

What Kind of Responsibility Do We Have for Future Generations? Redefining *Laudato Si*'s View on Sustainable Development Using the 'Planetary Boundaries' Framework

Jiby George, PhD Student, KU Leuven University, Leuven, Belgium

Abstract

In the wake of climate change and its impact on bio-physical conditions on life on earth, the question about our responsibilities for future generations has become a pressing one. Currently, careless developmental activities, with potential damage to eco-systems, demand an ethical response ensuring intergenerational justice. This recognition binds every generation with the responsibility to address potential consequences of present behaviour and to present a habitable environment to succeeding generations. The encyclical *Laudato Si*' (*LS*) exhorts that human development and the protection of nature should go hand-in-hand while advocating for an “integral and sustainable development.” In this regard, Pope Francis speaks about ‘integral ecology’, based on the well-known ‘principle of common good’ which should benefit the interests of both the present and future generations. However, his understanding of sustainable development, premised in *LS*, is still based on the Brundtland’ definition of sustainability, which is a “weak” form of sustainability because sustainability is always a compromise between economy, sociality, and ecology. Although Pope Francis condemns any kind of unsustainable development—by way of misguided anthropocentrism or the consequences of an unethical technocratic paradigm—his plea for an integral ecology neither refers to nuanced scientific concepts such as the ‘Anthropocene’ nor to a strong view on sustainability. An example of the latter is the ‘planetary boundaries’ concept which scrutinizes human activities to control unprecedented damage to the environment and guides us with the help of defining science-based boundaries to act more sustainable, presenting a ‘safe space’ for human thriving. Therefore, this article explores the importance of the ‘planetary boundaries’ concept to redefine the pope’s endorsement for ‘setting reasonable limits’ on human developmental activities and consequently providing a healthy environment for both the present and future generations. The engagement of analytical and describing methods throughout this paper helps to reach the aim of providing a more adequate understanding of sustainable development in the catholic social teachings which , by doing so, deepens our responsibilities towards future generations.

Introduction

Human developmental activities and their negative consequences for the resilience of the planet earth with exacerbating climate issues seriously question the wellbeing of both present and future generations. Evidently, human-induced climate issues, such as the extinction of species and the destruction of ecosystems—due to excess consumption and pollution and the immoderate use of natural resources—point to the urgent need of considering

and caring for “our common home.”¹ Hence, Pope Francis innovatively explores several major Catholic social teachings’ themes in *Laudato Si’* but with a special interest in the rather new theme of our responsibility to future generations.² Our present unsustainable lifestyles are masking a fundamental indifference towards the generations yet-to-come. The pope states, “[w]hat is at stake is our own dignity. Leaving an inhabitable planet to future generations is, first and foremost, up to us.”³ The questions arise, what kind of responsibility do we have to future generations? Why should we care about the people yet-to-come? An effective response to this analysis is quite visible at the proposal of ‘integral ecology,’ which competently considers the global crisis with its “human and social dimensions.”⁴ However, the pope’s plea for an integral ecology seems ‘weak’ and synonymous with the Brundtland’s notion of sustainable development. Hence, I propose a strong view on sustainability, i.e., planetary boundaries framework, introduced by Johan Rockström and his colleagues, that offers a ‘safe space’ to flourish sustainably within ‘reasonable limits.’

1. Is there a Need for Counting Future Generations?

From the second half of 19th century onwards, the concern for the ‘vulnerability of nature’ due to the unprecedented, irreversible, and long-term impact of many scientific and technological developments and their effects on the planet, resulted in philosophical and moral discussions on the question of responsibility to future generations.⁵ Following this critique, Pope Francis raises similar concerns on the anthropogenic impacts on the environment and related difficulties in transferring a liveable planet to the generations yet-to-come.⁶ To better comprehend and to offer a clear footing for further discussion, he analyses the most pressing environmental issues: “what is happening to our common home?”⁷ The encyclical, being aware of the incapacity of humanity to discover more sustainable production and consumption systems, exposes the impacts of some human activities that intensify climate change, biodiversity loss, and freshwater shortage and

1 Pope Francis, *Laudato Si’: On Care for Our Common Home* (May 24, 2015) § 1761, http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html [accessed on December 1, 2019].

2 See, for details, Kevin Clarke, “Pope Francis Explores Key Catholic Social Teaching Themes in ‘*Laudato Si’*,” *America: The Jesuit Review* (June 18, 2015), <https://www.americamagazine.org/issue/laudato-si-joins-tradition-catholic-social-teaching> [accessed on October 5, 2022]. Cf. Lisa Sowle Cahill, “*Laudato Si’*: Reframing Catholic Social Ethics,” *The Heythrop Journal* 59, no. 6 (2018), 887900; Vincent J. Miller ed. *The Theological and Ecological Vision of Laudato Si’: Everything is Connected* (London: Bloomsbury, 2017); Robert McKim ed. *Laudato Si’ and the Environment: Pope Francis’ Green Encyclical* (London: Routledge, 2020).

3 *Laudato Si’*, § 160.

4 *Laudato Si’*, § 137.

5 Martin P. Harney & John P. Meagher, “Responsibility,” *New Catholic Encyclopaedia* 12 (Washington, DC: Gale, 1967), 392. Hans Jonas, *The Imperative of Responsibility: In Search of an Ethics for the Technological Age* (Chicago: University of Chicago Press, 1984), 68. See also, Dieter Birnbacher, “Responsibility for Future Generations – Scope and Limits,” *Studia Ecologiae et Bioethicae*, no. 1 (2009), 78.

6 *Laudato Si’*, § 159.

7 *Laudato Si’*, § 1742.

related issues.⁸ The pope speaks about human beings' irresponsible attitudes and habits and refers to the 'global inequality' in terms of 'ecological debt.' As alternatives, he presents the promotion of the 'common good' and striving towards 'integral ecology' and 'an integral and sustainable development.'⁹

From an intergenerational perspective, the main challenge future generations will face is the availability of a quality environment, in particular pure air, clean water, fertile soil, decent climatological conditions, and biodiversity.¹⁰ Hence, in *Laudato Si'*, the pope condemns intolerable living conditions: "some forms of pollution are part of people's daily experience. [...] And] there is also pollution that affects everyone, caused by transport, industrial fumes, substances which contribute to the acidification of soil and water, fertilizers, insecticides, fungicides, herbicides and agrottoxins in general."¹¹ Similarly, according to the World Health Organization's 2022 updates (WHO), in many places in the world, air pollution has a hazardous impact on the health of humans and on the environment.¹² Based on the WHO global air quality guideline limits, already 99% of the world's population live below the standard quality air conditions and are thus exposed to various health issues such as respiratory diseases and lung cancer.¹³ The WHO also reported that inefficient household pollutions cause millions of deaths every year, especially in low and middle-income countries.¹⁴ These impacts draw attention to the urgent need of immediately reducing pollution levels in order to responsibly address the health issues in order to contribute "to the near and longterm mitigation of climate change."¹⁵ *Laudato Si'* also highlights the need for both minimizing and responsibly managing waste. Irresponsible waste management turns our earth into a "pile of filth."¹⁶ At the global level, in the present, the tendency to reuse and recycle things is still uncommon, consequently leading to the accumulation of waste disposals. The pope designates this tendency as "a throwaway culture."¹⁷ Efficiency is asked

8 *Laudato Si'*, § 1742. See also, Darrel Moellendorf, "The Cry of the Earth and The Cry of the Poor," in *Laudato Si' and the Environment: Pope Francis' Green Encyclical*, ed. Robert McKim (London: Routledge, 2020), 60.

9 *Laudato Si'*, § 18, 4352.

10 World Health Organization (WHO), "Air Pollution: Impacts," (2022 Update Status Report) https://www.who.int/health-topics/air-pollution#tab=tab_2 [accessed on October 15, 2022]. See also, Edith Brown Weiss, *In Fairness to Future Generations: International Law, Common Patrimony, and Intergenerational Equity* (Dobbs Ferry, New York, NY: Transnational Publishers, Inc., 1989), 10; Avner de-Shalit, *Why Posterity Matters: Environmental Policies and Future Generations* (London: Routledge, 1995), 810.

11 *Laudato Si'*, § 20, 2126.

12 World Health Organization (WHO), "Air Pollution: Impacts."

13 World Health Organization (WHO), "Ambient (Outdoor) Air Pollution" (22 September 2021), [https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health) [accessed on October 20, 2022]. See also, World Health Organization (WHO), "Household Air Pollution and Health" (27 July 2022), <https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health> [accessed on October 20, 2022].

14 World Health Organization (WHO), "Ambient (Outdoor) Air Pollution" (22 September 2021). *Laudato Si'*, § 20.

15 World Health Organization (WHO), "Overview," https://www.who.int/health-topics/air-pollution#tab=tab_1 [accessed on October 20, 2022].

16 *Laudato Si'*, § 21.

17 *Laudato Si'*, § 22.

for in recycling, moderation in production and consumption, and a drastic reduction of the consumption of irreversible resources is proposed in order to secure the availability of such resources for the coming generations.¹⁸

Obviously, scientific studies show that the present unreserved pollution and emission of chemical and toxic gases is a potential threat to future generations. For example, these gases cause acid rain which is damaging the water reservoirs, rivers, and lakes. Future generations will have to invest a considerable amount of money to recover and clean this kind of pollution.¹⁹ Along with that, the present emission of greenhouse gases is causing a gradual temperature increase and is enhancing drastic changes in the climate system. Scientific studies confirm that these anthropogenic emissions will further aggravate global warming with long term impacts on the climate system, resulting in a sea level increase, more extreme weather conditions such as floods and droughts.²⁰ The recent Working Group III report of the Intergovernmental Panel on Climate Change (IPCC) on Climate Change 2022 indicates that the greenhouse gas emissions have continued to increase in the previous decade (from 2010-2019).²¹ Though the rate of growth in greenhouse gas emissions were lower between 2010 and 2019 compared to the 2000-2009 period, the average annual emissions were the highest on record between 2010 and 2019.²²

According to IPCC's Sixth Assessment Report on Climate Change, the global mean temperature may likely exceed 2°C unless there occurs at short term a drastic reduction in the emissions of carbon dioxide, methane, nitrous oxide and sulphur dioxide.²³ From a physical science perspective, a “strong, rapid, and sustained reduction” of CO₂ and other greenhouse gases is required to improve the air quality for the future generations.²⁴ IPCC recommends a rapid implementation of mitigation policies (at latest before 2025) to limit

18 *Laudato Si'*, § 22.

19 Peringe Grennfelt et al., “Acid Rain and Air Pollution: 50 Years of Progress in Environmental Science and Policy,” *Ambio* 49, no. 4 (2019), 860.

20 Johan De Tavernier, “The Ecology of Pope Francis and the Mitigation of Climate Change,” *Eastern Journal of Dialogue and Culture* 15, no. 1 (2022), 619. Ottmar Edenhofer et al., state that many scientists confirm the ‘solid consensus’ that *Laudato Si'* has with the IPCC findings. See for details, Ottmar Edenhofer et al., “Science and Religion in Dialogue Over the Global Commons,” *Nature Climate Change* 5, no. 10 (2015), 907909. See also, Ottmar Edenhofer and Christian Flachsland, “*Laudato Si'*: Concern for our Global Commons,” in *The Theological and Ecological Vision of Laudato Si': Everything is Connected*, ed. Vincent J. Miller (London: Bloomsbury, 2017), 177191. Cf. *Laudato Si'*, § 23. **See also**, Stephen M. Gardiner, “Ethics and Climate Change: An Introduction,” *Wiley Interdisciplinary Reviews: Climate Change* 1, no. 1 (2010), 54-66; Stephen M. Gardiner, “Ethics and Climate Change,” *Ethics* 114, no. 3 (April 2004), 557558. Gardiner exposes the required need for a greenhouse effect to make the planet earth liveable for humans.

21 Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2022, Mitigation of Climate Change: Summary for Policy Makers, Working Group III Contribution to the IPCC Sixth Assessment Report (AR6)*, https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf [accessed on October 20, 2022], 4 [hereinafter IPCC, Climate Change Working Group III Report 2022].

22 IPCC, Climate Change Working Group III Report 2022, 410.

23 International Panel on Climate Change (IPCC), “Climate Change 2021: The Physical Science Basis, Working Group 1 Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change,” https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf [Accessed on March 1, 2022], 14 [hereinafter IPCC, Climate Change Working Group I Report 2021].

24 IPCC, Climate Change Working Group I Report 2021, 27.

the global warming by 2100 at 2°C. Any failure in implementing such policies will lead to an extreme rise in global warming, probably between 2.2°C to 3.5°C by 2100.²⁵ IPCC scientists predict precipitation, frequent droughts and floods, irreversible ecological damage, tropic cyclones, drastic losses, and extinction of a lot of species, even when the global mean temperature remains at 1.5°C.²⁶ The IPCC statistics show how complex the crisis is already and how urgent our actions are.

The IPCC 2022 report also identifies that “the impact of climate change in limiting wellbeing is most acutely felt by the world’s poorest people, communities, and nations, who have the smallest carbon footprint, constrained capacity to respond and limited voice in important decision-making circles.”²⁷ For Christine Jost et al., the poorest are the most vulnerable to the impacts of climate change because many of them depend on agriculture and other small industrial production enterprises for their livelihood. Moreover, the available infrastructure does not help them tackling the environmental issues.²⁸ Globally speaking, the disproportionate sharing of natural resources, an increased demand for resources by the higher and middle-income nations, a higher pollution due to industrialization processes, and the importation of toxic wastes from developed countries have far-reaching effects on the poor countries.²⁹ Interestingly, the IPCC 2022 report mentions that 50% of the world’s poorest contribute “only about 10% of total lifetime consumption emissions,” whereas the 10% of the richest population emit 50% of the greenhouse gases.³⁰ Likewise, the rich-income countries “exhibit per-capita carbon footprints 30 times” greater than low-income countries.³¹ At the same time, when it comes to the impacts of climate change, sea level rise due to global warming will have a major impact on the poor coastal people and pollution may affect comparatively more premature deaths among poor people.³² In such situations, the incapability to adopt more nuanced and sustainable developing processes and the inability to withstand the forthcoming environmental challenges, apparently leave poor people always on the receiving end. Similarly, in COP27 (Conference of the Parties), scientists explicitly highlighted the difficulty in adapting to the impacts of climate change. By 2050 over three million people will inhabit the “vulnerability hotspots” and will succumb to extreme and intolerable climate hazards.³³ Further, they confirm again that the increase in global temperature will raise the sea level, consequently leaving the coastal

25 IPCC, Climate Change Working Group III Report 2022, 21.

26 IPCC, Climate Change Working Group III Report 2022, 9697.

27 IPCC, Climate Change Working Group III Report 2022, Chapter 1: 39.

28 Christine Jost et al., “Understanding Gender Dimensions of Agriculture and Climate Change in Smallholder Farming Communities,” *Climate and Development* 8, no. 2 (2016), 133. Cf. IPCC, Climate Change Working Group III Report 2022, Chapter 1: 39.

29 Anthony M.C. Waterman, “Pope Francis on the Environmental Crisis,” *The Independent Review* 21, no. 3 (2017), 377.

30 IPCC, Climate Change Working Group III Report 2022, Chapter 5: 25.

31 IPCC, Climate Change Working Group III Report 2022, Chapter 5: 26.

32 IPCC, Climate Change Working Group III Report 2022, Chapter 5: 2728. See also, *Laudato Si’*, § 4849.

33 United Nations, “At COP27 Scientists Warn against Limits of Adaptation,” (November 10, 2022), <https://unfccc.int/news/at-cop27-scientists-warn-against-limits-of-adaptation-0> [accessed on November 10, 2022].

populations vulnerable.³⁴ Again, it becomes clear that social challenges are to be addressed along with ecological challenges. IPCC scientists note, “socio-economic equity builds not only wellbeing for all, but also trust and effective participatory governance, which in turn strengthen demandside climate mitigation.”³⁵ Hence the question arises, whether we should respond first to the socioeconomic challenges of the present generation or to the environmental challenges that will have a huge impact on the future generations.

In sum, according to Gretel Van Wieren, *Laudato Si'*, unlike any other encyclical, addressed the impacts of climate issues in a wider horizon which not only includes the protection of the planet and the wellbeing of both humanity and ecological systems but even the generations not-yet-born.³⁶ For Pope Francis asserts that “these situations have caused sister earth [.....] to cry out” for greater initiatives which are capable of “meeting the needs of the present with concern for all and without prejudice towards coming generations.”³⁷

2. Develop Integrally and Sustainably! About ‘Integral Ecology’

Laudato Si' exhorts that human development and the protection of nature should go hand-in-hand while advocating for an “integral and sustainable development.”³⁸ In this regard, Pope Francis proposes ‘integral ecology’ as the alternative.³⁹ According to Jessica Ludescher Imanaka, integral ecology provides us “a broader vision of reality” including social, cultural, environmental, economic and human dimensions.⁴⁰ Moreover, she interprets integral ecology as a reframed vision of sustainability which “expands to include integral human development.”⁴¹ This broader vision enables the pope to recognize that selfish motives and the tendency to maximize profit at any price show the disinterest “in more balanced levels of production, a better distribution of wealth, concern for the environment and the rights of future generations.”⁴² This hinders an integral and sustainable development.⁴³ By integral and sustainable development, Pope Francis envisions the wellbeing of both human beings and the environment.⁴⁴ This interconnectedness necessitates for an integral approach that addresses both social and environmental concerns.⁴⁵ For Eoin O’Neill, the pope challenges humanity to address the interconnectedness between nature and human beings, in particular

34 United Nations, “At COP27 Scientists Warn against Limits of Adaptation.”

35 IPCC, Climate Change Working Group III Report 2022, Chapter 5: 27.

36 Gretel Van Wieren, “‘Realities are more Important than Ideas:’ The Significance of Practice in *Laudato Si'*,” in *Laudato Si' and the Environment: Pope Francis' Green Encyclical*, ed. Robert McKim (London: Routledge, 2020), 208.

37 *Laudato Si'*, § 53.

38 *Laudato Si'*, § 13, 18.

39 *Laudato Si'*, § 137.

40 Jessica Ludescher Imanaka, “Integral Ecology: Cry of the Earth, Cry of the Poor,” *A Matter of Spirit* 114 (Spring 2017), 1.

41 Ludescher Imanaka, “Integral Ecology: Cry of the Earth, Cry of the Poor,” 1.

42 *Laudato Si'*, § 106, 109.

43 *Laudato Si'*, § 109.

44 Johan De Tavernier and Kingsley Ndubueze, “*Laudato Si'*’s View on Integral Ecology in Light of the Planetary Boundaries Concept,” *New Blackfriars* 101, no. 1096 (2020), 753.

45 *Laudato Si'*, § 139.

the way human beings engage and influence the natural world and vice versa.⁴⁶

The idea of integral ecology enables one to imagine one's interconnectedness with God, with our fellow human beings, and with nature.⁴⁷ The foundation for this interconnectedness is the triune God. *Laudato Si'* § 240 states, "the divine persons are subsistent relations, and the world, created according to the divine model, is a web of relationships. Creatures tend towards God, and in turn it is proper to every living being to tend towards other things, so that throughout the universe we can find any number of constant and secretly interwoven relationships."⁴⁸ The recognition of this interconnectedness enables one to withdraw from selfishness to participate in society and appreciate the importance of ecology, thus leading to one's own fulfilment.⁴⁹ From that perspective Vincent J. Miller argues that ignoring this interconnectedness should be seen as brokenness or sin which invites for a "conversion of heart and deepening of understanding."⁵⁰ Hence, integral ecology includes a deep awareness of this interconnectedness and interdependence. Obviously, human beings have a specific place and a special role to play. This uniqueness encourages human beings to act responsibly, being aware of their important role of mediating between God and the rest of the creation. Fulfilling our stewardship role in a decent way is not easy at all. *Laudato Si'* warns for an over-reliance on techno-fix solutions ("technical thought over reality").⁵¹ In that sense, the awareness of this interconnectedness not only leads to moral transformation and conversion, but also allows one to act in a sustainable, nuanced way.⁵²

For Pope Francis, we cannot adequately address environmental degradation without discussing human and social degradation.⁵³ With regard to climate change, it is noted that the poor in the global south will be the most vulnerable (see the previous session about the

46 Eoin O'Neill, "The Pope and the Environment: Towards an Integral Ecology?," *Environmental Politics* 25, no. 4 (2016), 749. Cf. De Tavernier and Ndubueze, "*Laudato Si'*'s View on Integral Ecology in Light of the Planetary Boundaries Concept," 752.

47 *Laudato Si'*, § 66. In § 70 of the encyclical the pope also states about four important interconnections. The fourth one is the relationship with oneself.

48 *Laudato Si'*, § 240. Cf. Vincent J. Miller, "Integral Ecology: Francis's Spiritual and Moral Vision of Interconnectedness," in *The Theological and Ecological Vision of Laudato Si': Everything is Connected*, ed. Vincent J. Miller (London: Bloomsbury, 2017), 1213.

49 *Laudato Si'*, § 240.

50 Miller, "Integral Ecology: Francis's Spiritual and Moral Vision of Interconnectedness," 14.

51 *Laudato Si'*, § 68, 115. Cf. Celia Deane Drummond, "A New Anthropology? *Laudato Si'* and the Question of Interconnectedness," in *Laudato Si' and the Environment: Pope Francis' Green Encyclical*, ed. Robert McKim (London: Routledge, 2020), 195. Pope's particular attention to humanity does not advocate 'anthropocentrism' rather he invites for a 'responsible stewardship.' *Laudato Si'*, § 116.

52 *Laudato Si'*, § 11, 140. See also, Miller, "Integral Ecology: Francis's Spiritual and Moral Vision of Interconnectedness," 1617. Miller quotes Pope John Paul II to explain solidarity. Solidarity is the "firm and persevering determination to commit oneself to the common good. That is to say to the good of all and of each individual, because we are all really responsible for all." Pope John Paul II, *Sollicitudo Rei Socialis* (December 30, 1987) § 38, https://www.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_30121987_sollicitudo-rei-socialis.html [accessed on October 25, 2022].

53 *Laudato Si'*, § 48. Miller, "Integral Ecology: Francis's Spiritual and Moral Vision of Interconnectedness," 19.

IPCC 2022 report).⁵⁴ Poor people may easily lose their livelihood and will therefore be forced to migrate. Ignoring the victims of climate change from a self-centred attitude is a kind of ‘indifference’ which is contrary to integral ecology.⁵⁵ Maria Teresa Davila confirms Pope Francis’ consideration of the poor and the marginalized as an essential judging criterion for evaluating the success and failure of our environmental efforts.⁵⁶ Pope Francis asserts, “a true ecological approach *always* becomes a social approach; it must integrate questions of justice in debates on the environment, so as to hear both the *cry of the earth and the cry of the poor*.”⁵⁷ Hence, authentic sustainable and environmental justice requires an adequate attention to the poor and the most vulnerable. As a response, *Laudato Si’* invites for a personal and collective transformation which helps us to be responsible and sustainable in our actions (especially in production and consumption).⁵⁸

The invitation of *Laudato Si’* for an integral development, by acting for the flourishing of the poor, offering them an opportunity for a dignified life, and at the same time caring for the environment is partly in harmony with the traditional and well-known idea of sustainable development.⁵⁹ *Laudato Si’* repeats the Brundtland definition of sustainable development, which presents it as a development that meets the “needs of the present without compromising the ability of future generations to meet their own needs.”⁶⁰ The pope’s emphasis on the inseparable link between integral development and the idea of common good advocates the welfare of societies and individuals in their entirety. This sense of inclusion accommodates only a portion of future generations because the compromise between ecology, economy, and society must be considered as a ‘weak’ form of sustainability.⁶¹ On the other hand, *Laudato Si’* asserts that considering and meeting the needs of future generations is “not optional, but rather a basic question of justice.”⁶² This inclusion of future generations with the idea of common good includes a critique on utilitarian and

54 *Laudato Si’*, § 25, 48.

55 Miller, “Integral Ecology: Francis’s Spiritual and Moral Vision of Interconnectedness,” 14. See for details, International Organization for Migration (IOM), “The Complex Nexus,” <https://www.iom.int/complex-nexus#estimates> [accessed on October 22, 2022]. See *Laudato Si’*, § 25.

56 Maria Teresa Davila, “The Option for the Poor in *Laudato Si’*: Connecting Care of Creation with Care for the Poor,” in *The Theological and Ecological Vision of Laudato Si’: Everything is Connected*, ed. Vincent J. Miller (London: Bloomsbury, 2017), 146.

57 *Laudato Si’*, § 49 (*italics original*). In a practical sense, Celia DeaneDrummond states, when interconnectedness is emphasised, justice can mean “*right relationships with one another*,” a different way of parsing “*what is due to another*.” DeaneDrummond, “A New Anthropology? *Laudato Si’* and the Question of Interconnectedness,” 189 (*italics original*).

58 *Laudato Si’*, § 52. *See also*, Davila, “The Option for the Poor in *Laudato Si’*: Connecting Care of Creation with Care for the Poor,” 152-156. Pope’s urgent call for intergenerational solidarity is also a fair invitation to intragenerational solidarity. *See also*, *Laudato Si’*, § 162.

59 *Laudato Si’*, § 139. *Cf. Anthony Annett, “The Economic Vision of Pope Francis,” in The Theological and Ecological Vision of Laudato Si’: Everything is Connected*, ed. Vincent J. Miller (London: Bloomsbury, 2017), 170.

60 United Nations, *Report of the World Commission on Environment and Development: Our Common Future*, A/42/427 [Brundtland Report] (New York, NY: United Nations Publication, 1987), 24. *Cf. Annett, “The Economic Vision of Pope Francis,”* 170.

61 *Laudato Si’*, § 156-157.

62 *Laudato Si’*, § 159.

individualistic perspectives.⁶³ Given emphasis on the care of future generations, the pope exhorts for an international cooperation in implementing efficient and practical policies that are sustainable and ensuring the wellbeing of all, including the not-yet-born.⁶⁴ To that effect, *Laudato Si'* condemns “any form of misguided anthropocentrism” and stresses on sustainable development that involves “new forms of growth” within “reasonable limits.”⁶⁵ Surprisingly, his endorsement for sustainable development within reasonable limits must be understood from the old vision on sustainability. We believe that this is inconsistent. Nowadays, there are new views on sustainable development which counter weaker forms of sustainability such as the planetary boundaries framework.⁶⁶ The planetary boundaries framework presents a strong form of sustainable development that scrutinizes human activities and aims to offer “a safe space in the planetary system within which human beings can flourish indefinitely.”⁶⁷ *Laudato Si'* could have better situated climate change, biodiversity loss, fresh water crisis, and other environmental issues within ‘the planetary boundaries framework’ which provides a better framework to speak about integral and sustainable development.⁶⁸

3. Flourish within Reasonable Limits

According to both De Tavernier and Deane-Drummond, *Laudato Si'* lacks important contributions from scientific and environmental sciences. For them, the inclusion of the planetary boundaries framework would have enhanced a more adequate reaction to address the issue ‘what is happening to our common home?’⁶⁹ Hence, seen the urgency of the climate crisis, we need to indicate science-based boundaries on all human activities which

63 *Laudato Si'*, § 162. Cf. De Tavernier and Ndubueze, “*Laudato Si'*’s View on Integral Ecology in Light of the Planetary Boundaries Concept,” 752.

64 *Laudato Si'*, § 164175. Pope Francis admits the efforts taken by different countries, organizations, NGOs etc. but the ineffectiveness “due to lack of political will” were explicit in the global agreements and policies regarding the protection of the environment. See also, De Tavernier, “The Ecology of Pope Francis and the Mitigation of Climate Change,” 619.

65 De Tavernier and Ndubueze, “*Laudato Si'*’s View on Integral Ecology in Light of the Planetary Boundaries Concept,” 755. See also, *Laudato Si'*, § 106, 109, 118, 119, 122, 193.

66 Celia DeaneDrummond, “*Laudato Si'* and the Natural Sciences: An Assessment of Possibilities and Limits,” *Theological Studies* 77, no. 2 (2016), 408409. See for details, Johan Rockström et al., “A Safe Operating Space for Humanity,” *Nature* 461, no. 7263 (September 24, 2009), 472-475; Johan Rockström et al., “Planetary Boundaries: Exploring a Safe Operating Space for Humanity,” *Ecology and Society* 14, no. 2 (2009) 32, available from <http://www.ecologyandsociety.org/vol14/iss2/art32/>; Will Steffen et al., “Planetary Boundaries: Guiding Human Development on a Changing Planet,” *Science* 347, no. 6223 (2015) 1259855, 110, available from <https://www.science.org/doi/10.1126/science.1259855>.

67 De Tavernier and Ndubueze, “*Laudato Si'*’s View on Integral Ecology in Light of the Planetary Boundaries Concept,” 757. See also, Mark Lynas, *The God Species: Saving the Planet in the Age of Humans* (Washington, D.C.: National Geographic Society, 2011), 9.

68 DeaneDrummond, “*Laudato Si'* and the Natural Sciences: An Assessment of Possibilities and Limits,” 408409.

69 DeaneDrummond, “*Laudato Si'* and the Natural Sciences: An Assessment of Possibilities and Limits,” 407411; Johan De Tavernier, “The Planetary Boundaries Framework and Food Production: A Radical Redefinition of Sustainable Development?,” in *Theology and Ecology across the Disciplines: On Care for our Common Home*, eds. Celia DeaneDrummond and Rebecca ArtinianKaiser (London: T & T Clark, 2018), 149.

fit into a ‘strong’ view on sustainable development.⁷⁰ The planetary boundaries framework is suitable for this because it situates economic growth within social and ecological limits and no longer presents it as a compromise.⁷¹

In 2009 Johan Rockström and colleagues introduced the notion of planetary boundaries while considering the human capacity to seriously affect and deteriorate both human wellbeing and ecosystems. Their planetary boundaries framework aims at offering a “safe operating space for humanity with respect to the functioning of the Earth System.”⁷² In order to define this safe space, Rockström et al. have identified nine boundaries with threshold levels (except for atmospheric aerosol loading and chemical pollution). These nine boundaries are climate change, ocean acidification, stratospheric ozone depletion, atmospheric aerosol loading, biogeochemical flows, interference with phosphorous and nitrogen cycle, global freshwater use, landsystem change, biodiversity loss, and chemical pollution.⁷³ Drastic environmental challenges are probable at the transgression of these boundaries by unrestrained human developmental activities. As mentioned in their latest publications, the science-based boundaries with regard to climate change, biodiversity loss, interference with the nitrogen and phosphorus cycle and changes in land use have already been crossed and others are nearing the threshold.⁷⁴ Approaching the decisive limits does not necessarily mean an instant substantial change, but it triggers higher risks of gradually changing the resilience of the earthsystem. Apparently, going beyond the “danger” line can not only endanger but also ultimately destroy the existence of humanity.⁷⁵ In other words, only respecting these boundaries by strictly regulating human activities could preserve the planet for future generations.

Rockström et al. assert the possibility of human wellbeing and “a longterm social and economic development.”⁷⁶ Commenting on this, De Tavernier identifies two difficulties with regard to the debate on sustainable development which could be solved by making use of the planetary boundaries concept. Firstly, the still insufficient knowledge with regard to the functioning of natural ecosystems and secondly, the difficulty in managing “multiple ‘framings’ in the social field.”⁷⁷ At this point, the planetary boundaries framework helps us

70 De Tavernier, “The Planetary Boundaries Framework and Food Production: A Radical Redefinition of Sustainable Development?,” 149164. According to him the traditional understanding of sustainability is ‘weak’ because it promotes “economic growth at the expense of nonhuman creation.”

71 De Tavernier, “The Planetary Boundaries Framework and Food Production: A Radical Redefinition of Sustainable Development?,” 149.

72 Rockström et al., “Planetary Boundaries: Exploring a Safe Operating Space for Humanity,” 32.

73 Rockström et al., “A Safe Operating Space for Humanity,” 473. Chemical pollution is updated as ‘novel entities in 2015 by Steffen et al., see for details, Steffen et al., “Planetary Boundaries: Guiding Human Development on a Changing Planet,” 12598551; Linn Persson et al., “Outside the Safe Operating Space of the Planetary Boundary for Novel Entities,” *Environmental Science and Technology* 56 (2022), 15101521.

74 Rockström et al., “A Safe Operating Space for Humanity,” 473.

75 Steffen et al., “Planetary Boundaries: Guiding Human Development on a Changing Planet,” 12598552.

76 Rockström et al., “A Safe Operating Space for Humanity,” 475.

77 De Tavernier, “The Planetary Boundaries Framework and Food Production: A Radical Redefinition of Sustainable Development?,” 149150. De Tavernier uses the example of carbon emission. At this debate, “How important is the reduction of carbon emissions in relation to other contributing factors with regard to global warming? How is one to balance the needed reductions in emissions with the maintenance of a

to deal more competently with these difficulties.

The invitation of Pope Francis to offer an inhabitable planet to future generations would be possible provided we manage not to cross the tipping points of planetary boundaries. One of the tipping points is: “human changes to atmospheric CO₂ concentrations should not exceed 350 parts per million by volume” (p.p.m.v.) (in 2009 it was 387 p.p.m.v.). The critical threshold is marked at 550 p.p.m.v., above which the polar ice sheets will be completely destroyed. Managing to keep the range below 350 p.p.m.v. will ensure “the continued existence of polar ice sheets.”⁷⁸ Hence, the planetary boundaries framework helps monitor the human, economical, and social developments ensuring the resilience of the planet’s ecosystem when we respect safe and just boundaries. According to Rockström and Klum, the planetary boundaries framework “could chart a safe path into the future for generations to come, opening the door for greater prosperity, justice, and technological advancement.”⁷⁹ More importantly, for them this framework not only promotes sustainable economic development, but also “pursues alleviation of poverty.”⁸⁰ This consideration in fact harkens to the ‘cry of the poor.’⁸¹

According to Deane-Drummond, it is worth noting that the inclusion of social and physical boundaries together with planetary boundaries would effectively address the problem of worldwide inequalities. She refers to the “Doughnut-shaped Model” from Kate Raworth.⁸² In 2012 Raworth (for which she received an honorary doctorate in 2021 from KU Leuven) introduced a “visual framework for sustainable development—shaped like a doughnut—by combining the concept of planetary boundaries with the complementary concept of social boundaries.”⁸³ Her aim was to situate ‘poverty eradication’ and sustainable development in a single frame. According to Raworth, the ‘safe and just’ space for human thriving lies between the nine planetary boundaries in the outer circle (environmental

particular lifestyle?.” The first question could be debated based on scientific data but for the latter there is an uncertainty. See also, Jan Bebbington and Carlos Larrinaga, “Accounting and Sustainable Development: An Exploration,” *Accounting, Organizations and Society* 39 (2014), 395413.

78 IPCC, Climate Change Working Group III Report 2022. See to compare with the past thresholds, Rockström et al., “A Safe Operating Space for Humanity,” 473.

79 Johan Rockström and Mattias Klum, *Big World Small World: Abundance Within Planetary Boundaries* (Sweden: Bokförlaget Max Ström, 2015), 8. Cf. De Tavernier and Ndubueze, “*Laudato Si*’s View on Integral Ecology in Light of the Planetary Boundaries Concept,” 756.

80 Rockström and Klum, *Big World Small World: Abundance Within Planetary Boundaries*, 8.

81 Deane-Drummond, “*Laudato Si*’ and the Natural Sciences: An Assessment of Possibilities and Limits,” 409. See for details, Kate Raworth, “A Safe and Just Space for Humanity: Can We Live within the Doughnut?,” *Oxfam Policy and Practice: Climate Change and Resilience* 8 (2012), 1–26; Anna Ferretto et al., “Planetary Boundaries and the Doughnut Frameworks: A Review of their Local Operability,” *Anthropocene* 39 (2022), 100347, 112, available from <https://doi.org/10.1016/j.ancene.2022.100347>; Daniel O’Neill, “A Good Life for all Within Planetary Boundaries,” *Nature Sustainability* 88, no. 95 (2018), 116.

82 Deane-Drummond, “*Laudato Si*’ and the Natural Sciences: An Assessment of Possibilities and Limits,” 409. See for details, Kate Raworth, “A Safe and Just Space for Humanity: Can We Live within the Doughnut?,” 116.

83 Raworth, “A Safe and Just Space for Humanity: Can We Live within the Doughnut?,” 4. KU Leuven, “Kate Raworth,” <https://www.kuleuven.be/english/about-kuleuven/honorary-doctorates/kate-raworth> [accessed on January 06, 2023].

boundaries) and eleven social foundations in the inner circle. These eleven social foundations are food, water, income, education, resilience, voice, jobs, energy, social equity, gender equality, and health.⁸⁴ Indeed, she identifies the complexity in combining both social and planetary boundaries as they are interdependent. At the same time, they help design social and sustainable policies that allow to strive within environmental and social tipping points. For example, in the case of energy, providing “electricity to the 19 percent of the world’s population who currently lack it, could be achieved with less than a one percent increase in global CO₂ emissions.”⁸⁵ Similarly, scientists present at the COP27, warned against the use of fossil fuels for “energy and food security.”⁸⁶ According to Anna Ferretto et al. the doughnut framework could be seen as a stimulating and attractive development of the planetary boundaries framework. Social and environmental priorities are to be addressed together to offer a safe and just thriving space for humanity. E.g., unpredictable environmental issues may cause deprivation of food while there is a duty to feed around nine and a half billion people by 2050.⁸⁷ For Rockström, the scientific identification of tipping points and the awareness about the costs and dangers of climate change should encourage international collaborations to remain within the proposed ‘safe and just’ mitigation levels.⁸⁸

Conclusion

Laudato Si’ invites us to look with fresh eyes to the alarming realities and recognize limits to growth in order to continue fruitful human flourishing.⁸⁹ Obviously, the tendency to dominate and master, the attitude of consumerism, and the unrestrained use of natural resources are offshoots of a tendency not to recognize the interests of future generations.⁹⁰ In addition to this, Robert McKim, in line with *Laudato Si’*, outlines elements that trigger going beyond the limits, especially the technocracy of the market economy, such as the profit orientation, a kind of technological solutionist mentality and the acceptance of a confrontational relation between the reality and human beings.⁹¹ By stating these consequences, it does not mean that they reject scientific and technological innovations and developments, but on the contrary they invite for an appropriate integral and sustainable

84 Raworth, “A Safe and Just Space for Humanity: Can We Live within the Doughnut?,” 4. See also, United Nations, “*Report of the United Nations Conference on Sustainable Development: Rio de Janeiro, Brazil 2022 June 2012*, A/CONF.216/16 (New York, NY: United Nations Publications, 2012), 155.

85 Raworth, “A Safe and Just Space for Humanity: Can We Live within the Doughnut?,” 5.

86 United Nations, “The Breakthrough Agenda: A Master Plan to Accelerate Decarbonization of Five Major Sectors,” (November 11, 2022), <https://climatechampions.unfccc.int/breakthrough-agenda/> [accessed on November 11, 2022].

87 Ferretto et al., “Planetary Boundaries and the Doughnut Frameworks: A Review of their Local Operability,” 1003472.

88 United Nations, “At COP27 Scientists Warn against Limits of Adaptation.”

89 *Laudato Si’*, § 116.

90 *Laudato Si’*, § 11.

91 *Laudato Si’*, § 101114. See also, Robert McKim, “Opposing the ‘Technocratic Paradigm’ and ‘Appreciating the Small Things’,” in *Laudato Si’ and the Environment: Pope Francis’ Green Encyclical*, ed. Robert McKim (London: Routledge, 2020), 225230.

progress within ‘limits.’⁹²

Because of human beings’ enormous capacity to affect and to change the planetary living conditions, we feel challenged to respond immediately to the problems that affect ‘our common home’ in order to sustain it inhabitable for human beings, all forms of lives, including the not-yet-born. To attain this, *Laudato Si’* calls urgently for a moderate and sustainable way of life that accommodates and values other species and contradicts any kind of ‘irresponsible,’ ‘distorted,’ ‘excessive,’ and ‘misguided’ anthropocentrism.⁹³ The encyclical is a strong appeal to commit ourselves for the common good, essentially by transforming and being open to others, other living organisms and ecosystems, and to God.⁹⁴ The broader horizon of common good definitely includes future generations, which means that present generations should feel responsible to meet the needs of the generations yet-to-come.⁹⁵ Intergenerational solidarity with due compromise to intragenerational solidarity necessitates flourishing within limits, respecting a safe and just operating space. *Laudato Si’* would have profited from a stronger vision on sustainability, such as the planetary boundaries framework, in order to be better equipped to speak about the resilience of the planet, availing it liveable in an equal manner for both present and future generations.

References

- Annett, Anthony. “The Economic Vision of Pope Francis.” In *The Theological and Ecological Vision of Laudato Si’: Everything is Connected*, ed. Vincent J. Miller, 160176. London: Bloomsbury, 2017.
- Bagir, Zainal Abidin. “Reading *Laudato Si’* in a Rainforest Country: Ecological Conversion and Recognition of Indigenous Religions.” In *Laudato Si’ and the Environment: Pope Francis’ Green Encyclical*, ed. Robert McKim, 3859. London: Routledge, 2020.
- Bebbington, Jan, and Carlos Larrinaga. “Accounting and Sustainable Development: An Exploration.” *Accounting, Organizations and Society* 39 (2014): 395413.
- Birnbacher, Dieter. “Responsibility for Future Generations – Scope and Limits.” *Studia Ecologiae et Bioethicae*, no. 1 (2009): 75106.
- Cahill, Lisa Sowle. “*Laudato Si’*: Reframing Catholic Social Ethics.” *The Heythrop Journal* 59, no. 6 (2018): 887900.
- Clarke, Kevin. “Pope Francis Explores Key Catholic Social Teaching Themes in ‘*Laudato Si’*.” *America: The Jesuit Review* (June 18, 2015). <https://www.americamagazine.org/issue/laudato-si-joins-tradition-catholic-social-teaching> [accessed on October 5, 2022].
- Davila, Maria Teresa. “The Option for the Poor in *Laudato Si’*: Connecting Care of Creation with Care for the Poor.” In *The Theological and Ecological Vision of Laudato Si’: Everything is Connected*, ed. Vincent J. Miller, 145159. London: Bloomsbury, 2017.
- DeaneDrummond, Celia. “A New Anthropology? *Laudato Si’* and the Question of Interconnectedness.” In *Laudato Si’ and the Environment: Pope Francis’ Green Encyclical*, ed. Robert McKim, 189201. London: Routledge, 2020.

92 Though we find resemblances, for De Tavernier and Ndubueze, pope Francis does not offer practical measures to respect the planetary limits. See for details, De Tavernier and Ndubueze, “*Laudato Si’*’s View on Integral Ecology in Light of the Planetary Boundaries Concept,” 757758.

93 *Laudato Si’*, § 68, 69, 116, 118, 119, 122.

94 Neil Ormerod and Christina Vanin, “Ecological Conversion: What Does It Mean?,” *Theological Studies* 77, no. 2 (2016), 351352. Cf. Zainal Abidin Bagir, “Reading *Laudato Si’* in a Rainforest Country: Ecological Conversion and Recognition of Indigenous Religions,” in *Laudato Si’ and the Environment: Pope Francis’ Green Encyclical*, ed. Robert McKim (London: Routledge, 2020), 4951.

95 *Laudato Si’*, § 159, 162.

- DeaneDrummond, Celia. "Laudato Si' and the Natural Sciences: An Assessment of Possibilities and Limits." *Theological Studies* 77, no. 2 (2016): 392-415.
- de-Shalit, Avner. *Why Posterity Matters: Environmental Policies and Future Generations*. London: Routledge, 1995.
- De Tavernier, Johan. "The Ecology of Pope Francis and the Mitigation of Climate Change." *Eastern Journal of Dialogue and Culture* 15, no. 1 (2022): 619.
- De Tavernier, Johan. "The Planetary Boundaries Framework and Food Production: A Radical Redefinition of Sustainable Development?." In *Theology and Ecology across the Disciplines: On Care for our Common Home*, eds. Celia DeaneDrummond and Rebecca ArtinianKaiser, 149-164. London: T & T Clark, 2018.
- De Tavernier, Johan, and Kingsley Ndubueze. "Laudato Si's View on Integral Ecology in Light of the Planetary Boundaries Concept." *New Blackfriars* 101, no. 1096 (2020): 740-759.
- Edenhofer, Ottmar et al. "Science and Religion in Dialogue Over the Global Commons." *Nature Climate Change* 5, no. 10 (2015): 907-909.
- Edenhofer, Ottmar, and Christian Flachsland. "Laudato Si': Concern for our Global Commons." In *The Theological and Ecological Vision of Laudato Si': Everything is Connected*, ed. Vincent J. Miller, 177-191. London: Bloomsbury, 2017.
- Ferretto, Anna et al. "Planetary Boundaries and the Doughnut Frameworks: A Review of their Local Operability." *Anthropocene* 39 (2022): 100347, 112. available from <https://doi.org/10.1016/j.ancene.2022.100347>.
- Gardiner, Stephen M. "Ethics and Climate Change: An Introduction." *Wiley Interdisciplinary Reviews: Climate Change* 1, no. 1 (2010): 54-66.
- Gardiner, Stephen M. "Ethics and Climate Change." *Ethics* 114, no. 3 (April 2004): 555-600.
- Grennfelt, Peringe et al. "Acid Rain and Air Pollution: 50 Years of Progress in Environmental Science and Policy." *Ambio* 49, no. 4 (2019): 849-864.
- Harney Martin P., and John P. Meagher. "Responsibility." *New Catholic Encyclopaedia* 12. Washington, DC: Gale, 1967.
- Imanaka, Jessica Ludescher. "Integral Ecology: Cry of the Earth, Cry of the Poor." *A Matter of Spirit* 114 (Spring 2017): 12.
- International Panel on Climate Change (IPCC). "Climate Change 2021: The Physical Science Basis, Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change." https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf [Accessed on March 1, 2022].
- Intergovernmental Panel on Climate Change (IPCC). *Climate Change 2022, Mitigation of Climate Change: Summary for Policy Makers, Working Group III Contribution to the IPCC Sixth Assessment Report (AR6)*. https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf [accessed on October 20, 2022].
- International Organization for Migration (IOM). "The Complex Nexus." <https://www.iom.int/complex-nexus#estimates> [accessed on October 22, 2022].
- Jonas, Hans. *The Imperative of Responsibility: In Search of an Ethics for the Technological Age*. Chicago: University of Chicago Press, 1984.
- Jost, Christine et al. "Understanding Gender Dimensions of Agriculture and Climate Change in Smallholder Farming Communities." *Climate and Development* 8, no. 2 (2016): 133-144.
- KU Leuven. "Kate Raworth." <https://www.kuleuven.be/english/about-kuleuven/honorary-doctorates/kate-raworth> [accessed on January 06, 2023].
- Lynas, Mark. *The God Species: Saving the Planet in the Age of Humans*. Washington, D.C.: National Geographic Society, 2011.
- McKim, Robert, ed. *Laudato Si' and the Environment: Pope Francis' Green Encyclical*. London: Routledge, 2020.
- McKim, Robert. "Opposing the 'Technocratic Paradigm' and 'Appreciating the Small Things'." In *Laudato Si' and the Environment: Pope Francis' Green Encyclical*, ed. Robert McKim, 217-238. London: Routledge, 2020.
- Miller, Vincent J., ed. *The Theological and Ecological Vision of Laudato Si': Everything is Connected*. London: Bloomsbury, 2017.
- Miller, Vincent J. "Integral Ecology: Francis's Spiritual and Moral Vision of Interconnectedness." In *The*

- Theological and Ecological Vision of Laudato Si': Everything is Connected*, ed. Vincent J. Miller, 1128. London: Bloomsbury, 2017.
- Moellendorf, Darrel. "The Cry of the Earth and The Cry of the Poor." In *Laudato Si' and the Environment: Pope Francis' Green Encyclical*, ed. Robert McKim, 6075. London: Routledge, 2020.
- O'Neill, Daniel. "A Good Life for all Within Planetary Boundaries." *Nature Sustainability* 88, no. 95 (2018): 116.
- O'Neill, Eoin. "The Pope and the Environment: Towards an Integral Ecology?." *Environmental Politics* 25, no. 4 (2016): 749754.
- Ormerod, Neil, and Christina Vanin. "Ecological Conversion: What Does It Mean?." *Theological Studies* 77, no. 2 (2016): 328352.
- Persson, Linn et al. "Outside the Safe Operating Space of the Planetary Boundary for Novel Entities." *Environmental Science and Technology* 56 (2022): 15101521.
- Pope Francis. *Laudato Si': On Care for Our Common Home* (May 24, 2015). http://w2.vatican.va/content/francesco/en/encyclicals/documents/papafrancesco_20150524_enciclica-laudato-si.html [accessed on December 1, 2019].
- Pope John Paul II. *Sollicitudo Rei Socialis* (December 30, 1987). https://www.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_30121987_sollicitudo-rei-socialis.html [accessed on October 25, 2022].
- Raworth, Kate. "A Safe and Just Space for Humanity: Can We Live within the Doughnut?." *Oxfam Policy and Practice: Climate Change and Resilience* 8 (2012): 1–26.
- Rockström, Johan et al. "A Safe Operating Space for Humanity." *Nature* 461, no. 7263 (September 24, 2009): 472–475.
- Rockström, Johan et al. "Planetary Boundaries: Exploring a Safe Operating Space for Humanity." *Ecology and Society* 14, no. 2 (2009): 32. available from <http://www.ecologyandsociety.org/vol14/iss2/art32/>.
- Rockström, Johan, and Mattias Klum. *Big World Small World: Abundance Within Planetary Boundaries*. Sweden: Bokförlaget Max Ström, 2015.
- Steffen, Will et al. "Planetary Boundaries: Guiding Human Development on a Changing Planet." *Science* 347, no. 6223 (2015): 1259855, 110. available from <https://www.science.org/doi/10.1126/science.1259855>.
- United Nations. "At COP27 Scientists Warn against Limits of Adaptation" (November 10, 2022). <https://unfccc.int/news/at-cop27-scientists-warn-against-limits-of-adaptation-0> [accessed on November 10, 2022].
- United Nations. *Report of the United Nations Conference on Sustainable Development: Rio de Janeiro, Brazil 2002 June 2012*, A/CONF.216/16. New York, NY: United Nations Publications, 2012.
- United Nations. *Report of the World Commission on Environment and Development: Our Common Future*, A/42/427 [Brundtland Report]. New York, NY: United Nations Publication, 1987.
- United Nations. "The Breakthrough Agenda: A Master Plan to Accelerate Decarbonization of Five Major Sectors" (November 11, 2022). <https://climatechampions.unfccc.int/breakthrough-agenda/> [accessed on November 11, 2022].
- Van Wieren, Gretel. "'Realities are more Important than Ideas:' The Significance of Practice in *Laudato Si'*." In *Laudato Si' and the Environment: Pope Francis' Green Encyclical*, ed. Robert McKim, 202216. London: Routledge, 2020.
- Waterman, Anthony M.C. "Pope Francis on the Environmental Crisis." *The Independent Review* 21, no. 3 (2017): 375398.
- Weiss, Edith Brown. *In Fairness to Future Generations: International Law, Common Patrimony, and Intergenerational Equity*. Dobbs Ferry, New York, NY: Transnational Publishers, Inc., 1989.
- World Health Organization (WHO). "Air Pollution: Impacts" (2022 Update Status Report). https://www.who.int/health-topics/air-pollution#tab=tab_2 [accessed on October 15, 2022].
- World Health Organization (WHO). "Ambient (Outdoor) Air Pollution" (22 September 2021). [https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health) [accessed on October 20, 2022].
- World Health Organization (WHO). "Household Air Pollution and Health" (27 July 2022). <https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health> [accessed on October 20, 2022].
- World Health Organization (WHO). "Overview." https://www.who.int/health-topics/air-pollution#tab=tab_1 [accessed on October 20, 2022].
-