues. Use the questions below to explore the case in more depth.</p> <ul style="list-style-type: none"> • What is global climate change and how does it produce the effects experienced by the Mongolian herdsman? • Global climate change has created new moral problems not only for Mongolian herdsman, but also for every human being on Earth. What are these moral problems? • Who is responsible for these problems? What moral principles, goals, and virtues should guide our response to these problems?

	<ul style="list-style-type: none"> • As seen with the Mongolian herdsman, the impact of global climate change is felt in the very culture and spirituality of persons and groups. How might spirituality be a resource in addressing global climate change? • As the climate of Mongolia changes, the herdsman must act to save their lives. How can we act in our communities to mitigate climate change and save lives? <p>You may also want to look at the reflection questions given at the end of this chapter and begin to ask some of them in ways related to the case study.</p>
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II. Global Climate Change and Science	<i>Offers a solid scientific understanding of global climate change.</i>
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This section contains several major sections:

- Descriptions of Climate, Weather, and Atmosphere including greenhouse gases
- Methods for defining and detecting climate change
- Specific evidence for climate change
- Drivers of climate change (both anthropogenic and natural)
- Impact of climate change on the global distribution of water, extreme weather events, ocean acidification, sea levels, and plants or animals

By the end of these lessons students should have a deeper understanding of global climate change, especially detecting and assessing the impact of small changes such as a few degrees in temperature. As you are going through the lessons, make sure to pay attention to the “Closer Look” and “Looking Ahead” boxes and expand on these as wanted. Make sure that students are continually reflecting back to the questions and objectives explained at the beginning of the chapter. Try and make connections to the students’ own communities and interests.

Activities/Projects:

1. **Scientific Research Process:** watch the following four minute TED talk by Rachel Pike about how many scientists write Intergovernmental Panel on Climate Change report:
http://www.ted.com/talks/rachel_pike_the_science_behind_a_climate_headline/transcript?language=en#t-0. Your students can conduct similar research based on the IPCC report using the attached activity “Global Warning” by Blake Colaianne from *the Science Teacher*.
2. **Phenology Networks:** connect your students with one of many citizen science projects, which track phenology trends (Project Bud Burst <http://budburst.org>, US Phenology Network <https://www.usanpn.org>, Squirrel Watch <http://projectsquirrel.org>, or any others that you find online.)
3. **Class Garden Project:** Help your students to research which plants survive best in your area based on the weather and climate. In the US, the following USDA Plant Hardiness Maps are a good place to start:
[\(http://planthardiness.ars.usda.gov/PHZMWeb/\)](http://planthardiness.ars.usda.gov/PHZMWeb/). Then work with your students to plant some of these plants near your school. Record observations as the plants grow

over the years with relevant data such as temperatures, average rain and snowfall, and any extreme weather events.

4. **Exploring Data and Graphs:** assign your students graphs from the National Climate Assessment Report for the United States (<http://nca2014.globalchange.gov/report>). Ask them to prepare a short summary of what each graph shows about global climate change.
5. **Preparing Data:** Assign your students different cities near the same latitude or longitude. Have them research and track weather or frost data (from reputable sources) over the past 50+ years to explore changes in these patterns. Help them to prepare a graph to portray these data to others. See if your students find any trends across the class data.
6. **Greenhouse Gases Lab:** the following outline presents a lab where students can model the greenhouse effect using soda bottles and obtain temperature data to make claims about how greenhouse gases affect the average planetary temperature: (http://www.esrl.noaa.gov/gmd/outreach/lesson_plans/Modeling%20the%20Greenhouse%20Effect.pdf).

III. Global Climate Change and Ethics

Guide students in their navigation of the principles, goals, and virtues that will allow them to make more informed choices in healing our Earth

It is important that you understand the logic that holds together the environmental ethic presented in *HE*. As explained in the Teacher Guide Introduction, the ethic is built on three foundations: the intrinsic value of nature, the instrumental value of nature, and the value of sustainability. The value of sustainability should shape how we use of nature (instrumental value); by using nature in a way that neither exhausts nor degrades it, we honor the integrity of the nature world (intrinsic value).

From these foundations a set of moral principles, goals, and virtues are derived that aid us in thinking through moral challenges that surface as human beings interact with the natural world. The foundations, principles, goals, and virtues used in *HE* are rooted in Roman Catholic social thought. You can see how these are presented and employed in such texts as Pope Francis' encyclical [*Laudato Si'*](#) (2015), Pope John Paul II's message [*The Ecological Crisis: A Common Responsibility*](#) (1990), the Southern African Catholic Bishops Conference's [*Pastoral Statement on the Environmental Crisis*](#) (1999), the Australian Catholic Bishops' statement [*A New Earth: The Environmental Challenge*](#) (2002), or the United States Conference of Catholic Bishops' pastoral statement [*Renewing the Earth: An Invitation to Reflection and Action on Environment in Light of Catholic Social Teaching*](#) (1991). All these texts are available on the internet at the provided hyperlinks.

Understanding the background logic to *HE's* environmental ethic is not, in the first instance, for the purpose of teaching it to your students. Rather, the purpose is to help you feel more comfortable taking a single foundation or norm and explore it in depth

with your students. You may, for example, wish to lead a class discussion on what the intrinsic value of nature means and what bearing this might have on the issue of species extinction. In other words, consider approaching the Ethics Section with an emphasis on *depth* rather than *coverage*. Your students may eventually develop a sense of what it means to have a coherent environmental ethic, but a better place to start is often with a specific ethical idea in relation to a specific moral problem.

There are many ways to conduct an informative exploration of environmental ethics as it pertains to global climate change. You may wish to facilitate small and large group discussion, a class debate, or a case study analysis.

Small and Large Group Discussion

The moral principles of the preferential option for the poor and the common good help to illuminate the extent of climate change (how is everyone affected) while drawing our attention to specific impacts (how are certain groups affected differently). Discuss the meaning and some examples of these principles with your students. Then have them read the following case studies and identify how these two moral principles apply for the groups involved (both humans and other living and non-living things). In small or large groups, ask your students to discuss the moral issues present and how the moral principles connect with these issues.

South Asia: [Climate Change Adaptation and Disaster Risk Reduction](#) in Bangladesh is a women-centered initiative that helps communities adapt to climate change by addressing extreme weather conditions such as cyclones and flooding.

Asia Pacific: Scientists estimate that by 2100, rising seas will drown the Pacific Ocean nation of Kiribati. To forestall disaster, the Kiribati government has developed a migration policy for its 103,000 citizens and has purchased 20 sq. kilometers of land on the island of Fiji for the day when residents will have to leave their homes. For this story, go [here](#).

Class Debate

The following case study discusses how some scientists in Columbia have worked to lessen the impact of climate change on food resources. Some ethical issues that connect with this case study include:

- Will people with limited resources be able to afford these new beans?
- Who will have the right to sell and grow the beans?
- What happens if these beans do not actually survive as the climate changes?
- Who should be responsible for researching and paying for this research?

Conduct a class debate with your students around these issues. You may have already discussed GMO foods in the Food chapter, so try to focus the debate in this chapter around issues more closely related to global climate change. For a more detailed method of preparing for this debate, have your students follow the questions in the outline at: http://www.scu.edu/ethics/practicing/focusareas/environmental_ethics/lesson12.html.

South America: Scientists in Columbia who work for the International Center for Tropical Agriculture (CIAT) have identified 30 “elite” lines of beans that show tolerance to temperatures 4 degrees Centigrade above the crop’s normal “comfort zone.” These lines represent a major breakthrough in protecting a vital protein source for the poor against the climate change scenario of a 4-degree temperature rise. A reduction in bean production due to climate change will have catastrophic effects on world food access. However, some of the heat-tolerant lines identified by the CIAT team have undergone genetic improvement for increasing the beans' iron content. This raises the ethical question of whether GMO research like this is an acceptable way to address climate change-induced food shortages. [Read](#) the article and discuss this issue with your teacher and your class.

Case Study Analysis

Many regions of the world are taking decisive actions to address issues related to climate change. Ask your students to read through the following regional reports and identify the actions that certain groups are taking. What effects have these actions had (positive or negative)? How could your students or school take similar actions?

Africa: In an effort to build resilience against climate change, several African nations are working with the European Union in an [Against Desertification](#) program. Funds and training aim at improving sustainable land management and restoring degraded land.

Europe: It is said that no region of the world fights climate change harder than Europe. To find out the latest developments in European Union actions against climate change, go [here](#).

North America: Today, the U.S. Environmental Protection Agency (EPA) recognizes that Indigenous cultures possess Traditional Ecological Knowledge (TEK) that can aid everyone in the fight against climate change. [Read more](#) about this developing partnership between the EPA and Indigenous people.

<p>IV. Global Climate Change and Spirituality</p>	<p><i>Shows the connection between global climate change and environmental spirituality.</i></p>
<p>It is very important, here, that you have a clear understanding of the approach taken toward spirituality in <i>HE</i>. Spirituality will undoubtedly be the most challenging part of <i>HE</i> for teachers and students to accept as related to environmental science. It will be tempting to move through the topic quickly, or not at all. This would, however, degrade the very purpose of <i>HE</i>, which is to educate the <i>whole person</i> in environmental science. And spirituality is part of what makes up a whole person.</p> <p>The difficulty is that most people immediately associate spirituality with either religion or some kind of mystical activity. The association of spirituality with religion is a problem for many people due to the history of some religions denying the results of</p>	

science or intruding into the work of scientists. The association of spirituality with mystical activity is a problem for many people because, again, this activity seems completely unrelated or dismissive of science.

It is important that you help your students understand that spirituality is--in the first instance--a **constitutive feature of every human life**. Students need to understand that **all people have a spirituality--that they have a spirituality**. As stated in the Teacher Guide Introduction, *HE* begins with the view that spirituality is "the energy and content of beliefs that lie at the core of [every] human being's personal identity." This is why every Ethics Section in *HE* invites students to probe their fundamental thoughts and feelings about the natural world. This is an invitation to explore their 'inner spirit', or spirituality.

HE also relates spirituality to the particular experiences some people have of sensing a *sacred* quality in nature. Everyone has a spirituality in terms of an 'inner spirit', but not everyone experiences nature as something sacred. Additionally, *Healing Earth* relates spirituality to the beliefs and rituals of the world's religions, with a particular interest on beliefs and rituals concerning the natural world. Again, everyone has a spirituality in terms of an 'inner spirit', but not everyone's spirituality is linked to a religion.

With this in mind, the Spirituality Section of the Global Climate Change chapter invites students to explore what global climate change means to them, how people experience climate as sacred, and how the world's religions treat weather and climate in their beliefs and rituals.

The material in this section can provide a breadth of information to connect with how students understand global climate change both scientifically and spiritually. The following activities can help to support these connections.

Global Climate Change and Personal Spirituality

Ask your students to make a list of cyclical parts of their spiritual lives. For example: do they have daily prayer or religious customs? Do they go to religious services each week? Are there special religious services at certain times of the year? Do they have certain regular spiritual practices with their families? Do they feel spiritually connected to nature at certain times of the year? Are there longer cycles, such as the three-year liturgical reading cycle for Catholics?

Then have your students reflect and write in their journal about how their life and spirituality might be affected if these cycles are disrupted. Has there ever been a time in their life where their cycles were interrupted by something out of their control? How did they react? A common theme throughout this chapter has been that people and other organisms depend on the natural cycles of the planet, and the disruption of these cycles, even in small ways, can cause imbalance in these other organisms. Discuss with your students if they think that these cycles in their spiritual lives and in nature are valuable or not and why they think so.

Global Climate Change and Sacred Experience

Ask students if they have ever seen an almanac. Share some example almanacs if possible (such as <http://www.almanac.com>). Explain the *Spiritual Almanac* as a blend of observing nature and reflecting personally. Have students pick a spot on campus or near their homes where they can commit to spending 10-15 minutes each day for about a week observing, sketching or taking a photo, and writing journal entries about their experiences. Share the following guiding questions with students: How does your natural location feel? Did it change since your previous observations? What do you observe about the location and about yourself as you sit in nature? What are you grateful for in this location on each day?

After they have kept their journal for a few weeks, check back in with your students to see if they have noticed anything that surprised, intrigued, or worried them as they were journaling. What patterns emerged in the world and in their lives?

Global Climate Change in the World's Religions

Seasonality plays a large role in many religious holidays or calendars. Ask your students to research two different religious traditions to compare and contrast how the seasons affect the schedules of those two religions. A good place to start would be this interfaith calendar: <http://www.interfaithcalendar.org>.

Global Climate Change Examen

If your students are Catholic Christians you may want to lead them in the Jesuit Examen on Global Climate Change below, adapted from Joseph Carver's *Ecological Examen*.

Ask students to take a relaxed posture, sitting up, and closing their eyes, as they feel comfortable. Lead them through the following examen, allowing a minute or two between each question for them to reflect.

All creation reflects the beauty and blessing of God's image: in our climate, the weather that shapes our planet, the seasons that give a rhythm to our life, and our own internal fluctuations. Where were you most aware of these today?

How did you respond to these aspects of the climate today? Did you make a conscious effort to care for any of these aspects of creation?

What challenges or joys do you experience as you recall your care for creation today? Were you surprised, hurt, confused, or amazed at your experiences of creation?

How can you take actions to repair breaks in your relationship with creation, in the ways that you may have hurt the planet?

As you imagine tomorrow, ask for the grace to see the Incarnate Christ in the dynamic interconnections of all Creation.

Consider asking students to then write down a brief prayer of their hopes for the planet especially in their perspective on climate change. Ask students to share some of the prayers with the online *HE* community.

V. Global Climate Change and Action

Gives awareness of actions taking place around the world to mitigate global climate change and suggests personal actions students can take in their own communities.

Actions in the World

Artists around the world have mobilized to produce sensitization songs about climate change and how communities can adapt and thrive. For information, have your students check out: <http://www.apeuk.org/artists-gathered-around-climate-change/project-327>. Could your classroom connect with this global movement by creating a song or by helping share the message in your own communities? Consider sharing your ideas with the *HE* community.

Actions in the Community

Foods and other crops depend heavily on natural weather cycles for regular growth. Often, communities only have access to certain foods at certain times of the year. Therefore, our consumption of certain foods is closely linked with climate change. Eating seasonally can help people become aware of the natural cycles of the planet as well as reducing the need for artificial growing methods or shipments of food over long distances. Have your students work together in groups to design a local seasonal menu to be used in your school, their homes, or with local community organizations. How else can your class support the use of local and seasonal foods in your community?

Personal Habits

Your students might not have an understanding of their own role in political, social, and economic structures that contribute to global climate change. Guide your students to become more aware of their role in these processes by having them write a letter around the topic of climate change to a governmental or non-governmental agency. This activity is adapted from *Catholic Social Teaching: Learning and Living with Justice* by Michael Pennock. Provide the following summary for your students:

Writing letters is an effective way to voice an opinion on an issue of justice, seek out more information on a topic, and encourage others who are working for justice. First, pick an issue relating justice and climate change. Learn enough about your topic by doing your own research to understand the topics you are going to mention. Then, choose to whom you will write your letter: a government official or group, a

newspaper to express your opinion, a non-governmental organization like Amnesty International, experts in climate change to get more information, or to social justice advocates to encourage them in their work. Next, focus on writing your letter:

- Address the letter properly to whomever you chose to write to
- Type your letter in a business format (check a grammar book for formatting)
- Keep the letter to one page using your own words
- Be clear
- Focus on one issue
- Give reasons for your opinion if you are expressing one
- Offer constructive comments
- Be specific if asking for information
- Share some of your own research if appropriate, including scientific data or ethical and moral principles
- Ask questions if you would like a specific response

In the opening paragraph, you should introduce yourself and why you are writing. In the body paragraph(s), you should express your ideas or ask for information. In the final paragraph, you should thank the person for their time and consideration. Try drafting a letter on an issue from this chapter. Then bring in your draft to have at least three classmates critique it. Then revise and send your letter to the appropriate person or organization.

VI. Reflection

Have students analyze their role in affected global climate change and how they can take action based on these convictions.

This is a chance to tie everything back together – science, ethics, spirituality, and action. By drawing all four of these aspects of the curriculum students should begin to understand the role they play in the planet Earth and why it is important for them to know all these aspects of the curriculum. Have them look back over all the work they have done and tie the different aspects together. This is where the concluding reflection questions should be brought in and students should be able to identify personal actions to address global climate change.

Any of the previous activities and explorations can encompass these lessons and values.

Share the following quote from Pope Benedict XVI on April 24, 2005: “The external deserts in the world are growing, because the internal deserts have become so vast. Therefore the earth’s treasures no longer serve to build God’s garden for all to live in, but they have been made to serve the powers of exploitation and destruction.” From www.ecojesuit.com/healing-a-broken-world-from-our-communities-thinking-and-praying-on-the-gift-of-creation/7290/. How does this quote connect with the integrated ecology of this chapter?

Inspired Person

James Balog began the Extreme Ice Survey in 2007 to document the changing ecosystems of the planet, especially the changes in glaciers and other ice formations. Depending on

how much time you have in class, choose a short two-minute video from this website (http://extremeicesurvey.org), a medium twenty-minute video of Balog's TED talk (https://www.youtube.com/watch?v=bAbDDA3otfc&ab_channel=GlobalClimateNews), or the full <i>Chasing Ice</i> video to watch with your class. As you watch, ask your students to keep track of their emotions (using this feeling wheel as helpful: https://www.flickr.com/photos/lisapyke/5284544706). Could they imagine themselves taking similar actions to document the impact of climate change in the world?

Conclusion

By the end of this chapter, students should have a deep scientific, ethical, and spiritual understanding of global climate change by going through case studies, regional reports, identifying personal actions, and studying the causes and effects of climate change. Important questions that students should be able to reflect on and answer by the end of this lesson are:

1. What are the differences between weather and climate?
2. How would you define climate change?
3. What are the main natural drivers of climate change? What are the main anthropogenic drivers of climate change? How do the anthropogenic drivers of climate change amplify the natural drivers?
4. How does climate change affect Earth's oceans?
5. Why is global climate change sometimes referred to as a "perfect moral storm"?
6. What is the Kyoto protocol? Did your home country ratify this protocol?
7. How does climate affect human culture? How can climate, in turn, affect human spirituality?
8. What do the spiritualities of many world religions mean by the idea of 'balance' in our relationship with Earth? How does global climate change disrupt this balance?