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AFTERWORD

Carolyn Merchant

In the foregoing chapters of *After the Death of Nature*, numerous scholars have praised, analyzed, and made suggestions for further work on my part. For all of these I am deeply grateful and have learned a great deal about the impact of my own work as well as ways to expand and enhance the argument made in my book *The Death of Nature: Women, Ecology, and the Scientific Revolution* (Merchant [1980] 1990). In the "Afterword" that follows, I discuss the historical changes that took place "after the death of nature" by looking at the eighteenth through the twenty-first centuries and the rise of a new age, now called the Anthropocene. In so doing, I include ideas from my other books and engage with ideas from the foregoing chapters, especially those by J. Baird Callicott, Holmes Rolston III, Mark Stoll, Norman Wirzba, Debora Hammond, Patsy Hallen, Shepard Krech III, Kenneth Worthy, Nancy Unger, Elizabeth Allison, and others. In the process I relate some of my own personal history as well as my own answers to the need for a new story, a new ethic, a new economy, new policies, and new spiritualities.

The "death of nature" as I conceptualized it in my book, *The Death of Nature* (hereafter *TDN*), dealt with the period in Western history from the Greco-Roman world to the end of the seventeenth and early eighteenth centuries. I focused in particular on the change between the Renaissance to what many have called the Scientific Revolution of the mid-sixteenth to the late seventeenth century, and how the worldview was transformed from an organism to a machine. I discussed the organic world as comprising a body, soul, and spirit in which the heavens were alive and the earth was viewed as a nurturing mother. The transformation of the earth-centered cosmos of Ptolemy to the sun-centered universe of Copernicus, Kepler, and Newton was reinforced by the terrestrial mechanics of Galileo, Boyle, and Newton who synthesized the two systems in his *Principia Mathematica* (*The Mathematical Principles of Natural Philosophy*) in 1687

(Newton 1960). In writing *TDN*, I incorporated ideas developed in my earliest publications under my former name Carolyn Iltis, and I am delighted that in Chapter 1 of this book, J. Baird Callicott has analyzed these contributions and placed them in the context of the ideas synthesized in *TDN*. His superb insights into my earliest work from the perspective of 2017 are both highly informative and deeply appreciated.[1]

In *TDN*, I argued that, in addition to the change in worldview from a living organism to a machine, God was now conceptualized a clockmaker, mathematician, and engineer. Simultaneously, society in the theories of Descartes, Hobbes, and Locke changed from an organic society of feudal manors and small farms in the Middle Ages and Renaissance to a mechanical model of individuals with machine-like bodies who competed like "atoms" fulfilling their own self-interests through ownership of land, factories, and industries.

In this "Afterword," I explore what happened historically after "the death of nature" during the period from the Enlightenment[2] of the eighteenth century through the mid-twenty-first century, an era named the Anthropocene by Paul Crutzen and Eugene Stoermer (Crutzen and Stoermer 2000). They argue that, as a result of the introduction of James Watt's steam engine in 1784, humans have dramatically altered the earth's climate. Although numerous scholars who have written on the Anthropocene have proposed new names and new starting points for the era (Haraway 2015; Moore 2014, 2016, 2017a, 2017b; Steffen, Crutzen, and McNeill 2007), I have chosen Crutzen and Stoermer's date because at that time the graph of greenhouse gases shows a major rise, followed by an acceleration in 1950s (Steffen et al. 2004). The late eighteenth and nineteenth centuries also introduced a full-scale industrial, capitalist society so that, by the middle of the twenty-first century, we might well experience a new "death of nature." This time, however, it puts at risk the human species itself which, as digital mechanist, data analyst, and environmental manipulator *par excellence*, has potentially set up the preconditions for its own extinction.

Indeed, climate change projections as of 2017 by the U.S. Environmental Protection Agency (EPA) say that by the year 2100 the average world temperature will increase by around 3–12°F (degrees Fahrenheit) and that the number of days with temperatures above 90 degrees will increase from around 5 percent in the years 1950–1979 to around 70 percent by 2035–2064. Projections of greenhouse gas emissions from the burning of fossil fuels range from a pessimistic high of over 1200 ppm (parts per million) of CO_2 (carbon dioxide) by 2100 to the most optimistic projection of a low of around 400 ppm. The organization 350.org[3] was formed in 2007 to pressure the nation to create policies to reduce the parts per million of CO_2 in the atmosphere from 400 ppm to 350 ppm as the safe upper limit for life on the planet (U.S. Environmental Protection Agency 2017; Raftery et al. 2017). These alarming projections would seem to herald the possibility of a new "death of nature" in the Age of the Anthropocene.

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Advent of the Anthropocene

The eighteenth-century Enlightenment (*ca.* 1815–1889) that followed the Scientific Revolution was a period of great optimism. The advances in science that culminated in Isaac Newton's 1687 *Principia mathematica* (Newton 1960) led to a sense of the human ability to understand and control nature. The ideas of Jean Jacques Rousseau, Adam Smith, Voltaire, David Hume, Immanuel Kant, and other *philosophes* promoted scientific understanding, religious freedom, political independence, and equality. New compilations of human knowledge of the world appeared in the form of Rousseau's *Discourse on Inequality* (Rousseau 1983, 1992) and *The Social Contract* (Rousseau 1977, 1990), Adam Smith's *Wealth of Nations* (Smith 1776), and Denis Diderot and Jean d'Alembert's *Encyclopédie* (Diderot and d'Alembert 1754–1772). Academies, salons, and journals discussed and dispersed new knowledge of the natural world and its applications.

Especially important were the eighteenth-century scientific discoveries that would ultimately lead to the Age of the Anthropocene. These included the discovery of carbon dioxide (fixed air) by Joseph Black,[4] the chemical experiments of Antoine Lavoisier,[5] and the improvement of the steam engine by James Watt,[6] the results of which are the burning of enormous quantities of fossil fuels and the pumping of CO_2 and other greenhouse gases into the atmosphere. In 1754, Black discovered that by heating limestone (calcium carbonate) and treating it with acids he could produce a gas, which he called fixed air (CO_2), which would not support a flame or life itself. In 1762, he introduced the concept of latent heat—the idea that a substance such as water will remain at the same temperature until the entire volume evaporates, a concept critical to the workings of the steam engine (Fleming 1952). In 1775, Joseph Priestley showed that this "fixed air" could be made "respirable" again by growing plants in it. Lavoisier in 1778 coined the term oxygen, "an eminently respirable part of the air" and discovered that it would support combustion (MacLeod 1908:134). Most important to the concept of the Anthropocene, however, was James Watt's steam engine.

James Watt's Steam Engine

The task of moving objects other than by human (or animal) lifting, pushing, and pulling is an age-old problem. The five simple machines of the Greeks (the lever, the pulley, the wheel, the inclined plane, and the wedge) were force-maximizing devices, but needed to be powered by human or animal labor. In the Middle Ages, watermills used the force of gravity in the form of falling water to move objects, while windmills used moving air to accomplish similar tasks. Horses and mules were also used for comparable purposes. In the early eighteenth century (*ca.* 1712), Thomas Newcomen[7] (building on the work of Denis Papin and others) developed an engine[8] that by burning wood or coal in a furnace, water in a boiler was converted into steam[9] that would expand to push a piston in a

cylinder upward. Then by condensing the steam with a shot of cold water, a vacuum was created in the cylinder, and external atmospheric pressure pushed it down, pulling the rocker arm upward. The rising and falling of the piston could then move the rocker arm that pushed, pulled, raised, or lowered external objects without the use of human or animal labor.

The Newcomen engine was immediately put into use all over England and greatly increased productivity, especially to pump water out of coal mines. The problem was that when the steam was cooled by injecting a shot of cold water to create the vacuum, it also cooled the cylinder. The cylinder then had to be reheated so that more steam could be created for the next motion of the piston, thereby wasting a lot of fuel.

In 1769, James Watt began to improve the efficiency of the Newcomen engine by working on a small model of the engine at Glasgow University. He discovered that by adding an exterior unit in which condensation could take place, he did not have to waste fuel by heating and cooling the same cylinder over and over again. Steam was created in a boiler and by expanding was pushed into the cylinder where the piston was located. The expanding steam pushed the top of the piston downward. Then a separate condenser filled with cold water sprayed water into the steam above the piston, reducing the air pressure and drawing the piston upward. With stopcocks placed both above and below the piston, the steam and low pressure could act alternately in a double action that enormously increased efficiency. In 1784, Watt and his partner Matthew Boulton patented a diagram of a double-acting steam engine that was used to construct steam engines throughout England. It was soon adapted beyond raising coal from mines to the development of steam-driven textile mills, steam boats, and steam trains.[10]

The Steam Engine and the Second Law of Thermodynamics

In the mid-nineteenth century, physicists Sadi Carnot (1796–1832) and Rudolph Clausius (1823–1888) addressed the problem of how to improve the amount of mechanical work obtained from the James Watt steam engine and in the process discovered that there can never be a perfect engine with no loss of heat—a discovery that by 1865 became the basis for the Second Law of Thermodynamics (Newburgh 2009; Mach 1986; Hiebert 1962). In 1824, Carnot published a short book titled *Reflections on the Motive Power of Fire*, in which he showed that the efficiency of the steam engine depends only on the temperatures of the two heat reservoirs in the cylinder and condenser, and that the ideal engine is frictionless and independent of the fluid used (Carnot 1824, 1890).

Then in 1850, Rudolf Clausius stated (without naming it as such) what became known as the second law of thermodynamics: "A transfer of heat from a hotter to a colder body always occurs in those cases in which work is done by heat, and in which also the condition is fulfilled that the working substance is in the same state at the end as at the beginning of the operation" (Magie 1899:89). An 1856 paper,

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"On the Moving Force of Heat," stated the law as "heat can never pass from a colder to a warmer body without some other change occurring at the same time." In other words, for heat to be transferred from a cold to a hot body, work has to be expended. Then in 1865, he pulled it all together with his paper "On the Mechanical Theory of Heat—With Its Applications to the Steam Engine," naming the loss of energy available for work *entropy*. Here he stated the "first and second laws of thermodynamics" as (1) The energy of the universe is constant and (2) The entropy of the universe tends to a maximum (Clausius 1865, 1867:365; Clausius 1870:122–127). That is, the energy available for work (moving objects through space) is always decreasing because entropy, disorder, is always increasing. Disordered (high-entropy) matter such as burned ashes contains less energy than ordered (low-entropy) matter such as trees. The universe is running down to a higher-entropy state; order is turning to disorder; people grow older; rocks crumble. The cosmos seemed doomed to end in a heat death (a universe with no temperature differentials).

The second law of thermodynamics was of immense consequence in the historical period following the period described in my book, *TDN*. The optimism of the Enlightenment faded, exposing new limits to reality. But although what people could actually accomplish on earth was now severely compromised, the Watt steam engine nevertheless took off. It became the basis for the steamboat, the train, the factory, and the age of industrialization, spewing carbon dioxide from the burning of fossil fuels into the atmosphere. Ultimately, with the internal combustion engine in automobiles and airplanes, and then diesel-powered machines, more and more CO_2 was pumped into the air and oceans, resulting in global warming.

The Age of the Anthropocene in which humans are capable of causing a new "death of nature" on the planet is now our twenty-first-century nightmare. Do we need a new story, a new ethic, and a new type of economy that reverses the negative effects of the James Watt steam engine? Contributors to this volume argue that the answer is YES.

A New Story

Holmes Rolston III has written extensively about environmental ethics in books such as *Environmental Ethics: Duties to and Values in the Natural World* (Rolston 1988), *A New Environmental Ethics: The Next Millennium for Life on Earth* (Rolston 2012), and *Science and Religion: A Critical Survey* (Rolston 2006). I am honored that he has written a chapter for *After the Death of Nature*. In his chapter "Leading and Misleading Metaphors: From Organism to Anthropocene," Rolston writes:

> We need Carolyn Merchant today, more than ever … . She can make us much the wiser if we see that the twenty-first century is in even more danger than the sixteenth or seventeenth … . Facing an Anthropocene Epoch, we

> need her insights into how … the strictures of an ideology control us with controlling images of nature.
>
> *(Rolston, this volume, p. 103)*

I appreciate the time that Rolston has taken to read my work so carefully and to comment on its value. I agree that we need a new ethic, worldview, and narrative. What would these look like in the Age of the Anthropocene? Should they criticize or incorporate the idea of the Anthropocene?

In my books, *Earthcare: Women and the Environment* (Merchant 1996), *Reinventing Eden: The Fate of Nature in Western Culture* (Merchant [2003] 2013), *Radical Ecology: The Search for a Livable World* (Merchant 2005:83–87), and *Autonomous Nature: Problems of Prediction and Control From Ancient Times to the Scientific Revolution* (Merchant 2016), I have proposed an ethic of partnership with nature and called nature a partner with humanity—ideas that can help form an antidote to human dominance in the Anthropocene. I have also given examples of how this ethic can be put into practice. Although partner is an anthropomorphic term, it implies a new relationship of give and take between humans and the planet. We take from the earth the basic food, clothing, shelter, and energy that keeps us alive as humans, but we also give back by composting and enriching the soil, replanting native species, recycling renewable resources, and leaving non-renewable resources in place as much as possible. We also learn from indigenous peoples around the world who have developed and used such practices over thousands of years. In this ethic, people of all genders are equal partners and all are partners with the earth. Partnership can form the basis of a new story and worldview (Merchant [2003] 2013).

My partnership ethic holds that the greatest good for the human and nonhuman communities is in their mutual living interdependence.

My partnership ethic has five precepts:

1. Equity between human and nonhuman communities;
2. Moral consideration for both humans and other species;
3. Respect for both cultural diversity and biodiversity;
4. Inclusion of women, minorities, and nonhuman nature in the code of ethical accountability;
5. An ecologically-sound management that is consistent with the continued health of both the human and the nonhuman communities. (Merchant [2003] 2013:224)

Rolston asks whether my partnership ethic could be adapted or extended to living in the Anthropocene? Or does there come with this new revolution "a fear of human domination of nature returning with a vengeance?" He quotes extensively from the "Ecomodernist Manifesto" that maintains that "future humans can fix these human-caused problems" created by the Anthropocene, an era named

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after ourselves in which there will be no limits on producing food. People will free up natural areas and the human impact on nature will "peak and decline this century." Rolston notes, "When human progress is progressively upscaled, … the importance of ecosystem services is downscaled." He accurately concludes, "But none of this sounds like partnership." "There is nothing here of nature as active partner" (Rolston, this volume, p. 113).

In my view, this so-called "ecomodernism" is yet another form of human domination through technology and information theory, but this time it purports to save nature by moving people to ever more densely populated cities, freeing up so-called "wilderness" to be used for human recreation, not to be left alone. I do not believe that ecomodernism is the basis for a solution, a new story, or a new ethic.

Men and women are equally capable of reasoning and caring. As Rolston observes, "Merchant with her feminism anticipates the 'ethic of caring' as characteristic of her web-worked partnership ethic." In the past, women were perceived as being subordinate to men, but I do not think, as Rolston puts it, that "Merchant finds that what is distinctive about males … is their capacity to reason compared to the caring, nurturing capacities of women." (Rolston, this volume, p. 107. Women have challenged this assumption ever since the seventeenth century. In *TDN* (Merchant [1980] 1990: preface, ch. 11) and in my writings on ecofeminism, I have provided a great deal of historical evidence about the reasoning power, writing ability, and mathematical and scientific capacities of women from Greco-Roman times to the present, especially feminist Betty Friedan (Merchant [1980] 1990; Friedan 1963), and environmentalist Rachel Carson (Merchant [1980] 1990; Carson 1962). Sherry Ortner (1972) explicitly challenged the dichotomy in her article "Is Female to Male as Nature Is to Culture?" I discuss these issues at length in my chapter on ecofeminism in *Radical Ecology: The Search for a Livable World* (Merchant [1992] 2005) and in my book *Earthcare: Women and the Environment* (Merchant 1996).

Rolston concludes his chapter with the following prescient statement: "'Welcome to the Anthropocene!'—seen as an Epoch in which the dominant species, humans, increasingly treasure their planet with promise" (Rolston, this volume, p. 115). He concludes with a view of God as divine and the earth as God's divine creation. I am not a religious person, but I agree that there is indeed much about the earth that is awe-inspiring, and it needs to be preserved and treasured.

The new story must be a Story of Sustainability rooted in the idea that humans take from the earth what they need for subsistence, give back what can be regrown and recycled, and leave non-renewable resources (especially fossil fuels) within the earth to the extent possible. My use of the term sustainability, however, should be distinguished from "Sustainable Development" as enunciated by Gro Harlem Bruntland in *Our Common Future*—also known as the Bruntland Report (World Commission on Environment and Development 1987). As I elaborated in *Radical Ecology*:

Rather than sustainable development, which reinforces dominant approaches to development, women's environmental groups, and many other NGOs, have substituted the term "sustainable livelihood." Sustainable livelihood is a people's oriented approach that emphasizes the fulfillment of basic needs, health, employment, and old-age security, the elimination of poverty, and women's control over their own bodies, methods of contraception, and resources. Such approaches are exemplified by localized sustainable agriculture, bioregionalism, and indigenous approaches to sustainability (Merchant [1992] 2005:23; see also Braidotti et al. 1994).

They include ecological methods that incorporate the wisdom of indigenous peoples and new forms of ecological management and restoration ecology that give back what is taken from the land.

My partnership ethic is based on a give and take between humans, and between humans and nature. In the last chapter of *Reinventing Eden*, I provide numerous examples of how to put this ethic into place. I include ways to work with business and within current ideas of capitalism while arguing that a sustainable system must move away from the exploitation of resources for the sake of profit. Implementing a partnership ethic is critical to the new Story of Sustainability as an alternative to the negative aspects of the Age of the Anthropocene.

Science and Religion

Mark Stoll takes up the question of religion, ecology, and the future of the Earth in his contribution to this book. I very much admire Mark Stoll's works *Protestantism, Capitalism, and Nature in America* (Stoll 1997) and *Inherit the Holy Mountain: Religion and the Rise of American Environmentalism* (Stoll 2015). I appreciate his Chapter 10 for this volume, "The Other Scientific Revolution: Calvinist Scientists and the Origins of Ecology," detailing the influence of Calvinism and reformed Presbyterianism on ecology. Stoll argues that John Calvin's theology was a major inspiration for the development of ecological science, which he refers to as one of the "trends overlooked by Merchant." Stoll provides a long list of Calvinist/Presbyterian men who appreciated nature and integrated nature into their faith, showing how they can be considered predecessors of an ecological science. Yet an appreciation for God's works in nature includes many complex intellectual, ethical, and religious dimensions as well as social contexts that go beyond what Stoll was able to discuss in this chapter.

Although my main emphasis in *TDN* was, as Stoll points out, on the rise of the mechanistic worldview, my work does include religious frameworks and individuals as well as the importance of gender, conservation, and stewardship for appreciating and preserving the environment. For example, in *TDN*, I include discussions of John Calvin, Robert Boyle, John Ray, William Derham, and others mentioned by Stoll who developed a stewardship approach to the care of nature.

Much of what was operative during the Scientific Revolution was directly tied to women's subordination through their perceived connections to nature. In the sixteenth and seventeenth centuries, women began to assert their right to equal religious opportunity. Stoll quotes some important passages from Calvin's writings regarding nature, for example: "Wherever you turn your eyes, there is no portion of the world that does not exhibit at least some sparks of beauty" (Stoll, this volume, p. 163), but does not quote Calvin's pronouncement that "the order of nature implies that the woman should be the helper of man." Although Calvin advocated that a woman had a right to divorce and that she should have equal responsibility in family worship and the education of children, he did not change his ideas about women's place in the natural world. Calvinist women, however, who read the Bible engaged in theological speculation—a form of liberation that was important before women could fully engage with the project of saving nature (Merchant [1980] 1990:146–147).

I appreciate Mark Stoll's effort to highlight the influence of figures such as John Ray and William Derham on the development of ecology, although he might be overlooking my chapter titled, "The Management of Nature," in *TDN* in which I discuss the philosophies of religious naturalists Ray and Derham who developed a philosophy of stewardship toward nature. Much that developed from a religious standpoint resulted from political compromises after the English Civil War as well as a perceived loss of forests, pollution of air and water, and loss of habitat that inspired the idea of religious stewardship over nature. If nature "could be used wisely and understood rationally," I wrote, "nature's abundance would not be exhausted" (Merchant [1980] 1990:252).

Concerning William Derham, I noted: "Derham's *Physico-Theology* (1713) might today be called an *ecotheology*. It embodied a number of ecologically sound principles, in a managerial framework of stewardship modeled on man's role as caretaker of God's creation." I also argued that

> Derham made use of not only the principle of ecological interdependence but also the concept of adaptation … . Each lake, pond, hill, and vale had its own group of trees, shrubs, plants, and animals … . Another ecological principle was that of population stability. Each valley, forest, or lake was kept in perfect balance so that the number of species in any one place remained constant, and there was sufficient room, food, and other necessaries.
>
> *(Merchant [1980] 1990:248, 251)*

Stoll's own elaboration of the ideas of these philosophers enriches his argument that Calvinism and reformed Presbyterianism contributed to the roots of ecological science.

Although my main thesis in *TDN* was that the Renaissance organic worldview was replaced by a mechanistic framework, I also elaborated on alternative approaches that resonated with organic and ecological assumptions. For example,

in discussing small-scale utopian communities proposed in the sixteenth century, such as Tommaso Campanella's *City of the Sun* (1602), I wrote,

> Recognized today as keys to viable ecosystems in nature are the interrelationships and organic unity among a system's parts and the maintenance of ecological diversity ... . In the *City of the Sun*, such principles subtly guided community norms and practices. Nature was an organic whole in which both natural and human cycles were integrated.
>
> *(Merchant [1980] 1990:83)*

In *TDN*, I also discussed the vitalism of Cambridge Platonists Henry More and Ralph Cudworth, as well as that of natural philosophers Anne Conway and Gottfried Wilhelm Leibniz who reasserted the fundamental organic unity of nature. "As a philosophy of nature," I wrote, "vitalism ... was inherently anti-exploitative" (Merchant [1980] 1990:253).

My other books likewise include substantive discussions of religion and nature. *Ecological Revolutions* (Merchant [1989] 2010) has a chapter on "The Animate Cosmos of the New England Farmer" that discusses the movement away from a strict Calvinist separation of God from nature and toward ways in which God showed his glory by his presence within the world of nature. *Radical Ecology* (Merchant [1992] 2005), which Stoll quotes in his opening statement, contains a chapter on "Spiritual Ecology" as well as an elaboration of the religious dimensions of several forms of environmental ethics. *Reinventing Eden* (Merchant [2003] 2013) has a major focus on the Garden of Eden story, while *Autonomous Nature* (Merchant 2016) has an entire chapter on "Christianity and Nature," as well as a chapter on Spinoza who developed what was later called pantheism.

In his Chapter 10 in this volume, Mark Stoll has contributed new insights and connections that advance the discussion of the Calvinist threads that nourished the development of the science of ecology in the twentieth century, for which I am very appreciative. Religion and spirituality are important because they can enhance the new Story of Sustainability critical to dealing with the Age of the Anthropocene.

Ecological Ethics

Norman Wirzba's excellent books on *The Paradise of God: Renewing Religion in an Ecological Age* (Wirzba 2007) and *From Nature to Creation: A Christian Vision for Understanding and Loving Our World* (Wirzba 2015) raise critical issues for spirituality and environmental ethics. In his chapter for this book, "From a Partnership to a Fidelity Ethic: Framing an Old Story for a New Time," Wirzba writes that my work shows "how the memory of Eden as the attainment of paradise has been used to underwrite the exploration and domination of nature (and women, and racial minorities, and indigenous peoples)." Moreover, "this philosophical

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story, along with the dualist metaphysic and epistemology it endorses, has been the dominant story for a long time, and it has made it is very difficult to read the Garden of Eden in ways that do not endorse dominion" (Wirzba, this volume, p. 72). Wirzba wants instead to reclaim the Eden story in new ways consistent with what he calls a fidelity ethic. An ethic of fidelity is an idea worth considering in light of the new Era of the Anthropocene. I will first discuss (1) the Eden story and then (2) the fidelity ethic.

(1) At the outset, I want to clarify the argument I made in my book *Reinventing Eden: The Fate of Nature in Western Culture* (Merchant [200] 2013). In the Bible, the ideas of dominion and the simultaneous creation of man and woman are presented in Genesis, chapter 1, while the Garden of Eden story and the sequential creation of Adam and then Eve are presented in Genesis, chapter 2. Genesis 1 becomes the basis for the domination of nature, while Genesis 2 becomes the inspiration for an ethic of stewardship based on the human management of nature (Bible, Chamberlin and Feldman 1961). How do the ideas of dominion and stewardship play out over time?

In the Bible's Genesis 2 story, God first created "man" from the dust. The name Adam derives from the Hebrew word, *adama*, meaning earth or arable land. *Adama* is a feminine noun, meaning an earth that gives birth to plants. God then created the Garden of Eden, the four rivers that flowed from it, and the trees for food (including the tree of life and the tree of the knowledge of good and evil in the center). He put "the man" in the garden "to dress and keep it," formed the birds and beasts from dust, and brought them to Adam to name. Only then did he create Eve from Adam's rib. Underlying this story is an ethic of stewardship and care for the land, points made by René Dubos in his "Conservation, Stewardship, and the Human Heart," (Dubos 1972) and his "Theology of the Earth" (Dubos 1973).

It was not until the seventeenth century in the hands of Francis Bacon that the idea of recovering Eden after "man's" fall from the garden was connected with the idea of dominion over nature. "Man by the Fall," Bacon wrote, "fell at the same time from his state of innocency and from his dominion over creation. Both of these losses can in this life be in some part repaired; the former by religion and faith, the latter by arts and science." He boldly asserted that "man" can "*recover* that right over nature which belongs to it by divine bequest" (Bacon 1870, 4:247–248, 114–115; Leiss 1972:48–52; Whitney 1986).

After the work of Francis Bacon, the Garden of Eden story takes on new meanings. The strong interventionist version in Genesis 1 validates the recovery of Eden through domination, while the softer Genesis 2 version advocates dressing and keeping the garden through human management (stewardship). Human labor could redeem the souls of men and women, while the earthly wilderness could be redeemed through cultivation and domestication—thereby recreating Eden on earth.

But Wirzba argues that we can rethink the Garden of Eden in a new way. He elaborates: "When read and retold in a new/old light [it] can play a powerful role

in developing the ethic we need in a time of ecological degradation." It is a story of "human entanglements with the land, its diverse creaturely life, and with God." The gardening God loves the soil. He kisses it and breathes into it "divine, creating, nurturing, and sustaining life." He is "a creating God who does not ever want to be separated from creation." God wants to be with his creatures. He is not "a transcendent God who is distant from the world" (Wirzba, this volume, pp. 80–81).[11] I like and appreciate Wirzba's ideas of entanglement, nurturing, and sustaining life, but I am skeptical that a reclaimed Garden of Eden story is the best story for dealing with the problems of human domination in the Age of the Anthropocene.

(2) If we can rethink the Garden of Eden story, however, can we then move to what Wirzba calls a fidelity ethic? What exactly is a fidelity ethic and what are its underlying assumptions? What kinds of environmental problems can be solved by this ethic as opposed to my own partnership ethic? What might a fidelity ethic accomplish that a partnership ethic cannot?

Wirzba does not define the meaning of fidelity, but if we examine the roots of the term, we find that it comes from the Latin word "*fides*" meaning trust, faith, or belief; it is a word of the feminine gender. *Fides* was the goddess of trust.[12] Her symbol was the Turtle Dove. In Rome, she was worshipped as *Fides Publica Populi Romana*, the "trust" of the Roman people. *Bona fides* means "good faith." Faith (*fides*) as defined historically, therefore, seems to be at the root of what Wirzba calls a fidelity ethic, defining new human relations with God and the natural world. "A fidelity ethic," he writes, "offers us an invitation to develop the skill and sympathy, and discover the pain and joy a faithful life entails" (Wirzba, this volume, p. 83). I agree that skill and sympathy are critical to human relations with the natural world, but they are not inconsistent with a partnership ethic.

Drawing on the ideas of Tim Ingold concerning life and livelihood, Wirzba asserts that we need an ethic that treats all living things as relations in dynamic movement, embedded in entanglements and meshworks, "receiving from and giving to others." We need to appreciate the "countless ways in which humanity is entangled in the movements and lives of countless others." "Our activity and movement—our aliveness—are also the world's activity and movement in and through us."[13] Wirzba explains:

> If I have proposed that we speak in terms of a fidelity rather than a partnership ethic, it is because I think that the most fundamental task moving forward is to challenge the metaphysical picture and the epistemological stance that keeps us separate and in an oppositional frame of mind.
>
> *(Wirzba, this volume, p. 82)*

I like and accept Wirzba's ideas of "dynamic movement," "entanglement," and "receiving from and giving to others." But I ask: Fidelity to what? To humanity?

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The Earth? God? Is a fidelity ethic fundamentally a religious ethic that depends on God?

My own approach is a *secular* ethic rooted in a form of process philosophy (as articulated by Alfred North Whitehead, John Cobb, and Charles Hartshorne) that sees change as dialectical, continuous, and interactive. Process is more fundamental than parts (atoms). My approach to ethics is grounded in the concept of relation, not in the self (egocentric ethics), society (homocentric ethics), or the cosmos (ecocentric ethics). Humans are dependent on all other forms of animate and inanimate nature and those forms are dependent on us (Merchant [1992] 2005:table 3.1). My partnership ethic depends on give and take, back and forth, collaboration and negotiation between humans and nonhuman nature.

In evaluating Wirzba's arguments, my questions are the following: Can the Garden of Eden story be rethought as a new story for the Age of the Anthropocene? And, second, can a fidelity ethic go beyond a partnership ethic? In brief, my answer to both questions is: We are not there yet. Until Wirzba shows by detailed examples how to put his fidelity ethic into practice and how a rethought Garden of Eden story can be applied to the real world, I'm sticking with partnership.

Ecofeminism

I am deeply amazed by the tribute paid to my ideas in my books *TDN*, *Earthcare*, and *Radical Ecology* by Patsy Hallen in Chapter 16 of this volume, "A Mighty Tree is Carolyn Merchant."[14] Patsy's invitation in 1991 to teach a course on "Ecofeminism" in Australia was exceptionally timely. At that moment, I was writing my 1992 book *Radical Ecology*. Its chapter on "Ecofeminism" was profoundly influenced by Patsy, the course, and the students that I taught at Murdoch University in Fremantle, Western Australia, as a result of Patsy's invitation. Not only did I write the chapter on ecofeminism while teaching at Murdoch, but as a result of giving visiting lectures at several Australian universities, I wrote an article on "The Ecological Self: Women and the Environment in Australia" that was published in my 1996 book, *Earthcare: Women and the Environment* (Merchant 1996). I had been deeply affected both by Rachel Carson's *Silent Spring* in 1962 (Carson 1962) on the devastating effects of pesticides on the environment, and by Betty Friedan's *The Feminine Mystique* (Frieden 1963) the following year that inspired the women's movement. But the two ideas did not come together until the early 1970s when books, courses, and the environmental movement began to connect the concepts of women and nature.

In 1974, while teaching a course at UC Berkeley[15] as a visiting lecturer, I met Geography Department graduate students Sandra Marburg and Lisa Watkins, who were organizing a conference titled "Women and Environment: A Gathering of Interested Persons Meeting and Discussing Solutions to the Most Urgent Threats to Life." At the conference, we explored the connections between

women and nature and how women could work to save the planet. In 1978, Susan Griffin (author of the much-appreciated Foreword to this volume) published her earth-shattering book of poetic prose *Woman and Nature: The Roaring Inside Her*. I met her at a political meeting in a friend's living room in Berkeley as she was finalizing her book and I was working on the manuscript for *TDN*. We became friends, and she lectured in the classes I taught in my new position at UC Berkeley, which I began in 1979. Susan's book on *Woman and Nature* inspired a student-led class on "Women and Nature" that I sponsored in 1982.

I first heard the term ecofeminism in the year 1980 when *TDN* was published. People said, "Ok, nature is dead, now what?" The term "Ecofeminism" (*ecoféminisme*), as Patsy Hallen notes, was first used in print by Françoise d'Eaubonne in her book *Feminism or Death* (d'Eaubonne 1974). In 1972 she had founded the *ecologie-féminisme* center in Paris. D'Eaubonne called on women to lead an ecological revolution to save the planet and concluded her chapter on "The Time for Ecofeminism" with the prophetic phrase: "The planet placed in the feminine will flourish for all." A society recast in the "feminine," she asserted, would not mean power in the hands of women, but no power at all (d'Eaubonne 1974, in Merchant 2008:212). Around 1976, Ynestra King began teaching a course on "ecofeminism" at Murray Bookchin's Institute for Social Ecology in Plainfield, Vermont, and in 1980 she organized a conference in Amherst, Massachusetts on "Women and Life on Earth: Ecofeminism in the '80s." It was the advertisement for this conference on ecofeminism that gave me hope that feminism and ecology could come together to reverse "the death of nature."

In 1984, with the connections between women and nature being analyzed and conceptualized around the world, I was invited to be a Fulbright scholar at Umeå University in northern Sweden to teach two courses, one on "Nature and Culture" and the other on "Women and Nature." While there I researched and coauthored an article on "Making Peace with the Earth: Women and the Swedish Environment" with sociologist Abby Peterson (*Earthcare*, Ch. 8). In 1987, Irene Diamond and Gloria Orenstein organized a conference in honor of the 25th anniversary of Rachel Carson's *Silent Spring* on "Ecofeminist Perspectives: Nature, Culture, and Theory" at the University of Southern California that drew women and men from many countries. Out of that conference came their edited book *Reweaving the World: The Emergence of Ecofeminism* (Diamond and Orenstein 1990) in which I have a chapter titled "Ecofeminism and Feminist Theory."

During the 1980s and '90s, I published several articles (in addition to those mentioned above) articulating what women were doing to save the environment that were ultimately collected in my book *Earthcare* (Merchant 1996). In her chapter in this volume, Patsy Hallen goes on to relate how she sponsored several additional classes on ecofeminism at Murdoch during the 1990s and then how she came to UC Berkeley to teach "ecofeminism" in 1993 (Hallen, this volume, p. 270). Patsy was thus a great influence on my work not only through intense intellectual discussions, but also by giving me the opportunity to express and

refine my theory of the differing forms of ecofeminism in chapter 8 and table 8.1 of *Radical Ecology* (Merchant [1992] 2005). It also made it possible to research and write the chapter mentioned above on "Women and the Environment in Australia" for my book *Earthcare* (Merchant 1996). Feminism and ecofeminism are both critical aspects of the New Story of Sustainability and partnership with the earth.

Systems Theory

Debora Hammond has done remarkable work on systems theory, publishing her outstanding book *The Science of Synthesis: Exploring the Social Implications of General Systems Theory* (Hammond 2003), and serving as president of the International Society for Systems Sciences (ISSS) in 2006. I have learned a great deal from her analysis of the roots of systems theory in the mid-twentieth century that has helped me articulate my own systems approach as a dialectical process and a new Story of Sustainability.

I became interested in systems theory when, soon after I began my job at UC Berkeley in 1979, I audited my colleague Arnold Schultz's course on "Ecosystemology." It was an eye-opening experience, not only for Arnold's insights into systems theory, but for his teaching style. His "Ecosystemology" course reader was a compilation of many articles on the systems approach with each article printed on large differently colored 11 × 17 sheets of paper. At the beginning of each lecture he would post a piece of colored paper on the blackboard. When students asked what the paper was for, he would say "Read an article in that color from the Ecosystemology reader." He used extra-large-sized paper so that people could not just shelve the reader, but had to leave it on their coffee table. In teaching, Arnold sometimes stood behind the podium and sometimes walked back and forth across the stage. He told the students that when he was behind the podium he was lecturing and when he was not behind the podium (which was most of the time) he was teaching. He always held his final examination in the Berkeley Rose Garden where part of it was written (as then required by UC Berkeley) and part of it was held in small groups. Arnold's introductions to each chapter of his "Ecosystemology" reader can now be found on the Conservation and Resource Studies website.[16]

Arnold Schultz's systems theory influenced both my teaching and my approach to history in my second book *Ecological Revolutions: Nature, Gender, and Science in New England* (Merchant [1989] 2010), which I had just published when Debora Hammond arrived at Berkeley as a graduate student. My theoretical approach in that book was a synthesis of the dialectics of Karl Marx (Parsons 1977) as an interaction between systems of production and ideology into which I integrated Arnold's approach to ecological systems and Abby Peterson's approach to gender and reproduction. But rather than using boxes and arrows as was the method of systems theory, I used a diagram of interacting circles that reflected a feminist and

process-oriented approach. I also incorporated Thomas Kuhn's *Structure of Scientific Revolutions* (Kuhn 1962) in delineating two major Ecological Revolutions—a colonial ecological revolution that transformed native peoples' ways of life by way of external ecological inputs and European settlements, and a capitalist ecological revolution that occurred internally as colonial subsistence lifestyles were transformed by capitalist industrialization. This second revolution drew on and was shaped by my partner and husband Charles Sellers's theories in *The Market Revolution: Jacksonian America, 1815–1846* (Sellers 1991). Charlie's work has been a major influence on my thinking since the early 1970s when I was writing *TDN*, and especially on my theoretical approach in *Ecological Revolutions*.

Building on Debora Hammond's outstanding insights into systems theory, I believe that a dialectical systems approach and a critique of capitalist forms of economics can contribute to a new earth that uses resources both sustainably and economically as an integral part of a new Story of Sustainability.

The Ecological Indian

Shepard Krech III, long-time colleague through three summer seminars taught at the National Humanities Center (NHC) between 1996 and 2000, and co-research fellow in the NHC class of 2001, has written a gracious and provocative chapter for this volume titled "Carolyn Merchant and *The Ecological Indian*." Krech's books *The Ecological Indian: Myth and History* (Krech 1999) and his subsequent *Spirits of the Air: Birds and American Indians in the South* (Krech 2009) bring together our shared interests in the changing ecology of the American landscape and bird life throughout the Americas. I have benefitted from Krech's well-crafted critiques of approaches to environmental history that tend to idealize Native American relations with animals and the land prior to European intervention. I learned a great deal from his contributions to the summer seminars at the NHC as well as our work together on the three-volume *Encyclopedia of World Environmental History* while we were fellows at the Center in 2001 (Krech, McNeill, and Merchant 2004).

In his Chapter 8 for this volume, Krech notes that in some places "Merchant and I are [not] in perfect lockstep" and points to what he calls "differences in our reading of the history of ecology and conservation in Native North America." One example of this problem, he states in his chapter, "was an essay by historian Calvin Martin called 'Micmacs and French in the Northeast'" (Krech, this volume, p. 139), which I included in all three editions of my edited book *Major Problems in American Environmental History* (Merchant [1993] 2012). I did this even after reading the excellent arguments in *The Ecological Indian* because I wanted students to learn to analyze historical documents and essays and develop their own interpretations of history.

Calvin Martin's essay in *Major Problems* (Merchant [1993] 2012:ch. 2) was excerpted from his 1974 article, "The European Impact on the Culture of a

Northeastern Algonquin Tribe: An Ecological Interpretation," published in the *William and Mary Quarterly* (Martin 1974). Martin followed this article with his book *Keepers of the Game: Indian–Animal Relationships and the Fur Trade* (Martin 1978). Krech then challenged Martin's interpretation of the ways in which native peoples related to other animals and the environment in his edited book *Indians, Animals, and the Fur Trade: A Critique of "Keepers of the Game"* (Krech 1981).

The *Major Problems* series, in which Calvin Martin's essay is included, was designed to present documents and essays with differing perspectives so that students can learn to evaluate critically the evidence and arguments presented. Chapter 2 on "Native American Ecology and European Contact" included a comparison of the transformation processes initiated by the arrival of Europeans on three different Indian cultures (Pueblos in the Southwest, Micmacs in the Northeast, and Indians on the Great Plains). My goal was to present two or three primary source documents for each case along with an interpretive essay, asking the students to compare the three cases and to critically assess the documents in relation to the arguments in the essays. The documents for the Micmacs included a description from Jesuit Nicolas Denys from 1672, discussing Micmac life before and after the fur trade, and another from 1691, featuring the recollections of Father Chrestien Le Clercq on the ways in which hunters imitated the habits of their prey and adhered to rituals for disposing of their remains (Merchant [1993] 2012:ch. 2). The "Introduction" to chapter 2 states the following:

> Encounters between Pueblos and Spanish in the Southwest and between Micmacs and French in the Northeast and the introduction of horses on the Great Plains altered the ecological habitats and cultures of Native Americans. Although the transformation processes in the three cases had similarities, they were also different … . These three examples [cover] three different ecosystems: deserts, forests, and grasslands.
>
> *(Merchant [1993] 2012:33–34)*

Martin's emphasis is on Indian–animal spiritual relationships and the consequences of European introductions into the Micmac environment. Critics of Martin argued that the fur trade was established in the 1580s through 1640s, but the epidemics that Martin claimed changed the Micmacs' spirituality occurred *after* the fur trade began (Merchant [1993] 2012). In my lectures I drew on Krech's examples showing that the Pueblo and Great Plains Indians, as well as the Micmac, were not "ecological" as Martin and others had cast them (Krech 1999:chs. 2, 5, 7).

My objective was to engage students in a discussion of the pros and cons of Martin's, Krech's, and other historians' explanations. I asked: What is at stake here? A materialist or idealist interpretation of history or something far more complex? Is materialism (e.g., Jared Diamond's thesis that the "guns, germs, and steel" introduced by Europeans were the causes of change) or ideas (such as Martin's argument that emphasized spiritual change) the driver of history? Or is

there a much more complex process of change involving many factors, such as those pointed out by Krech? My goal was to teach students to question the underlying assumptions behind the arguments of environmental historians, to go to the sources for evidence of their thesis, and to give them confidence in their own abilities to read, analyze, and evaluate history.

I am grateful to Shepard Krech III for his insights and analysis of many North American Indian cultures in *The Ecological Indian* and his critical perspectives on the numerous factors operating in historical and environmental change which I integrated into my courses and lectures. I have learned a great deal from knowing him over the past two decades.

Enriching *TDN*

Kenneth Worthy's book *Invisible Nature: Healing the Destructive Divide Between People and the Environment* (Worthy 2013) is a brilliant analysis of the intellectual, social, and psychological consequences of humanity's disconnection from the natural world over the past two millennia and ways to restore lost relationships and connections. In his stimulating Chapter 2 for this book, "*The Death of Nature* or Divorce from Nature?", he shows how "the mechanistic cosmology advanced the project of divorce from nature … and perhaps more important, [how] it intensified the adoption of an organizing principle that [he calls] dissociation—various forms of disconnection, separation, isolation, and alienation—running through structures of Western thought." "The concept of dissociation," he writes, "deepens and enhances the understanding of mechanistic cosmology elaborated in *TDN* by elucidating the effects of mechanism on relations of all kinds" (Worthy, this volume, p. 43). Worthy especially focuses on Greek philosophy as background to the concept of dissociation. Dissociations alienate people from nature and from the consequences of each person's own actions on other people, the living world, and the natural environment. Restoring the lost wholeness will require a major reset in human/nature relations. I greatly appreciate his extension and elaboration of the personal and social effects of the "divorce" from nature. They contribute significantly to a new Story of Sustainability that must heal the divisions created by the divorce and dissociation of humanity from the natural world.

Nancy Unger's highly complimentary Chapter 7 in this volume, titled "Personal, Political, and Professional: The Impact of Carolyn Merchant's Life and Leadership" elaborates on the ways her own scholarship has been influenced by my work on gender. Examples include her superb book *Beyond Nature's Housekeepers: American Women in Environmental History* (Unger 2012), her first-rate article "Women and Gender: Useful Categories of Analysis in Environmental History" (Unger 2014) and her wonderful co-authored essay, "'Mother Nature is Getting Angrier': Turning Sacred Navajo Land into a Toxic Environment (Unger and Bolton 2015)." Nancy is a great public speaker, doing interviews and broadcasts for NPR, KQED, CNN, and C-Span. Her work includes the role of

LGBTQ in history, an enrichment that gives me great pleasure and admiration for her. I am deeply grateful to Nancy for detailing the ways in which her own work on gender has been enriched by mine. In turn, my own ideas have been enhanced by hers. Recognition of LGBTQ rights and responsibilities must become part of an ethic of partnership between people and the earth.

Elizabeth Allison's eloquently written Chapter 5, "Bewitching Nature," offers another road to "after the death of nature." Allison proposes an "ethic of flourishing," emerging from her studies in the Himalayas and especially of Buddhism. Her excellent dissertation *Enspirited Places, Material Traces: The Sanctified and the Sacrificed in Modernizing Bhutan* (Allison 2009) (and book in progress with the working title *Enchanted Earth: Ecology, Religion, and Development in Modernizing Bhutan*), reveals an array of ecological insights developed over many years by indigenous communities in Bhutan. Such approaches contribute to a revision of ideas of mechanism rooted in Western epistemology and ontology in directions that can enhance partnerships with nature. She advocates greater emphasis on justice, receptive listening, openmindedness, and recognizing that other peoples and life forms are active agents in a world that is polyfocal and polyvocal. By listening to indigenous peoples and marginalized groups, as well as the voice of the nonhuman world, we can move forward toward liberatory policies that can make "their way into national and international policy discourses." The contributions of indigenous peoples to listening, justice, partnerships, and an ethic of flourishing are critical to a sustainable earth. Moreover, her recent article, "Toward a Feminist Care Ethic for Climate Change" (Allison 2017), that draws on traditional ecological knowledge (TEK) is a profound addition to her ethic of flourishing that dovetails with my own partnership ethic. These approaches are well-argued, significant approaches to environmental history and ways to advance human partnerships with nature.

In addition to the chapters discussed above, I am honored by the admirable contributions made by Heather Eaton, Sverker Sörlin, Dewi Candraningrum, Laura Alice Watt, Yaakov Garb, and Whitney Bauman. Each has contributed significant insights into my work, enriched its implications, and extended it in new directions. Together, the contributors to this volume have produced pathways to a better future for both humanity and the earth.

Conclusion

The chapters in *After the Death of Nature* have helped me to rethink the ideas and assumptions on which my intellectual work has been based. I believe that we need a new story and a new ethic for the Age of the Anthropocene, as we are in danger of experiencing another "death of nature" that may include the human species as well as much of the physical and biological world as it exists today.

That new story is a Story of Sustainability in which humans and the earth are in dynamic interaction, and there is a give and take between humans and

nonhuman nature. It recognizes that nature is autonomous and not always predictable—a nature described not only by mechanistic science but also by chaos and complexity theories. As humans, we can learn from what is now happening to the oceans and atmosphere as a result of the anthropogenic accumulation of greenhouse gases that is disrupting life as we know it today. We can use our knowledge of science, technology, and society, along with our spiritual and ethical relations with each other and the nonhuman world, to create that new story. The New Ethic that accompanies the New Story is a Partnership Ethic. It states: *The greatest good for the human and nonhuman communities is in their mutual living interdependence.*

My mantra is

Solar panels on every roof;
Bicycles in every garage;
And
Vegetables in every backyard.

Policies, ethics, and individual actions can restore, reclaim, and reinvigorate the earth.

Notes

1 Carolyn Iltis was the name I took in 1961 when I married Hugh Iltis, a professor of Botany at the University of Wisconsin, Madison, where I did my graduate work and wrote my doctoral dissertation on "The Controversy over Living Force: Leibniz to d'Alembert" (Iltis [Merchant] 1967). As Shepard Krech III relates in Chapter 8 of this book, on my first date with Hugh we went out and burned a prairie. The Botany Department's teaching prairie north of Madison had become overgrown with invasive plants and aspens and burning was the time-honored method of restoring native prairie plants. Hugh took me out to see the prairie and while we were walking through it, he took out some matches and tossed them into the overgrown vegetation. As we drove along the road below, fire engines arrived and put out the flames. The following spring the rejuvenated prairie was a mass of beautiful flowers. During our marriage we burned several other prairies that we helped to purchase for the Nature Conservancy. I learned much about ecology and conservation from Hugh during my years in Madison. In 1967 after completing my doctoral dissertation, I left Hugh Iltis and moved to Berkeley, California where I obtained a position at the University of San Francisco and helped to found the Natural Sciences Interdisciplinary Program, sponsored by the Physics Department. When I began my position at the University of California, Berkeley in 1979, I took back my maiden name, Carolyn Merchant under which all my subsequent writings have been published. See Merchant … /carolyn-merchant. For more on my early history and a collection of publications that characterize my academic work over the past decades, see Merchant, 2018.

2 Enlightenment (n.d.) In *Wikipedia*. Retrieved November 10, 2017, from https://en.wikipedia.org/wiki/Age_of_Enlightenment

3 350.org. (n.d.). In *Wikipedia*. Retrieved November 10, 2017, from https://en.wikipedia.org/wiki/350.org

4 Joseph Black (n.d.) In *Wikipedia*. Retrieved November 10, 2017, from https://en.wikipedia.org/wiki/Joseph_Black

5 Antoine Lavoisier (n.d.) In *Wikipedia*. Retrieved November 10, 2017, from https://en.wikipedia.org/wiki/Antoine_Lavoisier
6 James Watt (n.d.). In *Wikipedia*. Retrieved November 10, 2017, from https://en.wikipedia.org/wiki/James_Watt
7 Newcomen (n.d.). In *Wikipedia*. Retrieved November 10, 2017, from http://technology.niagarac.on.ca/people/mcsele/newcomen.htm
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9 Steam. www.egr.msu.edu/~lira/supp/steam/
10 Steam Engine (n.d.). In *Wikipedia*. Retrieved November 10, 2017, from www.deutsches-museum.de/en/information/young-people/inventors-trail/drivetrains/steam-engine/
11 Wirzba's approach resonates with the idea of panentheism (as opposed to pantheism): The universe is a manifestation of God; God and the world are interrelated. God interpenetrates the world and is actively present in it. Panentheism … /panentheism/ citation may not be needed here.
12 Fides. (n.d.) In *Wikipedia*. Retrieved November 10, 2017, from https://en.wikipedia.org/wiki/Fides_(deity).
13 Wirzba's ethic also seems to resonate with the ideas of John Cobb and David Ray Griffin that grew out of Alfred North Whitehead's process philosophy—a theory in which everything is in constant change and based on relations.
14 Regarding Patsy Hallen's comment on Robert S. Cohen (Hallen, this volume, p. **000**), I first met Bob Cohen at the Enrico Fermi Summer Institute on the History of Twentieth Century Physics in Varenna, Italy in the summer of 1972 and we have been friends ever since. Cohen introduced me to the work of Boris Hessen (Hessen [1931] 1968). This essay played a formative role in my analysis in *TDN* (Merchant [1980] 1990). I believe that Cohen grew to appreciate the argument of *TDN*. When I saw him in June 2016 at the conference on Emile du Châtelet held at Boston University he made very complimentary comments about my work.
15 Merchant, Carolyn. https://ourenvironment.berkeley.edu/people/carolyn-merchant.
16 Conservation and Resource Studies website: https://nature.berkeley.edu/advising/majors/conservation-and-resource-studies

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