Introduction

Earth’s astonishing diversity, intricacy, and beauty inspires human imagination. Whether it is the 17,000 year-old cave paintings of bison at Lascaux, France, Igor Stravinsky’s orchestration of nature in the Rite of Spring, or Ansel Adams’ breathtaking photographs of California’s Yosemite National Park, human beings have always found Earth an inexhaustible source of creative inspiration.

Astronauts who have seen our planet from space are inspired. For more than four decades, astronauts from many countries and backgrounds have experienced the so-called ‘overview effect’ – a feeling of intense awe when looking down on Earth and seeing its luminous coloration and pulsating activity – all thriving under a thin band of life-giving atmosphere.

Something else accompanies this astounding beauty. The astronauts also see a wounded Earth – a planet stressed by areas of dead ocean water, deforested land, eroded soil and polluted air. After seeing both the beauty and the wounds, the astronauts return home with a heightened sense of responsibility for the planet and a reinvigorated motivation to heal the Earth.

The Idea of Healing Earth

Healing Earth is an environmental science e-textbook written by women and men who share awe and concern for the natural world. We are an international group of scientists and humanists who imagine—and work for—a cleaner and healthier planet. We are delighted you are exploring Healing Earth and we invite you to join your hopes for a healthy planet with ours.

Frank White describes the ‘Overview Effect’ in his 1998 book of that title. See the following video here and hear five astronauts describe how viewing Earth from space changed their lives.

Today, the environment faces threats unprecedented in human history. These challenges include decreasing biodiversity, shrinking natural resources, the transition to renewable energy sources, diminishing fresh water supplies, declining food quality and availability, and a changing global climate. Each of these threats are addressed in Healing Earth’s six chapters covering biodiversity, natural resources, energy, water, food, and climate change. The authors of Healing Earth believe that people everywhere need accessible and understandable scientific knowledge to meet today’s environmental challenges. The first aim of Healing Earth is to provide this science knowledge.

However, scientific knowledge is not enough to heal the Earth. If we truly value our planet, we must also look closely at our personal lifestyle choices and our public policies and ask: which choices and policies
best promote the well-being of the natural world and the human beings who depend upon it? This is a moral question that requires attention to ethics. The second aim of Healing Earth is to help you think ethically as you study environmental science.

The environmental threats treated in Healing Earth were first brought to international attention in the 2007 Millennium Ecosystem Assessment Report (MEA), a study produced by over 2000 scientists from 95 countries and sponsored by the United Nations Program on the Environment.

When we begin thinking carefully about environmental ethics, we quickly realize that diverse points of view exist on almost every moral question—and that the diversity can exist not only between people, but also within ourselves. Thinking through an ethical issue with so many alternative viewpoints challenges us to identify what we truly believe about the natural world and our place in it. Do you think of the natural world as essentially a storehouse of material goods for your use and enjoyment? Or, do you have another view of the natural world? When you consider the meaning of your life do you see it as basically a competition with other human beings to amass and consume as many material goods as you possibly can? Or, do you have another view of your life’s meaning?

Beneath our ethical perspectives lie our core beliefs about the world and about ourselves. These deep, sometimes unselfconscious, convictions make up our inner spirit, or spirituality. The third aim of Healing Earth is to help you identify and discuss spirituality as an aspect of environmental science; that is, the meanings we give to the natural world and the meanings we give to our life within it. We will discuss other dimensions of spirituality in Healing Earth, but our deepest conviction about nature is a good place to start.

John Muir (1838-1914) was a naturalist devoted to preserving wilderness areas in the United States against human development. He believed that knowledge of the environment required not only a scientific perspective, but also a moral and spiritual.

Ethics and spirituality help motivate action. The movement to be an agent of change in the world asks us to identify concrete environmental problems in our communities, gather information, analyze data, select responses, and act. The fourth aim of Healing Earth is to inform your preparations for action by alerting you to environmental activities taking place in different parts of the world and suggest actions you might consider in your own community.

It was ecologist and theologian Thomas Berry who first coined the phrase ‘integral ecology’ – a way of understanding and studying the natural world that combines environmental science, environmental ethics, and environmental spirituality for the sake of actions that promote the well-being of nature and society. This concept later became a hallmark of Pope Francis’ encyclical letter on the environment, Laudato Sí. By combining science, ethics, spirituality, and action, Healing Earth offers you a unique, ‘integral’ education in environmental science.

Thomas Berry, C.P. (1914-2009) was a Catholic priest of the Passionist order who devoted his life and writings to ecology, cosmology, and cultural history. His most famous book, The Great Work: Our Way Into
The Future (1999) challenges all of us to participate in the ‘great work’ of healing the Earth.

The Elements of Integral Ecology

Because we approach the study of nature in a unique way, it is important to have an opening sense of how science, ethics, spirituality, and action are understood in Healing Earth.

Science

Science is a systematic way of studying the structures and processes of the natural world. Researchers acquire scientific knowledge using the scientific method. The scientific method follows these steps:

**Scientific Method**

1. Ask a question about nature.
2. Do background research and observation.
3. Construct a hypothesis.
4. Test the hypothesis by experimentation.
5. Analyze the data and draw a conclusion.
6. Communicate the results to confirm the conclusion.

Scientists start with a feature of the world that interests them and that gives rise to a question they would like to research. Scientists then carefully observe this feature, gather and record preliminary data, and construct a hypothesis that is a testable answer to the question they are asking. Scientists then test the hypothesis with a series of experiments that follow an orderly procedure. The procedure holds all variables constant but the one being tested. Scientists then analyze the results and a conclusion is drawn as to whether the hypothesis is correct or incorrect. By communicating their findings in books and journals, scientists discover whether the results of their experiments are consistent with the findings of other scientists.

Melvin Calvin (1911-1997) was an American chemist whose careful use of the scientific method in laboratory experiments helped him discover facts that led to a new theory explaining photosynthesis—the process by which green plants convert solar energy into chemical energy.

If further experiments reconfirm a scientist’s hypothesis, the finding may be proposed as a scientific fact. Over time, scientists may build a theory out of facts that have been confirmed through multiple experiments by many different scientists. Scientific theories explain the relationship among many features of the natural world, such as Charles Darwin’s Theory of Evolution or Albert Einstein’s Theory of Relativity. Here again, scientists communicate their theories to other scientists so that their research can be validated or challenged.
See this short [video](#) for an example of how to use the scientific method.

All the scientific information communicated in *Healing Earth* is based on tested observations that have led to facts and theories. These facts and theories have been recognized, continually explored, and re-tested by scientists worldwide.

*Healing Earth* is a textbook in environmental science. This means that it studies the structures and processes of the natural world and the impact human beings have on them. To understand how the natural world functions, environmental scientists study ecology, the branch of science that investigates the many intricate and complex relationships that exist between organisms and their physical environment.

Environmental scientists use their knowledge of ecology to develop solutions to environmental problems. Because these problems are linked to human actions in society, environmental scientists must also investigate how human social systems and the Earth’s ecosystems interact. For example, how does a society's method of economic production and consumption impact the environment? Or, what are the environmental effects of a society’s public policy regarding waste disposal?

Rachel Carson (1907-1964) was an aquatic biologist who faced fierce social opposition when she pointed out that synthetic pesticides threaten the environment. Her courageous book *Silent Spring* led the U.S. government to ban the pesticide DDT.

Economics and politics are just two of the social systems that environmental scientists must engage in order to help solve environmental problems. Others include public health, business, education, and culture. Environmental science is, therefore, an interdisciplinary field of study with ecology at its center. Covering all these topics would require a second textbook—one we hope to develop in the future. For now, *Healing Earth* can only touch on these topics within its discussion of environmental ethics.

**Ethics**

Ethics is the study and practice of actions that contribute to the well-being of humans, human societies, and the natural world. *Healing Earth* takes the approach that certain basic goods are needed for the well-being of human beings, the natural world, and human society.

Among a human being's basic goods are those enabling physical survival (e.g. air, food, water, shelter, medical care, security) and personal growth (e.g. positive human relationships, occupation, social participation, enjoyment of the natural world). As the *Healing Earth* chapters will explain, basic goods of and for the natural world include species diversity, abundant natural resources, human use of renewable energy sources, clean water, organic food production, and mitigation of global climate change. The basic goods for a human society are structures and processes of political, economic, and cultural life that make it possible for human beings and the natural world to thrive together.

Aldo Leopold (1887-1948), (left, with naturalist Olaus Murie) was an American ecologist famous for the
‘land ethic’ he proposed in his book A Sand County Almanac (1949). Leopold believed we must change our characters from “conqueror of the land-community” to “plain member and citizen of it”; only then will we respect all creatures of the natural world as our “fellow members” in a shared community. 

Healing Earth focuses on the natural world and asks: What is a sound ethical perspective to take as we face declining biodiversity, fossil fuel extraction, natural resource depletion, water shortages, inadequate food systems, and climate change?

Healing Earth provides a coherent environmental ethic. This is not to say that Healing Earth provides answers to every moral question posed by today’s environmental challenges. That would be impossible—and unethical! What Healing Earth provides is a coherent moral framework you can use to work out rational—and faithful—moral responses to the environmental challenges you face within your specific context.

Healing Earth’s environmental ethic begins with three foundational claims. From these foundations are derived three sets of ethical norms.

### Three Ethical Foundations

The first foundation of Healing Earth’s environmental ethic is the precept that nature has intrinsic value. This means that the natural world has value in itself, that it does not require human need or desire to give it value. For example, a honeybee has value as a creature of nature whether it serves the human needs or not.

The second ethical foundation in Healing Earth is the precept that nature has instrumental value. This means that the natural world has resources that are useful to the well-being of all creatures on Earth. Again, as an example, nearly one third of all plants and plant products necessary for human survival depend on honeybee pollination and humans have been utilizing honeybees for this purpose for centuries.

The meaning of intrinsic value and key points in the debate over whether nature has intrinsic value is discussed in this short paper.

Though nature has instrumental value, it is critically important that we not see this as nature’s first and only value. Many of the environmental problems we face today are the result of actions taken by people who disregard nature’s intrinsic value and see nature as only a store for satisfying human wants and needs. This view too often leads to the exploitation of Earth’s resources and the destruction of ecosystems.

The third foundation of Healing Earth’s ethic is the value of environmental sustainability. By this precept we mean that a natural resource may be used only if it will 1) remain healthy and capable of performing its function for the ecosystem within which it exists and 2) be plentiful enough to meet the reasonable needs of future human generations. When people respect the instrumental value of the honeybee by using it
sustainably, they are respecting its intrinsic value and the future of humanity.

Dr. Vandana Shiva is an Indian physicist and environmental activist who opposes the idea that nature has only instrumental value, as in the development of genetically modified organisms (GMO’s). See this video for a presentation of her ideas and opposition to GMO’s. ?

Three Sets of Ethical Norms

The three ethical foundations of intrinsic value, instrumental value, and environmental sustainability support three sets of ethical norms that provide further guidelines to help us make moral decisions. The three sets of ethical norms include moral principles, moral goals, and moral virtues.

Moral Principles

Moral principles express standards that help us decide which of our actions contribute to or detract from the well-being of human beings, human societies, and the natural world. Healing Earth offers six moral principles to keep in mind as we guide our actions in the natural world.

1. Care for creation
2. Human dignity and rights
3. Common good
4. Universal destination of goods
5. Preferential option for the poor
6. Subsidiarity

Definitions of these principles are given above. The meaning and application of all six principles receive careful attention in each Healing Earth chapter.

Care for Creation: the moral principle that calls us to care for the Earth in a way that preserves and protects the integrity of the natural world while making its fruits available for the legitimate needs of human beings.

Human Dignity and Rights: the intrinsic value of human beings that calls us to respect two types of human rights:

- right of immunity from unjust harm (e.g. right not to have bodily integrity abused, expression of ideas suppressed, practice of religion forbidden)
- right of access to basic goods necessary for life (e.g. right to food, shelter, health care).

Common Good: the sum total of those conditions of the natural world and of humanity’s physical, social, and spiritual life that allow groups and their individual members the relatively free and equal ability to achieve a fulfilled life.
**Universal Destination of Goods:** the moral principle that the availability, or ‘destination’, of goods necessary for human life is ‘universal’; that is, basic goods such as water, food, air, land, shelter and clothing cannot be withheld from human beings who are in absolute need.

** Preferential Option for the Poor:** the moral principle that people in absolute need of the basic goods of life (e.g. water, food, air, land, shelter, clothing) are given priority in caregiving.

**Subsidiarity:** the moral principle that requires community problems to be resolved at the appropriate level. This means that proposed solutions to community problems should be neither over-localized if the problem requires regional, state, or international assistance, nor over-globalized if the problem is best resolved at state, regional, or community levels.

**Moral Goals**

Moral principles guide our actions toward the accomplishment of moral goals. *Healing Earth* has seven moral goals, six specific to the environmental topic of each chapter and one overall moral goal embracing human and natural ecology as a whole. Each of the goals listed below are discussed more fully in the *Healing Earth* chapters.

1. Protect and preserve biological diversity.
2. Support sustainable and renewable energy sources available to all people.
3. Decrease damage done to nature and people by extractive industries.
4. Conserve and protect water and its availability to all people and forms of life.
5. Make healthy food available in a sustainable way to all people.
6. Reduce human-induced global climate change.
7. Contribute to authentic, integral development.

Goal 7, the overall moral goal of *Healing Earth*’s environmental ethic, relates to the above discussion of human, environmental, and social well-being. Authentic, integral development involves the moral effort of making available the basic goods necessary for human, environmental, and social flourishing.

**Moral Virtues**

Moral virtues are features of a person’s character that contribute to the well-being of humans, human societies, and the natural world. Virtues are developed in our character through practice and commitment. A virtuous person pursues moral goals using moral principles as a compass. Throughout the textbook, six moral virtues are explored as important responses to the natural world.

1. Gratitude for the existence, beauty, and resources of the natural world.
2. Courage to live sustainably and advocate for the good of the natural world.
3. Justice in preserving, restoring, and distributing the goods of the natural world.
4. Prudence in decisions that affect the health of the natural world.
5. Temperance in consuming the goods of the natural world.
6. **Generosity in sharing the goods of the natural world.**

**Spirituality**

The ethical choices you make reflect what you value. But why do you value one thing over another? Why is a certain thing valuable to you, but not to others in your society? Why do different people value different things?

Our values are connected to our beliefs, the conscious and sometimes unconscious convictions that are at the heart of our individuality and our view of the world. These core convictions express our inner spirit. This is one dimension of spirituality discussed in *Healing Earth*. If you have always only associated spirituality with religious beliefs and practices, this basic human dimension of spirituality may surprise you. But it is there. As Roman Catholic author Fr. Ronald Rolheiser writes: spirituality “issues forth from the bread and butter of ordinary life.” “We all have a spirituality,” says Rolheiser, “whether we want one or not, whether we are religious or not.”

- Imagine that most people in your society truly respected the intrinsic value of the natural world. How might life in your community be different than it is now?
- How is nature’s intrinsic value, instrumental value, and value of sustainability exemplified by the honeybee?

Today, more and more people are finding wisdom in the perspective of naturalists and scientists like Rachel Carson, John Muir, and Jane Goodall who insist that care for the environment begins with a sense of ‘awe’ over the beauty and complexity of the natural world. When our senses are captivated in a lasting way by *intrinsic* features of the natural world, we are touching what is truly ‘set apart’ or sacred in an element of nature. By calling something sacred, we are saying that something has an inner quality that communicates power, or ‘wholeness’, beyond common human measurement. Experiences of awe and sacrality in nature can be life changing. As Carl Sagan and twenty-two prominent world scientists wrote in their 1990 “*Appeal for Dialogue to the Religious Leaders of the Earth*”

> Efforts to safeguard and cherish the environment need to be infused with a vision of the sacred.

This experience of awe and sacrality is another dimension of spirituality discussed in *Healing Earth*.


In addition to naming one’s inner beliefs about nature and experiencing nature as awesome and sacred, a third dimension of spirituality in *Healing Earth* is the many beliefs and rituals that people in the religions of the world hold and practice in relation to the natural world. Approximately 80% of the people in the world
identify themselves as members of a religion, so it is important to learn something about the value that major world religions place on the natural world. In each chapter of Healing Earth you will learn about religious teachings and practices of Indigenous People, Hinduism, Buddhism, Islam, Judaism, and Christianity as they relate to the natural world.

Read the Appeal for Dialogue to the Religious Leaders of Earth.

This Healing Earth textbook discusses spirituality because it opens us up three realities about human beings, society, and the natural world that environmental science should not overlook. These realities are:

- a person’s deepest beliefs about the meaning and value of the natural world.
- a person’s experience of awe and wonder over the sacred beauty and intricacy of the natural world.
- the way people have, from time immemorial, understood and drawn on nature in the world’s religions.

Imagine a community where nature is honored as something sacred. Do you think life in that community would differ from life in your community? Give examples for your answer.

Are the religious leaders in your community also leaders in caring for the Earth? If so, how do they connect their religion with care for the Earth? If they are not leaders in caring for the Earth, why do you think that is the case?

Taking Action

If we reach greater understanding of the structures and processes of the natural world, make ecologically sound ethical choices, and develop deep spiritual gratitude for nature, but fail to take action for the good of the Earth, then we are still a step away from a full appreciation of Earth’s environmental challenges.

A real love of nature and all its creatures has two aspects: benevolence and beneficence. The word ‘benevolence’ comes from the Latin phrase bene velle, which means to wish well. The word ‘beneficence’ comes from the Latin phrase bene facere, which means to act well. Healing Earth is committed to the idea that true solutions to environmental problems depend on both a benevolent attitude that wishes the Earth well and beneficent actions that make the Earth well. An authentic and active environmental spirituality promotes actions that protect and heal the Earth.

Like science, action for the environment requires a method. Throughout Healing Earth the authors encourage you to follow four steps as you prepare to act for the environment. These steps draw on the science, ethics and spirituality discussed in Healing Earth.

1. See a problem that you want to address.
2. Study the scientific and social aspects of the problem (the 5 Ws).
3. Imagine possible action responses that are ethically coherent and spiritually genuine.
4. Select one of these action responses, perform the action and monitor results.
William Kamkwamba is the Malawian “boy who harnessed the wind”. In 2002, William used blue gum trees, bicycle parts, and materials from a local scrap yard to create a power source for his village. Since then, he has built a solar-powered water pump and two other windmills. In 2013, Time Magazine named William one of the “30 People Under 30 Changing the World”. See his TED Talk presentation.

Here is a quick example of how the action steps work. Imagine that you and your friends notice that the swimming area in your local lake has been gradually taken over by underwater weeds and dead fish. You want to do something to correct this.

Step 1: write as objective a statement as you can on the problem that you observe.

For Step 2, gather and analyze as much scientific and social information as you can about the problem. Maybe you suspect this problem is related to fertilizer runoff from farm fields lying along the lake’s shoreline. You could check the quality of the lake water with a water testing kit, visit your local park district or Department of Natural Resources for lake information, and talk to farmers who work along the lake. Through information gathering and analysis, you draw the conclusion that farm fertilizer runoff is indeed elevating weed growth and fish deaths.

You now enter Step 3: using the Healing Earth environmental ethic and thinking through the three dimensions of spirituality, consider various options for action. One option might be to write an article in your local newspaper alerting your community to the problem. Another option might be to attend a city council meeting and express your concerns. You might also consider asking farmers about alternative methods of crop fertilization. Evaluate all your options and determine which one you think will bring you closest to your goal of a cleaner lake in an ethically coherent and spiritually genuine manner.

These students from the School of Environment, Enterprise and Development at the University of Waterloo, Canada joined efforts with musician Jack Johnson to help build All At Once, a community-based, social action network focusing on environmental sustainability. [efn_note] Photo by D. Murray, used with permission Source: https://uwaterloo.ca/school-environment-enterprise-development/news/environment-and-business-students-join-forces-musician-jack [/efn_note]

Step 4: act on your option and monitor the effect of the action on your goal and yourself. You want the action to have a positive result on the problem and on your own moral and spiritual growth. In fact, if your moral integrity and spiritual depth have been compromised by the action, this is likely a sign that the action was not positive, despite appearances.

The seriousness of today’s environmental problems calls each of us to deepen not only our knowledge of the natural world, but also our knowledge of self and society. We believe the wisest and most effective response to Earth’s urgent ecological challenges will come from people who are scientifically literate, ethically grounded, spiritually aware, and motivated to act.
Imagine living your day-to-day life with keen attention to the health of the nature in your community. What actions that you currently perform would fit in this life? What actions that you currently perform would need to be changed?

Think of a time in your life when you were deeply moved by some feature of nature. Imagine this feature of nature damaged or destroyed by human behavior. How would you use the four action steps to repair this damage?

**Healing Earth Structure and Features**

**Chapter Organization**

As you go through Healing Earth you will see that each chapter has an identical organization that takes you through the science, ethics, spirituality, and action pertaining to the chapter topic. Each chapter begins with a case study and ends with both a Reflection Questions and Explorations section and an Additional Resources section.

You will note that the Action section in each chapter has two parts: Regional Reports and Action Ideas. In the Regional Reports section, current news stories and organization reports are given from six regions of the world: Africa, Asia Pacific, Europe, Latin America, North America, and South Asia. These are important to broaden your awareness of environmental problems confronting people around the world and make connections to problems in your own community. This awareness will sharpen your ability to see problems and imagine actions you can take.

Healing Earth Regional Reports come from six regions of the world. [efn_note] Source: https://www.jesuits.org/ [/efn_note]

**Translations**

Language options (currently English, Spanish, French, or Portuguese) can be accessed by pressing the Language tab at the top right of the opening page.

**Icons**

Healing Earth uses several icons to direct your attention to important supplemental readings and videos, text, additional resources, and connections with other sections of the text. Become familiar with the appearance of the following icons so that you can recognize them throughout the text.

**Closer Look** icons appear in orange margin boxes containing the image of a microscope or a video camera. These icons direct you to supplemental readings or videos which contain important information that is relevant to the current subject matter.

**Looking Ahead** icons appear in blue margin boxes and are marked by the image of a person looking
through a telescope. These icons point to connections between the current subject matter and content that appears later in the text.

**Looking Back** icons appear in blue margin boxes and are marked by a swivel arrow. These icons point to connections between the current subject matter and content that appeared earlier in the text.

**Inspired People** contains pictures and information about individuals who have made a difference in environmental science, ethics or spirituality on the local, national, or **international level**.

**Questions to Consider** are posed throughout Healing Earth, inviting you to imagine how the subject matter might apply in various life contexts.

**Supplements**

*Healing Earth* has several useful supplements that can be accessed from the drop down menu on the opening page. These supplements include maps, unit conversions, and a glossary.

**Bulletin Board and Facebook Page**

Check the bulletin board at the bottom right of the opening page to see current *Healing Earth* news from textbook users around the world. Submit news about actions and events at your school or community that we can post to the Bulletin Board. Also check the Facebook posts at the bottom left of the opening page for current news about the environment.

**Joining the Healing Earth Community of Scholars**

From the opening page dropdown menu ‘About Us’, go to the ‘Scholars’ section and meet those who have contributed to *Healing Earth*. Whether you are a teacher, student or adult leaner, we invite you to become one of the team by sending your own news, ideas, works, updates and edits to the *Healing Earth* staff for inclusion in the textbook.

Now it is time to open the *Healing Earth* chapters and magnify your awe for our magnificent planet. Feed your imagination for a healed planet with the fruit of scientific discovery, ethical evaluation, and spiritual reflection. Then join the *Healing Earth* authors, fellow students, and teachers from around the world in acting for the good of the planet Earth.