



Chapter 4: Water

Science, Ethics, Spirituality, Action

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

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), co-directors of the International Jesuit Ecology Project. The information that you share will help improve these resources for your and others' use. We appreciate your feedback.

Overview

The goal of this lesson is to understand the science behind water—its structure and function—while relating these concepts back to the current water crisis being experienced around the world. Students should be able to explain the science behind water, then be able to draw on lessons in ethics and spirituality to make educated decisions on what their role is and should be as living beings that require water to survive. Students should deepen their understanding of ethical issues related to water, using ethical vocabulary to discuss current world problems and possible solutions. The importance of water in the spirituality of many individuals and religious traditions figures prominently in this chapter. Students should be able to explain how the properties of water influence these spiritual understandings of water. Furthermore, students should begin to recognize and discuss the importance and spirituality of water in their own lives. Finally, students should apply the knowledge they gain about the scientific, ethical, and spiritual dimensions of water to tangible actions in their own life, their communities, and the world.

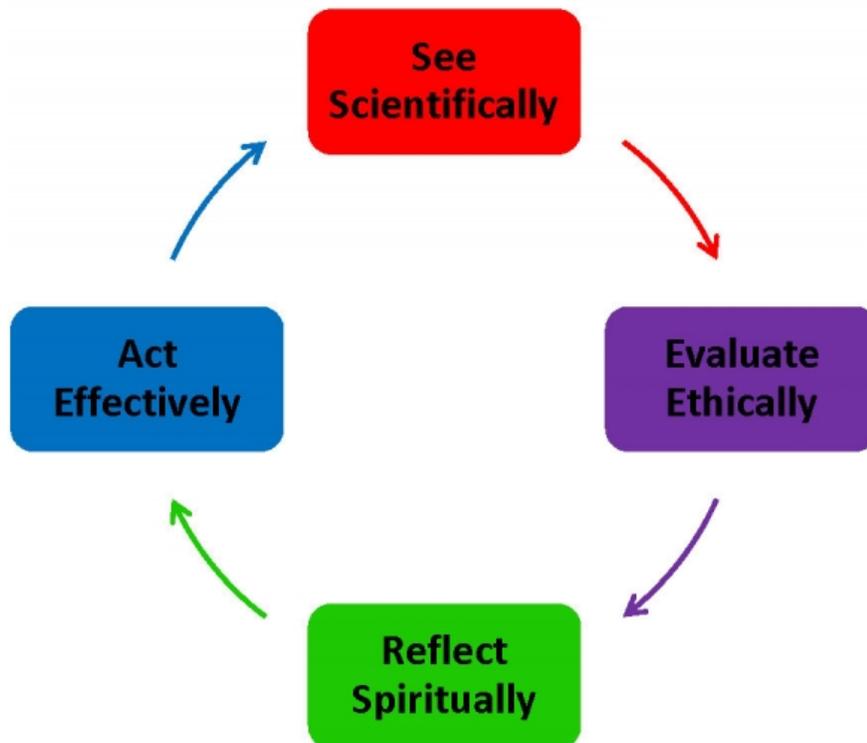
Learning Objectives

1. Investigate a case study about water that raises **scientific, ethical, spiritual, and action** questions.

2. Describe the structure of the water molecule, the water cycle, and the changing water content in the atmosphere.
3. Explain how water cycles and air currents create weather patterns and climates.
4. Describe the sources of water, the distribution of water on Earth, and the effect of human activities on distribution cycles.
5. Analyze key **ethical challenges** about water that human beings are confronting in the world today and understand the moral principles, goals, and virtues important for guiding water decisions.
6. Describe ways in which spirituality has influenced the human understanding and use of water, and recognize the importance of spirituality for **responding constructively** to today’s water crisis.
7. Plan and execute an **environmental action** that addresses a water problem in your community.

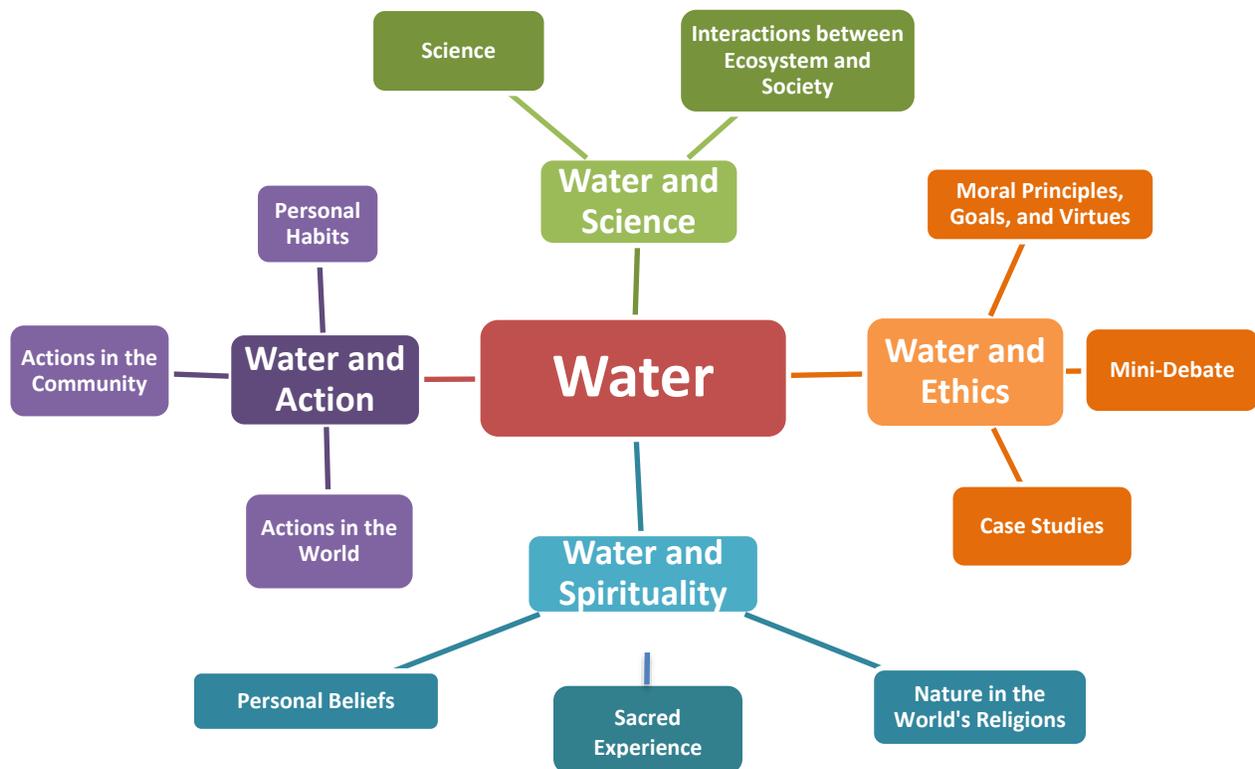
Connection of this Chapter to Ignatian Pedagogy

An integrated understanding of water engages students as *whole human beings*, connecting their scientific curiosity, moral lives, deepest beliefs, and energy to act on behalf of Earth. 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 Water Chapter, the following graph emerges.

Connection of this Chapter to Overall Course Goals



Environmental science taught through the method of Ignatian Pedagogy begins with *science* education. However, with this method, teachers must be sensitive to (and aware of) each student’s ‘entry point’ into the subject. A student may come to the subject as an environmental activist; they should be affirmed (and guided) in that activism, but also led to further knowledge of the science, ethics, and spirituality of environmental science. Or, a student may come to the subject with a deep religious attachment to the natural world; they should be affirmed (and guided) in that attachment, but also led to further knowledge of the science, ethics, and actions that are part of a thorough understanding of environmental science. Of course, other students will come to the subject with indifference; they should be at least initially drawn to the subject by experiencing the teacher’s passion and commitment to the natural world

Lesson Outline and Suggested Activities

Keep in mind that while the activities below are presented in a linear outline form, *HE* 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 biodiversity, natural resources, energy, water, food, or global climate change.

I. Case Study: The River Ganges	<i>Raises scientific, ethical and spiritual questions that will be further explored.</i>
	<p>The chapter opens with a case study to peak student interest in water and its importance around the world. Topics that are introduced include but are not limited to:</p> <ul style="list-style-type: none"> • Water Conservation • Pollution • Global Climate Change • Political consequences • Ethics of fair water distribution • Role of water in many religions (Hinduism, in this case study) <p>Make sure that as you go through the case study with your students, special attention is given to the reflection questions given at the end of this chapter. These questions can be discussed in class and can also be incorporated as a free write in students’ science journals. Incorporate these into the lesson by asking students throughout what they would do in Mallika’s situation.</p> <ul style="list-style-type: none"> • Have them compare and contrast this case study with that of their own experience with rivers and water. • How do other religions that students are familiar with view water? (<i>Possible assignment: have students research different religions and what their view on water is to bring to class and discuss.</i>) • Discuss the definitions of moral principles, moral goals, and moral virtues with students and how they have encountered these in their daily lives. • Do they know of any water pollution in their neighborhoods? • What can be done about water pollution at a political level vs. an individual level?
II. Water and Science	<i>Help students gain a solid scientific background into water and all of the properties that make it important and unique to Earth’s environment</i>
	<p>This chapter covers three major topic areas involving water:</p> <ol style="list-style-type: none"> 1. The chemical and physical properties of water 2. The role of water in ecology, especially the hydrologic cycle 3. The role of water in human life and communities <p>These topics have significant overlap with each other and with daily life. Presenting these topics to students should involve connecting their experiences with the scientific concepts.</p>

Science Activities:

1. **Properties of Water** - Find additional information on water properties at: <http://water.usgs.gov/edu/waterproperties.html>
2. **Water Quality Control** - Prepare students to test different measures of water quality such as pH, heavy metal content, biological materials. One possible outline can be found at: <https://www.asme.org/getmedia/48f79566-d096-4c57-afbb-ed018fa6742/Engineers-Week%20-Video-Clean-Water-Ph5-Implementation-29694.aspx>
3. **Statistics of Water Usage** - have students graph water usage statistics in the world or their communities, trying to portray this information clearly to others. Some example statistics and graphs are found in the Water chapter.
4. **Documentary** - Watch “A Thirsty World” (<http://www.youtube.com/watch?v=2pXuAw1bSQo>). Discuss student reactions from this video, especially how their own experiences and uses of water connect with what they watched.
5. **Trace Your Water Path** - Working in small groups, take a large piece of paper and trace the path that water takes from its source to your faucet and back to the earth. Be sure to label locations where evaporation, condensation, precipitation, transpiration, and runoff can occur along H₂O’s cycle.
6. **Virtual Water Labs** –
 Assessing Water Quality:
http://glencoe.mheducation.com/sites/dl/free/0078802849/383929/BL_09.html
 How can we conserve water?
http://glencoe.com/sites/common_assets/science/virtual_labs/ES20/ES20.html
 When is water safe to drink?
http://glencoe.com/sites/common_assets/science/virtual_labs/CT04/CT04.html
 Why do things float?
http://glencoe.com/sites/common_assets/science/virtual_labs/CT01/CT01.html
 Ocean Acidification:
<http://web.stanford.edu/group/inquiry2insight/cgi-bin/vu-rla/vu.php?view=acidocean>

III. Water and Ethics	<i>Guide students in their navigation of the principles, goals, and virtues that will allow them to make more informed choices in healing our Earth</i>
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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.

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 exploring 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 water issues. You may wish to facilitate small and large group discussion, a class debate, or a case study analysis.

Small and Large Group Discussion

The following articles were gathered from three of the major regions of the world. Have students evaluate the ethical dimensions of these cases by asking them to identify which of the moral virtues (Justice, Temperance, Generosity, Kindness, Prudence, and Gratitude) the people mentioned in these articles possess. Then in small or large groups, have students discuss the moral virtues and the moral problems involved in these articles.

South Asia: The Non-Government Agency 'Gospel for Asia' plans to drill 5,000 water wells across India and South Asia over the course of this next year for those struggling to find clean water. See this story at: ["5,000 'Jesus Wells' bringing clean water across India and South Asia."](#)

Asia Pacific: Extensive deforestation for palm oil plantations has had a devastating effect on flood control in many areas of Indonesia. [See](#) how collaboration between local and regional governments has helped communities respond to this water problem.

Africa: In response to the water crisis that the Western Cape of Africa is experiencing, a wave of new water-saving innovations has emerged across the province. A new and unique competition based out of Cape Town is calling for innovators, start-ups and small businesses from across the city to submit their best water-saving technologies for evaluation. Learn more about this inventive competition and other water resilience efforts in Africa [here](#).

Class Debate

There are many ways to conduct a class debate. The following is one model that has been used by an *HE* teacher.

The European regional report outlines how a group of committed citizens acted politically to advocate for their right to water. Help your students to prepare a debate about whether access to water should be considered a human right, a commodity, or something else. Some helpful resources are included in the example lesson module for this chapter. Allow students to do some of their own research first. Then decide upon collective definitions of “human right,” “commodity,” and any other important terms that come up in students’ research. Then examine how different ways of defining water affect the way that access to water is treated politically.

Europe: A 1.9 million-strong petition from citizens across Europe demanding recognition of their right to water has forced the European Union to improve access to clean water. See this [story](#).

Case Study Analysis

These two case studies show how groups of people have responded to environmental issues in their communities. Have your students choose one of these regional reports (or another topic that they find on their own), summarize the report in a few sentences, and create a poster using pictures, charts, tables, and other visual graphics to present the region’s water issues and solutions to their peers and teachers.

North America: World Water Day is recognized around the world every year on March 22. It is a time to draw attention to the global water crisis and what we can do about it. Canada is noteworthy in the practical actions and ideas that are supported during its week-long celebration of Water Day. Visit this [website](#) for examples.

South America: Rural communities in Guatemala are using new technologies to wring water out of the air. It is called fog harvesting and it helps to overcome water shortages. Access the video explaining this unique process at: “[Guatemala combats water shortage](#).”

IV. Water and Spirituality	<i>Help students identify core convictions about the meaning and value of water and the historical basis of these core convictions</i>
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It is very important, here, that you have a clear understanding of the approach taken toward spirituality in *HE*. Spirituality will undoubtedly be the most challenging part of *HE* 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 *HE*, which is to educate the *whole person* in environmental science. We recommend that you give all the time that this section needs, so as not to miss the opportunity to tackle it in greater depth. With all the possibilities that the spirituality dimension offers and with the integrated commitment of engaged teachers and students, a comprehensive path for restoration and environmental protection can be achieved.

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 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 Water chapter invites students to explore what water means to them, how people experience water as sacred, and how the world's religions treat water in their beliefs and rituals. The spirituality of water is deeply historical and connected with many students' experiences. The material in this section can provide a breadth of information to connect with how students understand water both scientifically and spiritually. The following activities can help to support these connections.

Water and Personal Spirituality

Explain some of the uses of water in the body, such as for transport of blood cells or for cooling the body through sweat. Ask students if they can think of any other ways that their bodies use water. Assign them to slowly drink a cup of water and try to imagine the water moving through your body providing vital resources for them. This activity could be used as

a group reflection to begin or end class. You can have your students write a brief list of ways that water helps support their life. If students would like to do this activity in the form of a poem, fable or story, that is also welcome.

Water and Sacred Experience

Alternatively, ask students to take some reflection time near a lake, river, or other body of water. Assign them to draw a picture or create some form of art to convey their experience to others. Ask if there have been other times in their life when they have felt spiritually moved by an experience of water in nature.

Water in the World's Religions

Investigate the spirituality of water with your students based on these questions: Why do many religions identify water as a symbol of purity? How does solvency influence sacredness? Have your students look for images and symbolism of water in movies, books, or other media, and have them take a picture of these symbols, explaining what the image conveys about a spiritual understanding of water.

What religious rituals and uses of water do your students know about? Perhaps some of the students know about baptism, cleansing rituals, or other ceremonies. Have students describe one of these rituals that they have experienced or know about and connect at least one of the science concepts to the ritual (solvency, polarity, physical states, etc.).

Water Examen

If your students are Catholic Christians you may want to lead them in a Jesuit Examen that focuses on water. The Examen below focuses on daily water usage. Read the statements and questions for your class, leaving 30 seconds to a minute in between each section for silent reflection, depending on your students.

Take a moment to calm yourself. Become aware of your breathing as we remember that we are in the presence of God. Ask the Holy Spirit to be with you in this Examen.

Recall the ways that water nourishes you and supports your life. Where in your life do you feel grateful to God for the gift of water?

Review the events of this day, starting with when you woke up this morning. When have you used water today? For drinking or eating? For washing?

When have you wasted water today or when could you have used water in better ways? When did you take water for granted? Ask for forgiveness from God for your shortcomings.

How could you use water better in the future? Ask for the strength and knowledge to use water in ways that praise, reverence, and glorify God above all else.

Close with the Ignatian prayer of generosity: “Lord, teach me to be generous. Teach me to serve you as you deserve. To give and not to count the costs. To fight and not to heed the wounds. To toil and not to seek for rest. To labor and not to ask for reward, save that of knowing that I do your will. St. Ignatius, pray for us.”

V. Water and Action

Guide students in identifying personal actions to restore, protect, and preserve Earth’s water resources in their own community, region, and nation.

How can we use our scientific, ethical, and spiritual knowledge to act in ways that heal the planet? What beneficent actions can you imagine that would help restore, protect, and preserve Earth’s water resources in your community, region, or nation?

Actions in the World

World Water Day is celebrated every year on March 22. The North American case study mentioned how Canadian citizens organized a week-long celebration of this day. Talk with your students about how your class or school could be involved in this world-wide celebration.

Connect your students with another *Healing Earth* classroom through the online forum or Facebook community. Share water usage statistics between your classes and compare the differences and similarities between these different regions of the world. If possible, let your students talk individually with another student in a different region through letters, email, or social media. Ask them to compare water issues between their respective communities. Are there any ways that your students could share knowledge or resources with these students in other classrooms?

Actions in the Community

Help your students to research the following questions: How is water quality monitored in your community? Are there any major sources of pollution in your area? Who owns the water? How could students help keep water resources clean for all?

Help students organize a stream clean up in your community once a year as a way to counteract water pollution from physical waste. If the initiative is successful, in the following years they can invite other schools and people from the community asking for support from the local government. Perhaps it could become a project assumed by the entire community where you live.

Personal Habits

Have students research ways to conserve water in their homes such as fixing leaks or installing low flow showers and toilets. Encourage them to talk with their family about which of these actions they can take to reduce their water usage the most.

	<p>Then, challenge students to see who can make the largest reductions in their personal water use for a week. Consider using the 4Liter challenge curriculum and website where students can track and share their water usage through social media (https://www.4liters.org)</p>
<p>VI. Reflection</p>	<p><i>Have students analyze their role in the water crisis, how they can help alleviate the water crisis, and be aware of how countries around the world are dealing with the water crisis.</i></p>
	<p>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 alleviate issues involving water.</p> <p>Inspired Person</p> <p>Have your students watch a YouTube video about either Pauline Tangiora (https://www.youtube.com/watch?v=zJwIPYx9nig) or Rajendra Singh (https://www.youtube.com/watch?v=xF5243GA19M), who both share a concern for water issues in their communities. Ask your students to describe both how and why these inspired people worked to help alleviate issues related to water. Do your students share similar views with either of these people? Can they imagine themselves taking similar actions in their own community based on what they learned throughout this chapter?</p>

Conclusion

By the end of this chapter, students should have a deep scientific, ethical, and spiritual understanding of water by going through case studies, regional reports, identifying personal actions, and studying the water cycle as it exists on Earth. Important questions that students should be able to reflect on and answer by the end of this lesson are:

1. What chemical and physical properties of water make this resource vital for supporting life on Earth?
2. Define bioaccumulation. What uses of water contribute to bioaccumulation?
3. What countries are or will be most affected by global water crisis? What countries actually consume a majority of the world's water?
4. Do you know people who live in coastal regions? Where would they go if sea levels rose and overtook their homes?
5. What moral principles are necessary to consider when addressing water conflicts?
6. What ethical questions are raised by the privatization of water?

7. How have water's physical properties contributed to its use as a symbol in religious rituals?
8. In the Christian religious tradition, what is the source of a spirituality of gratitude?