Integritas 8.3 (Fall 2016), pp. 1-16.
doi: 10.6017/integritas.v8i3p1

Seven Billion and Counting: Paradise Crowded

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This paper focuses on the contemporary challenge of humanity living in a modern technological world with finite resources and a growing population. The exploitation of fossil fuels and other natural resources has had a dramatic negative effect on our environment and climate. Our future demand for energy and clean drinking water at the current rate is unsustainable given known resources.

The recent encyclical *Laudato Si'* by Pope Francis appeals to scientific data, the Gospels, Catholic social teaching, and to the writing of recent popes to critique the exclusion of anyone, particularly "the poor," from the fruits of creation. Technology alone cannot solve the world's current and future demand for energy, food, and clean water and air without regard for environmental sustainability. Reflecting on the status quo, this paper suggests some educational goals and methodologies in the context of Catholic higher education that can address both the environmental challenges and the promotion of a human solution as stewards of creation.

Introduction: *Paradise Lost, Regained, and Crowded*

Milton's epic poem *Paradise Lost* is an imaginative retelling of Genesis 2-3 and how Adam and Eve came to lose their innocence and their home in the Garden of Eden. Central to this tale is the character of the rebellious, fallen angel Lucifer (a.k.a. Satan), who thirsts for revenge against God following his defeat and expulsion from heaven by the faithful archangel Michael. In the sequel *Paradise Regained,* Milton continues the

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story of sin and redemption starting with the baptism of Jesus in the River Jordan by John and retelling Luke's account of Jesus' temptation in the desert by Satan. If Milton were alive today he might write a further sequel entitled *Paradise Crowded* that relates the story of a garden crowded with people competing for the natural resources necessary for their very survival in a modern world: water, food, and energy. We can only imagine how Milton might characterize Satan's influence on human activity in helping to make critical choices about the distribution of available resources in the contemporary world. Because John Milton is unavailable for such a literary project, we might look at the world to reflect on the "garden" in which we live (our environment) and how a growing human population might live in harmony with plentiful but limited natural resources.

This essay will present reflections on current scientific data and its relationship to sustainability in our use of natural resources and population growth. I will attempt to summarize Pope Francis's call to reflection and the actions he suggests in *Laudato Si'*. And I will comment on the sense of conversion necessary to embrace environmental stewardship, both for ourselves and for the community or generations that follow us.

Population, Energy, and Water

Human history is a narrative with two major themes: population growth and resource scarcity. Evidence from early hominid history from one to two million years ago shows that small bands and family groups subsisted by hunting, fishing, and gathering plant-based foods from a bountiful yet unforgiving wilderness.[1] The shift away from the hunter-gatherer mode of living, which sustained humans for greater than 99% of their earthly existence, to farming and herding was a major transition that required continuous and reliable sources of energy and water. This transition coincided with the decreased reliance on passive solar energy and a dependence on domestic wood-fueled fire as a means of survival. As a result, over the past 20,000-35,000 years a radically different way of life emerged based on a major alteration to natural ecosystems in order to produce crops and provide pasture for animals. Agriculture and herding made human society capable of providing much greater quantities of food, which made possible the evolution of settled, complex, hierarchical cultures and a growth in population.[2]

Reliable energy resources in the form of wood/trees, potable water from streams/rivers, and abundant clean air not only encouraged population growth but made the potential for expansion of human culture seem inevitable. The use of coal as an energy source goes back thousands of years and it's the most plentiful fossil fuel. Evidence of its use is found in caves throughout Europe and Asia prior to 10,000 BCE. When modern mining operations and techniques developed in the early half of the eighteenth century, coal enabled the Industrial Revolution and provided energy for steam engines, industrial

1 A. DeVries, *Primitive Man and His Food* (Chicago: Chandler Book Co., 1952); L. Cordain, et al., "Plant-Animal Subsistence Ratios and Macronutrient Energy Estimations in Worldwide Hunter-Gatherer Diets," *The American Journal of Clinical Nutrition*, 71 (2000), 682-692.

2 Clive Ponting, *A New Green History of the World: The Environment and the Collapse of Great Civilizations* (New York: Penguin Books, 1991).

machines, and buildings. Coal's energy density in terms of energy per mass (Joules per kilogram) made it a much more desirable fuel than wood. However, the first commercial production of oil in Titusville, Pennsylvania, in 1859 inaugurated a trend in energy use that has shaped modern human history, industry, and climate in unimaginable ways.

Although Colonel Drake, who pumped the first oil from petroleum wells in western Pennsylvania, was mainly interested in cooking and lantern fuel, by the year 1862 75 wells in Pennsylvania were producing some 3 million barrels per year for a variety of uses. By 1909 hundreds of wells in Pennsylvania, California, Texas, Ohio, and Indiana were producing 500,000 barrels per day.[3] Oil has an extremely high energy density and the trend to consume more energy per person has increased steadily from that time to the present. The primary cause of increased energy use is that today there is a net increase of about 200,000 people per day on the planet.[4] These new inhabitants need energy to live and this leads naturally to a continuous increase of primary energy consumption. Significant population increase in relation to the limits of our ecosystem is a recent phenomenon. Only 200 years ago, humans numbered less than 1 billion; today world population stands at 7.4 billion. Another significant contributing factor in the rise of population is the decline in death rates due to infectious diseases and infant mortality. Both are a consequence of modern medicine and improved sanitation. Between 1900 and 2000, the increase in world population was three times greater than in the entire previous history of humanity—an increase from 1.5 to 6.1 billion in just 100 years.[5] Projections from the United Nations' Department of Economic and Social Affairs, Population Division, estimate that by 2100 the human population will reach or exceed 11.6 billion.[6]

Following the rise of population and fossil fuel use, it is estimated that in 2004 the consumption of crude oil was 2.86×10^{10} barrels and of natural gas 2.5×10^{12} cubic meters. That of coal was approximately 4.0×10^{9} tons. Fossil fuels represent around 80% of global energy consumption.[7] It is important to note that this is an enormous quantity of energy that took 100-200 million years to produce by storing solar energy in a hydrocarbon chemical form from decaying plant and animal material. The use of this immense quantity of energy in such a short time has had a major impact on our environment on both local and global levels. The primary problem associated with fossil fuels is that all of them contain carbon atoms in their molecules. Combustion

3 Christian Ngo and Joseph B. Natowitz, *Our Energy Future: Resources, Alternatives, and the Environment* (New York: John Wiley & Sons, 2009), 245-256; Robert A. Ristinen and Jack J. Kraushaar, *Energy and the Environment,* 2nd ed. (New York: John Wiley and Sons, 2006), 31-35.

4 Population increase per year: 200,000 [people/day] x 365 [days/year] = 73,000,000 [people/year].

5 Michael Kremer, "Population Growth and Technological Change: One Million B.C. to 1990," *Quarterly Journal of Economics* 108, 3 (August 1993), 681-716.

6 United Nations, Department of Economic and Social Affairs, Population Division (2015). "World Population Prospects: The 2015 Revision Methodology of the United Nations Population Estimates and Projections," Working Paper N. ESA/P/WP.242.

7 Ngo and Natowitz, *Our Energy Future: Resources, Alternatives, and the Environment*, 40-42.

The majority of the scientific community feels that there is high probability that the approximate 0.5°C temperature increase in the last 100 years is directly related to increased CO_2 concentrations.

releases CO_2 as an atmospheric gas. For example, generating 1 kWh of electricity with oil produces 700-800 g of CO_2, whereas using natural gas produces about 480-780 g of CO_2, depending on technology.[8] Research conducted by Le Quéré and colleagues reveals that humans annually introduce 4.0 x 10^{10} tons (3.6 x 10^{13} kg) of CO_2 into the atmosphere.[9] CO_2 is considered a "greenhouse gas" that once introduced into the air increases the ability of solar heat/energy being trapped in the atmosphere with a corresponding impact on global climate.[10] While there is a minority of people who doubt the linkage between fossil fuels and climate change, the Keeling Curve, which records the atmospheric concentration of CO_2 across time, shows a systematic increase from 315 ppm in 1958 to 401 ppm in October 2016.[11] In addition to the Keeling Curve, other research shows that the aggregate global temperature has risen since 1980.[12] The average global temperature over the past 160,000 years is correlated rather closely with atmospheric CO_2 concentration. While there may be room for refinement, the majority of the scientific community feels that there is high probability that the approximate 0.5°C temperature increase in the last 100 years is directly related to increased CO_2 concentrations.[13] The wealth of modern industrialized civilization owes much to fossil fuels. Our dependence upon oil, coal, and natural gas will likely have to change in the

8 Ngo and Natowitz, *Our Energy Future: Resources, Alternatives, and the Environment*, 49-50.

9 C. Le Quéré, et al.,"Global Carbon Budget 2013," *Earth Sytstems Science Data* 6 (2014) 235-263.

10 The common garden greenhouse is a passive solar building that admits sunlight (solar radiation: UV, visible, and infrared) through glass panels but the outgoing infrared radiation from the interior of the building is trapped and re-reflected back into the building by the glass panels. The process involving additions of atmospheric CO_2, N_xO_y (nitrogen oxides), and CH_4 (methane) is more complicated yet the thermal "effect" is similar. The heat added to the atmospheric system that produces a global 1°C rise in temperature is the result of the addition of a huge amount of thermal energy because the system size is enormous. If one were to calculate the approximate amount of energy necessary to raise the air and ocean temperature by 1° C it is: 5.95 x 10^{21} J and 5.30 x 10^{24} J, respectively. Trapping this much energy in such a system changes the operational parameters of the system itself.

11 R.F. Keeling, S.C. Piper, A.F. Bollenbacher, and J.S. Walker. "2009 Atmospheric CO_2 Records from Sites in the SIO Air Sampling Network." In *Trends: A Compendium of Data on Global Change* (Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A.), doi: 10.3334/CDIAC/atg.035. The data for October 2016 is taken from the weekly updated Scripps Institution of Oceanography website: https://scripps.ucsd.edu/programs/keelingcurve/.

12 J. Hansen, et. al, "Global Temperature Change," *Proc Natl Acad Sci USA* 103, No. 39, 14288, September 26, 2006.

13 Ristinen and Kraushaar, *Energy and the Environment*, 335-340.

future due to both environmental factors and the fact that future fossil fuel supplies are limited and dwindling.

The major consequence of the greenhouse effect and rising global temperature comes in the form of climate change. The Intergovernmental Panel on Climate Change[14] notes that given the current trend in fossil fuel usage, the mean global surface temperature will go up by 1 to 6°C by 2100. In every scenario considered by the panel, the average rate of warming would probably be greater than any seen in the past 10,000 years.[15] The increase in global temperature can have dramatic effects on weather systems and climate, such as altering annual rainfall and seasonal temperatures. The direct consequence of such changes can significantly decrease agricultural production yields, so that once abundant cropland can become a desert. Any experienced gardener will be quick to relate how either drought or cold weather can alter prospects for their vegetable harvest.

Additionally, an important incident in regard to climate change and its effect on population was the asteroid or comet impact that is thought to have occurred about 65 million years ago on the Yucatán Peninsula in eastern Mexico. The transition from the Cretaceous period to the Paleogene epoch was marked by a mass extinction of 75% of large land animals, while many semi-aquatic creatures (turtles, frogs, and crocodiles) survived. Scientists theorize that the extraterrestrial impact choked the skies with debris and temporarily changed the earth's climate system. Once the impact dust and volcanic ash settled, greenhouse gases absorbed by the atmosphere from dust particulate would have caused the temperature to soar. A swift climate swing and food shortage likely toppled much of the life that survived the prolonged darkness.[16]

The Sustainability of Fresh Water Supplies

The growth in human population over the past 200 years has required significant water resources in order to survive and expand. Although 75% of the earth is covered in water, only a small fraction of that water—about 2.5%—is fresh water and of that less than 0.5% is accessible to humans. The 2% balance of fresh water is bound up in glaciers and ice caps. Contemporary Americans use about 100 gallons per person per day, which comes to about 2.88 million gallons over a lifetime.[17] Among scientists there is broad agreement that greenhouse warming will have major impacts on water resources. Those impacts include changes in predictable precipitation and runoff patterns and sea level rise.[18] Hydrological uncertainties attributable to change in atmospheric chemistry and

14 G. Flato, et al., "Evaluation of Climate Models," in T.F. Stocker, et al., eds., *Climate Change 2013: The Physical Science Basis.* Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmenal Panel on Climate Change (Cambridge: University of Cambridge Press, 2013).

15 Ristinen and Kraushaar, *Energy and the Environment*, 335-340.

16 Charles Frankel, *The End of the Dinosaurs: Chicxulub Crater and Mass Extinctions* (Cambridge: University of Cambridge Press, 1996), 145.

17 2.88×10^6 gallons = 78.86 years (average U.S.A. lifespan) x 365 days/year x 100 gallons/day.

18 K.D. Frederick and D.C. Major, "Climate Change and Water Resources," *Climatic Change*, 37 (1) (September 1997) 7-23, doi:10.1023/A:1005336924908.

CO_2 concentration are likely to persist into the future. River basin hydrology, watershed levels, permafrost thawing, and the performance of aquifers are likely to change as a result of anthropogenic climate change.[19] Population growth will be a major, if not the most important determinant of future water resources in the developed world. It is likely that countries with high population growth will experience sharp declines in per capita fresh water availability even with limited climate change. Population trends; advances in technology; economic conditions; social, religious, and political factors; and the value individuals and society place on sustainable water use may be the most important factors in future water availability.[20]

The Story of the Honeybee

Emblematic of the adverse human impact on our environment is the current situation of the honeybee, a member of the genus *Bombus*. St. John Chrysostom commends the humility of the honeybee in his reflection on Christian life: "the bee is more honored than the other animals; not because she labors, but because she labors for others."[21] Bees are frequently displayed in Christian art and even decorate the helical columns of the baldachin in St. Peter's Basilica. Bernini's inclusion of bees connects Pope Urban VIII (formerly Maffeo Barberini) with the Barberini coat of arms, which features a trio of bees. Most people recognize the bee's nobility because it labors producing honey and wax.[22]

However, the bee is a much more important actor in the world by pollinating 75% of fruits, vegetables, and trees throughout temperate ecosystems. The majority of human food production literally depends on pollination, the activity of bees laboring for others. A recent interdisciplinary review of bee species in North America indicates a 50% decline in the last 30 years in several range-wide populations.[23] Pollinator decline has become a worldwide concern and raises the question of impact on global food production and agricultural systems.[24] Ongoing research indicates that climate change, pesticides, disease, and hive fatigue, as well as the loss of floral and nesting habitat, contribute significantly to this population decline. While other insect species may emerge to overcome the current pollinator deficit, they are no guarantee of future success or even a more unwelcome systematic change in worldwide agricultural production.[25] The labors

19 C. Rosenzweig, et al., "Attributing Physical and Biological Impacts to Anthropogenic Climate Change," *Nature*, 453 (15 May 2008), 353-357.

20 K. Frederick, D. Major, "Climate Change and Water Resources," *Climate Change* 37(1) (1997), 7-23.

21 John Chrysostom, Nicene and Post-nicene Fathers First Series, Volume XI, St. Chrysostom: *On the Priesthood, Ascetic Treatises, Select Homilies and Letters, Homilies on the Statues*, Ed. Philip Schaff (New York: Cosimo Publishers, Inc., 2007), 200.

22 Prior to the nineteenth century, honey was the primary ingredient of mead (honey wine) and an essential sweetener of food, and beeswax was used as candle fuel.

23 S.A. Cameron, et al., "Patterns of Widespread Decline in North American Bumble Bees," *Proceedings of the National Academy of Sciences*, 108-2 (January 11, 2011), 662-667.

24 S.G. Potts, et al., "Global Pollinator Declines: Trends, Impacts and Drivers," *Trends in Ecology and Evolution* 25 (2010), 345-353.

25 G. Allen-Wardell, et al., "The Potential Consequences of Pollinator Declines on the Conservation of

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Laudato Si': On Care for Our Common Home

Remarkably, Pope Francis chose to address the issues we have been describing in his first encyclical. On the 24th of May 2015, the Solemnity of Pentecost, Pope Francis issued *Laudato Si': On Care for Our Common Home* (hereafter *LS*).[26] He called for an urgent conversation about a crisis affecting "our common home" and addressed this call to "every person living on this planet" (*LS* 3). The encyclical is an open invitation to dialogue and reflection "with all people of good will" (*LS* 62) about how the environment is being adversely influenced by humanity. Christina Peppard notes, "*Laudato Si'* is a sustained theological and moral reflection on the multifaceted idea of ecology in ways that generate spiritual insights and ethical obligations."[27] The roots of this encyclical are diverse and focus a prophetic call to personal reflection, conversations in our community, and conversion in regard to how humanity lives in its own environment.

Laudato Si' reflects an intent similar to Leo XIII's *Rerum Novarum* of 1891, which dealt with modern-day labor problems. Pope Francis uses some of the traditional foundations of Catholic social teaching, particularly the idea of the "common good," to frame a discussion and for reflection and solution. However, Pope Francis leaves little doubt about the connection between climate change and human activity. The encyclical makes an explicit link with *Pacem in Terris* and John XXIII's approach to the problem of the world on the brink of nuclear war.[28] Gerard O'Connell comments, "The spirituality of the saint whose name he has taken as pope, St. Francis of Assisi, is the soul of the encyclical. It is this profound spirituality that gives the encyclical real power in generating a true conversion on the environment."[29] The encyclical is in keeping

Biodiversity and Stability of Food Crop Yields," *Conservation Biology* 12-1 (February 1998), 8-17; D. Goulson and E. Nicholls, "The Canary in the Coalmine; Bee Declines as an Indicator of Environmental Health," *Science Progress* 99-3 (2016), 312-326.

26 Pope Francis, *Laudato Si': On Care for Our Common Home*, online at www.vatican.va.

27 Christiana Z. Peppard, "Hydrology, Theology, and *Laudato Si'*," *Theological Studies* 77-2 (2016), 416-435.

28 J. Martin, S.J., "Top Ten Takeaways from *Laudato Si'*," *America Magazine* (June 18, 2016).

29 G. O'Connell, "Encyclical from Pope Francis Welcomed as Global Call to Arms," *America Magazine,* July 6-13, 2016.

with the progressive movement and scientific thought of Paul VI, whose message to the Stockholm Conference on the Human Environment focused on the human effects on the environment and challenges to future generations.[30]

This encyclical echoes the previous environmental groundwork done by John Paul II as he addressed the participants of the World Day of Peace in 1990 and the Vatican Symposium on the Environment, both with ecological themes.[31] In his summary on the World Day of Peace, John Paul II concludes, "...discoveries in the fields of industry and agriculture have produced harmful long-term effects. This has led to the painful realization that we cannot interfere in one area of the ecosystem without paying due attention both to the consequences of such interference in other areas and to the well-being of future generations."[32]

In 2001 the United States Catholic Bishops released *Global Climate Change: A Plea for Dialogue, Prudence, and the Common Good* and called upon people of faith to acknowledge the gift of creation and respond to the challenges surrounding global climate change.[33] The document embraces the scientific consensus of the Intergovernmental Panel on Climate Change (IPCC)[34] that human activity is changing world climate patterns that threaten our ability to flourish. "It is about our human stewardship of God's creation and our responsibility to those who come after us. With these reflections, we seek to offer a word of caution and a plea for genuine dialogue as the United States and other nations face decisions about how best to respond to the challenges of global climate change."[35] From these and similar works from Catholic social teaching, Francis weaves an argument in *Laudato Si'* to take the data of climate change seriously because the consequence of neglect will spare no one, rich or poor. The encyclical challenges people living in developed countries in a particular way. Too often people in the developed world believe that technology holds the key to a better life and the complete solution to a future environmental crisis.

One of the striking contrasts of *Laudato Si'* with other documents of Catholic social teaching and previous encyclicals is the confidence with which Francis addresses and embraces scientific data to simultaneously analyze the problem and reject relying entirely

30 Paul VI, "A Hospitable Environment for Future Generations: Message to the Stockholm Conference on the Human Environment" (Vatican City: Libreria Editrice Vaticana, June 1, 1972).

31 John Paul II, *Ecology and Faith: The Writings of Pope John Paul II*, ed. Sr. Ancilla Dent, O.S.B. (Berkhamsted, England: Arthur James, 1997).

32 John Paul II, "Message of His Holiness Pope John Paul II for the Celebration of the World Day of Peace" (Vatican City: Libreria Editrice Vaticana, December 8, 1989).

33 United States Conference of Catholic Bishops, "Global Climate Change: A Plea for Dialogue, Prudence, and the Common Good," June 15, 2001, http://www.usccb.org/issues-and-action/human-life-and-dignity/environment/global-climate-change-a-plea-for-dialogue-prudence-and-the-common-good.cfm.

34 J. T. Houghton, et al., eds., *Climate Change 2001: The Scientific Basis*; J. McCarthy, et al., eds., *Climate Change 2001: Impacts, Adaptation, and Vulnerability*; O. Davidson, et al., eds., *Climate Change 2001: Mitigation* (all Cambridge and New York: Cambridge University Press, 2001).

35 United States Conference of Catholic Bishops, "Global Climate Change."

upon technology and science as the solution (*LS* 107). Perhaps Francis's early studies in chemistry shaped his appreciation for the use and importance of technology. Prior to entering the Jesuits, Jorge Mario Bergolio graduated with a *título* (a certification) in chemistry from the Escuela Técnica Industrial No. 12 and then worked for a few years as a technician in the food section at Hickethier-Bachmann Laboratory with his mentor and friend Dr. Esther Ballestrino. Writing confidently and appreciatively about the scientific aspects of environmental issues may also have had the secondary or tertiary benefit of exorcising the ghost of Galileo and the missteps in astronomical judgments made by Church leaders at that time. A modern pope who embraces the scientific method in such a public way may not appear as mysterious or unappealing to scientists in the future.

A second important difference in *Laudato Si'* lies in its address and appeal to all people on the planet. It is a document that addresses the Catholic world as a part of the greater whole and invites people of every faith or no faith to consider the practical consequence of not acting in our own self-interest for the common good and for the world as a whole. The document embraces all people as we might imagine St. Francis of Assisi humbly embracing the poor and encouraging them to make the best choices in their world. Similarly, Pope Francis goes out of his way to acknowledge and praise the work of the Ecumenical Patriarch Bartholomew for the prophetic words and actions he has taken to address the "ethical and spiritual roots of environmental problems" (*LS* 9). Pope Francis writes, "He [Bartholomew] asks us to replace consumption with sacrifice, greed with generosity, wastefulness with a spirit of sharing, an asceticism which 'entails learning to give, and not simply to give up. It is a way of loving, of moving gradually away from what I want to what God's world needs. It is liberation from fear, greed and compulsion'" (*LS* 9).

Francis makes a particular appeal in the encyclical for considering the poor and paying attention to how they are affected by climate change and environmental decline. "Many of the poor live in areas particularly affected by phenomena related to warming, and their means of subsistence are largely dependent on natural reserves and ecosystemic services such as agriculture, fishing and forestry. They have no other financial activities or resources which can enable them to adapt to climate change or to face natural disasters…" (*LS* 25) Cardinal Reinhard Marx notes, "The encyclical is a plea to realize the impact that the ecological crisis has on people, and particularly on the poor. The pope looks at reality from the point of view of the poor, which is why we cannot separate ecological concerns from the social concerns."[36] These considerations are linked not only with Francis's pastoral work with the poor of Buenos Aires as bishop but with the socio-historical debate of Latin American liberation theology and how it was received in South America and Argentina after Vatican II.[37] Thus the Pope approaches the issue

36 Reinhard Cardinal Marx, "'Everything is Connected': On the Relevance of an Integral Understanding of Reality in *Laudato Si'*," *Theological Studies* 77-2 (2016): 295-307.

37 Daniel P. Castillo, "Integral Ecology as a Liberationist Concept," *Theological Studies* 77-2 (2016): 353-376.

of "the poor" in a prophetic rather than a doctrinaire way. He wants an experience and perception of the poor to raise the question, How can one help? rather than, How can we insulate ourselves from the problem? The Pope's preferential option for the poor insists that people need and deserve the special concern of the Church and society. In this Pope Francis is deeply connected to the poverty Jesus experienced in his life, which is reflected in the special concern of Jesus for the poor throughout the Gospel narrative (e.g., the story of Lazarus and Dives in Luke 16:19-31) and reveals God's special concern for those in need. In different ways, the encyclical reminds us of the integrated nature of both the problems and solutions of climate change and environmental degradation. A sense of integrated ecology is suggested as the path forward. Marx suggests,

> The pope's realistic perspective leads to the realization that "everything in the world is connected" [*LS* 16]. Impacts on nature are not without consequences for other areas of the ecological system, even though they differ in intensity. No area of the environment exists by itself alone; everything is connected.[38]

In the encyclical, ecology includes and "studies the relationship between living organisms and the environment in which they develop" (*LS* 138). However, Francis also intends ecology to include the social dynamic of human society. Castillo notes, "Thus, 'ecology' when used in the term 'integral ecology' is meant to signify the broader complex of eco-social relationships that order the world."[39] In this connectedness, Celia Deane-Drummond finds a sense of hope in *Laudato Si':*

> Ecology, for him [Pope Francis], can never mean shifting priorities away from concern for the needy and most excluded human members of the global community [*LS* 49]. He is also aware of the resilience of ecosystems and the possibility for regeneration [*LS* 140] even while describing it as fragile, or noting its fragility [*LS* 16, 56, 78, 90, 239].[40]

There is much to be praised in *Laudato Si'*. It is generally easy to read, albeit like a Mahler symphony it may be a bit too long, yet it hits all the right notes. Its message is profound and has been received by Catholics, Christians, and non-Christians with almost a universal voice of acclaim. Perhaps one of the most encouraging parts of its message is that no matter who we are, rich or poor, we will be affected by the environment and we can react positively about its ecological issues if we have the desire and courage to change the way we relate to the world around us.

Sustainability and The Spiritual Exercises of St. Ignatius Loyola

It should not surprise anyone that Pope Francis writes so passionately about creation in *Laudato Si'* and the unfortunate threat that human beings face because of their neglect or destructive actions toward their environment. No doubt the origins of such passion are drawn from a prayerful reflection on the Genesis story and that intimate connection

38 Marx, "Everything is Connected," 295-307.

39 Castillo, "Integral Ecology as a Liberationist Concept," 353-376.

40 Celia Deane-Drummond, "*Laudato Si'* and the Natural Sciences: An Assessment of Possibilities and Limits," *Theological Studies* 77-2 (2016): 397-415.

between the Creator and creation. However, there is likely another point of reflection on the environment that Francis utilized, which originates in *The Spiritual Exercises of St. Ignatius Loyola (SE)*.[41] Twice in the *SE,* Ignatius asks the person praying to consider all of creation and its source. The first occurs in the Principle and Foundation, where one is to consider, "Humans are created to praise, reverence and serve God,...other things on the face of the earth are created for humans in attaining the end for which they are created" (*SE* 23). The second moment occurs in the fourth week of the exercises: "...reflect how God dwells in creatures; in the elements giving them existence, in plants giving them life, in animals conferring upon them sensation, in humans bestowing understanding" (*SE* 235). Both of these considerations call upon a person to understand more deeply the grace and fragility of created things and our relationship to them. If we seek to "find God in all things" (a familiar Ignatian phrase), then caring for the environment is an attempt to acknowledge God's presence in creation. In addition to our relationship to creation, the one praying is asked to become indifferent; that is, to develop an internal freedom to see created things in their relationship to God. This is a particular understanding of the theology of creation leading the believer to the realization that Creation is the first great work of redemption and is the foundational saving act of God.

In 2008, the 35th General Congregation of the Society of Jesus produced a set of documents that includes a call to Jesuits and those who collaborate with them to look at their mission in the world and reflect on our environmental challenges, the reality of climate change, and the lack of social responsibility in exploiting natural and mineral resources.[42] Decree 3 notes, "Care of the environment affects the quality of our relationships with God, with other human beings, and with creation itself. It touches the core of our faith in and love for God."[43] The drive to exploit natural resources and have dominion over the earth has resulted in severe damage to its ecosystem to the point of jeopardizing the very future habitation of the planet. As a way of rectifying this present and future calamity, Decree 3 considers how people might restore their threefold right relationship to God, others, and creation:

> This Congregation urges all Jesuits and all partners engaged in the same mission, particularly the universities and research centres, to promote studies and practices focusing on the causes of poverty and the question of the environment's improvement. We should find ways in which our experiences with refugees and the displaced on the one hand, and people who work for the protection of the environment on the other hand, could interact with those institutions, so that research results and advocacy have effective practical benefits for society and

41 Ignatius of Loyola, *The Spiritual Exercises of St. Ignatius*, trans. L. J. Puhl, S.J. (Chicago: Loyola University Press, 1951).

42 John Padberg, ed., *Jesuit Life and Mission Today: The Decrees and Accompanying Documents of the 31st-35th General Congregations of the Society of Jesus* (St. Louis, Missouri: Institute of Jesuit Resources, 2009). See General Congregation 35, Decree 3.

43 Padberg, ed., *Jesuit Life and Mission Today,* GC 35, D. 3, n. 32.

> the environment. Advocacy and research should serve the poor and those who work for the protection of the environment. This ought to shed new light on the appeal of the Holy Father [Benedict XVI] that costs should be justly shared "taking due account of the different levels of development."[44]

Constructive Solutions to Our Ecology Problem

The call by the United States Conference of Catholic Bishops to reflect on our environmental condition and seek restorative solutions,[45] the encyclical *Laudato Si',* and the vision of GC 35[46] all rest on personal conversion and the desire to reform one's actions to create a better future. In many ways, "ecological conversion" is parallel to a personal religious conversion. For ecological conversion, the axis of benefit runs between person and community. The dynamics of such a conversion, as explored by Ormerod and Vanin, use the insights of Bernard Lonergan and Robert Doran, and include religious, moral, intellectual, and psychic elements. Regarding the need for conversion, Ormerod and Vanin conclude,

> [Our] present environmental destruction is the end product of generations of decisions based on a failure to attend to the ecological impact of those decisions, either initially through ignorance, or, as evidence of that impact has accumulated, willfully and maliciously.[47]

Just as the magnitude of environmental destruction took time and effort, so too will the process of conversion take time to retreat from this destructive modality.

Peter Hans Kolvenbach, the Superior General of the Society of Jesus from 1983 to 2006, argues that the promotion of justice requires an action-oriented commitment to shape and achieve our desire, a commitment that reflects the concerns raised by Ormerod and Vanin.[48] Regarding the environment specifically, Kolvenbach concludes, "The problem is more an ethical than a technical one. Ecology invites us to face that part of global responsibility which everyone bears due to his/her participation, to whatever degree, in social and economic life."[49] Inspired by this leadership, a task force on Jesuit Mission and Ecology was established and a report[50] was issued concerning a

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44 Padberg, ed., *Jesuit Life and Mission Today,* GC 35, D. 3, n. 35.

45 United States Conference of Catholic Bishops, "*Global Climate Change."*

46 Padberg, ed., *Jesuit Life and Mission Today,* GC 35, D. 2-3.

47 Neil Ormerod and Cristina Vanin, "Ecological Conversion: What Does It Mean?" *Theological Studies* 77-2 (2016): 328-352.

48 Peter Hans Kolvenbach, "The Service of Faith and the Promotion of Justice in American Jesuit Higher Education," *The Santa Clara Lecture.* Santa Clara: Santa Clara University, 6 October 2000, https://www.scu.edu/ic/programs/ignatian-tradition-offerings/stories/the-service-of-faith-and-the-promotion-of-justice-in-american-jesuit-higher-education.html.

49 Peter Hans Kolvenbach, "Our Responsibility for God's Creation," Inaugural Address at Arrupe College, Harare, Zimbabwe, August 1998, http://www.gonzaga.edu/campus-resources/sustainability/Readings/Our_Responsibility_for_Creation-Kolvenbach.pdf.

50 Patzi Álvarex, S.J., ed., "Special Report on Ecology: Healing a Broken World, Task Force on Ecology," *Promotio Iustitiae*, 106 (2) 2011, www.sjweb.info/sjs/PJnew.

number of constructive suggestions on the path forward to ecological conversion. This report applies the see-judge-act method of Catholic social teaching in assessing the current state of the environment and suggests initiatives that can be undertaken both individually and corporately.[51]

It is incumbent upon institutions of learning at all levels to develop a culture of sustainable practice whose focus is sustainable growth and the common good.

The "Special Report on Ecology" recommends three categories or avenues of response to foster environmental sustainability: *education*, *technological innovation*, and *advocacy*. *Education* is perhaps the most powerful tool to raise awareness of the environmental problems and effect a positive outcome. If people are unaware of the power of their choices in regard to the environment, no action will be taken to mitigate the situation. It is incumbent upon institutions of learning at all levels to develop a culture of sustainable practice whose focus is sustainable growth and the common good. The report suggests promoting awareness of environmental issues through teaching, writing, and research. "Jesuit higher education institutions, theological faculties, business schools, and research and capacity-building centres are invited to engage students in transformative education and to explore new themes and areas of interdisciplinary research."[52] The essential question is raised: do we want to be part of a problem or a solution? Increased awareness and knowledge of the issues regarding the environmental crisis entail an understanding of the root causes of the problems and their effects. Even simply committing ourselves to examining our own patterns of consumption and fostering a "recycle-reuse-reduce" mentality can produce sustained benefit through the power of human action. Such efforts should include educating people on the dynamic of consumer convenience and its environmental impact.

A particular example is the environmental cost of bottled drinking water and the trash produced once the bottle is empty. The world consumes over $100 billion worth of bottled water each year, which is roughly 50 billion bottles.[53] Approximately 17 million barrels of oil are used annually to manufacture those bottles of which only 20% are

51 Omid Sabbaghi and Gerald F. Cavanagh, "Jesuit, Catholic, and Green: Evidence from Loyola University Chicago," *Journal of Business Ethics* 127 (2015), 317-326.

52 Álvarex, S.J., ed., "Special Report on Ecology," Section 79.

53 If the average water bottle is 2.5 inches in diameter, 50 billion bottles placed side by side (standing up) would wrap around the earth's equator ~ 79.23 times. Calculation: 2.5 [inches/bottle] x 50,000,000,000 [bottles] x 1 [ft]/12 [inches] x 1 [mile]/5280 [ft] x 1 [earth's circumference]/24,901 [miles] = 79.2 times the earth's circumference. If placed end to end, assuming a bottle is 9 inches in height, the distance that would be covered is 285.2 times the earth's circumference.

recycled. The other 80% ends up in landfills, waterways, on beaches, and in the ocean. Studies of bottled-water quality show that such water may be contaminated by phthalates (chemicals used in plastics) contained in the bottling material, so the perceived benefit of the product may be illusory when compared to tap water.[54]

A second avenue of environmental stewardship is the promotion of restorative and ecologically sensitive *technology*. While technology and industry may have contributed to environmental decline, technology that encourages sustainable energy use can be a positive step. Renewable energy platforms such as ocean wave electrical generators, wind turbines, geothermal heating, and thermal and photovoltaic solar devices can produce enormous amounts of energy while adding minimal carbon to the atmosphere. Investing in these types of alternative energy sources could replace 50% of world fossil fuel use in a decade and mitigate global warming. The report states:

> Technological developments in areas such as clean energy production, energy efficient architectural design, water reclamation, microbial degradation of pollutants, and sustainable agriculture hold promise for climate change mitigation. Our knowledge of nature can be oriented toward developing new natural and technological resources. It is crucial to recognize that science and technology have opened up the possibility of organizing a sustainable economic process.[55]

Sustainable development presents a deep and fundamental challenge to scientists, engineers, and consumers. Given the realities of a growing world population and modern society's energy dependence, technology must be part of an ecologically sensitive future solution.

The third method suggested by the report involves political and economic *advocacy*, acting locally for global common good. "Given the environmental challenges we face, there is a need for a conscious and active citizenship to convince governments to adopt necessary sacrifices and political decisions."[56] Influencing public policy at the local, national, and international levels will be essential to our future because political power structures often hold the key to natural resource development, pollution control, and industrial growth through permits and regulations. The gift of life, which we see as precious, calls us to change our attitudes and practices and uproot a sense of personal complacency about the future of our environment.

Finally, the report reminds citizens everywhere of personal justice and the need for justice for those less privileged in the world, the poor.

> ...the cry of the poor who suffer the consequences of environmental degradation calls us all to stop and reflect. Jesuits, members of the Ignatian family, and those responsible for our apostolic institutions are all invited to reflect seriously on the

54 Richard Wilk, "Bottled Water: The Pure Commodity in the Age of Branding," *Journal of Consumer Culture*, 6-3 (2006), 303-325.

55 Álvarex, S.J., ed., "Special Report on Ecology," Sections 24, 58.

56 Álvarex, S.J., ed., "Special Report on Ecology," Section 76.

way in which our functional values driving our everyday decisions and actions remain consumerist at the core.[57]

Sustainability

Sustainability involves maintaining or improving the material and social conditions for human health and the environment over time without exceeding the ecological capabilities that support them. Human population has grown exponentially over the last 150 years and "our paradise" is becoming more crowded. As population grows in our modern technological world so too does the demand and competition for all its natural resources: energy, water, metals, and minerals. The effects of fossil fuel energy use, the requirements of fresh water, and the demands of agricultural production are straining our capacity for future growth and the environment's sustainability. The first encyclical by the first pope from the southern hemisphere of the "new world" is a clarion call for all people to consider their place in the world's ecology. It is a call to reflection, conversation, conversion, and action. Despite those few who are skeptical about climate change, overwhelming scientific research shows us climate change is in our future. The severity of that climate change depends on how people across the world respond to the challenge before them. The future of the world's ecosystem and our ability to flourish in our "garden" will be affected in direct proportion to our response to the needs of the environment and our relationship to it.

Ecological sustainability requires people to respond to the crisis in the environment by working with the natural ecosystem to promote its well-being. Sustainability requires making educated choices which promote certain ends and a long-term strategy to accomplish present and future goals. Our failure to do so will have consequences as to what culture or what people are allowed to flourish. For many years, humanity has understood the environment as something to be exploited and dominated. This attitude has brought amazing changes and advances in our comfort level, health, survivability, prosperity, and technology. These advances, combined with the natural growth in population, are unfortunately leading to a crisis in humanity's future.

Discernment and Stewardship

There are many ways to respond to the impending crisis in environmental sustainability. Some will choose to do nothing and take their chances with the environment and its future. For those engaged in the Catholic intellectual tradition and the field of education, one model of reflection and action may help us address both the environmental and human questions before us. This model includes both discernment and stewardship.

Discernment in the Ignatian sense is a process of reflectively considering one's place in creation, as well as the gifts and talents one can bring to change both self and the world. It is a continual, life-long activity. Sometimes the motivation for it is a sense of gratitude (What am I grateful for?) and other times there is an important question to be answered (What am I to do?). But its most basic impetus is self-understanding

57 Álvarex, S.J., ed., "Special Report on Ecology," Section 69.

(What am I experiencing and what does it mean?) and understanding of the world (What am I observing and what does it mean?). People engaged in the sphere of education, by spreading the leaven of ideas and knowledge, raise these questions continually. The resources of Catholic social teaching and the methodology of higher education can greatly facilitate discernment, whose fruit is a fundamental assessment of our needs and our ability to change for the better. The challenge of ecological sustainability needs this kind of personally discerned response because the issues are complex and affect not only the present but future generations. A discernment based on a relationship with the reality of one's life can be suffused with the virtue of hope, inspiring questions, innovative methodologies, and ultimately solutions to the challenge of environmental sustainability.

A steward is a person who is placed in a position of trust with another person's property and acts on behalf of the owner. The environment, of which we are a part in the cycle of life, is something we have been entrusted with by those who came before us and it is something we hand on to those who come after us. The image of the unjust steward from Luke's Gospel (Lk 16:1-13) may be applicable here. In the Gospel story the master of the house discovers some behavior on the part of his steward that casts doubt on his trustworthiness and future employment. This unjust steward, faced with losing his position, decides to befriend the poor and discounts his share of what they owe his master. The master praises the unjust steward for his craftiness in looking toward his future by showing mercy to the debtors. The poorest actors in this Gospel story benefit from the steward's self-interest and the steward even earns the master's praise. How ironic! Perhaps in our craftiness as reformed "unjust stewards" we may discern similar solutions to our predicament with regard to sustainability. Pope Francis points out in *Laudato Si'* that caring for "our common home" is inextricably linked with the care for the poor in the world. As crafty stewards of our environment we have much to do.

Perhaps the best way to conclude this reflection on the care of "our garden" is by referring to the final words used by Pope Francis in *Laudato Si':*

> God, who calls us to generous commitment and to give him our all, offers us the light and the strength needed to continue on our way. In the heart of this world, the Lord of life, who loves us so much, is always present. He does not abandon us, he does not leave us alone, for he has united himself definitively to our earth, and his love constantly impels us to find new ways forward. *Praise be to him*!" (LS 245).