Article

A Comparison of Green Chemistry to the Environmental Ethics of the Abrahamic Religions

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Green chemistry, or environmentally benign chemistry, is in its second decade as a recognized area of research. It is unique within chemistry because of its normative character. It rests on a set of principles, and the principles rest on certain ethical propositions. The ethical tenets that underlie green chemistry are substantially consistent with the environmental ethics of the Abrahamic religions of Christianity, Judaism, and Islam. The ethical presuppositions of green chemistry bear the greatest similarity to the ethics of the productivity stewardship model of Christian environmentalism and bear the least similarity to the ethics of preservationist stewardship of Islamic environmentalism.

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Green chemistry, or environmentally benign chemistry, is now in its second decade as a recognized area of research. Its normative character makes it unique within chemistry. It began as a specific form of implementation of a national policy of the United States that focused on source reduction as a pollution prevention strategy. Because green chemistry sprouted from an enacted law, and because laws result from political compromise and agreement among interested parties in order to garner broad support, the ethical tenets that underlie green chemistry reflect ethical beliefs regarding the environment that large portions of the public share. Although not everyone derives environmental ethics from theology, many people in the U.S. who do so derive their ethics from an Abrahamic religion, such as Christianity, Judaism, or Islam. Hence, the ethical tenets that underlie green chemistry are substantially consistent with the environmental ethics of the Abrahamic religions. Such theologically derived environmental ethics invoke the idea of stewardship, but they differ as to what degree that stewardship should aim to preserve natural resources for future generations or to put natural resources to productive use now. The ethical presuppositions of green chemistry bear the greatest similarity to the ethics of the productivity stewardship model of religious environmentalism and bear the least similarity to the ethics of preservationist stewardship of Islamic environmentalism.

This article begins with an overview of green chemistry, including its development, its definition, its codification in principles of best practice, and its ethical premises. Following this account is a discussion about the circumstances that led to the enshrinement of these ethical premises in policy. The discussion of professionally derived environmental ethics is followed by a brief overview of the rise of modern environmentalism and a discussion of theologically derived environmental ethics on the basis of a comparison between the preservationist stewardship and productivity stewardship models of Christianity, Judaism, and Islam. The article concludes with an analysis of how the ethical assumptions of green chemistry compare with the preservationist and productivity stewardship models.

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Green Chemistry

Green chemistry rests on a set of principles, and the principles, in turn, rest on certain ethical propositions. In this section, I will first briefly survey the development of green chemistry since 1990, then define green chemistry and its principles, and delineate the ethical assumptions that underlie the principles.

Green chemistry arose in the United States in response to the Pollution Prevention Act of 1990. That piece of legislation declared pollution prevention by source reduction (as opposed to waste management and control) to be the national policy of the United States.[1] In 1991, the Office of Pollution Prevention and Toxics at the U.S. Environmental Protection Agency (EPA) initiated a research grant program in the area of Alternative Synthetic Pathways for Pollution Prevention.[2] The EPA also announced its Industrial Toxics Project, a.k.a. the 33–50 Program, through which companies agreed to voluntarily cut emissions of certain high-volume toxic chemicals.[3] At about the same time, the Chemical Manufacturers Association (now known as the American Chemistry Council) launched its Responsible Care initiative that established a set of guiding principles and management practices, including pollution prevention through source reduction.[4] At the basic research level, Barry Trost of Stanford University introduced the concept of atom economy, which is a measure of how much of the reactants in a synthetic process end up in the intended product.[5] Since that watershed year, green chemistry has become a theme of basic and applied research, graduate and undergraduate education, industrial methods, conferences and symposia, and grants and award programs.[6] Green chemistry reached the symbolic pinnacle of science when it figured prominently in the announcement of the 2005 Nobel Prize in chemistry.[7]

Green chemistry has been defined, among other ways, as "carrying out chemical activities—including chemical design, manufacture, use, and disposal—such that hazardous substances will not be used and generated."[8] The key feature of this definition is the intentionality expressed by the word *design*. Prior to the emergence of green chemistry, chemists typically designed products and processes for functionality. Within that framework, a decrease in the use or generation of hazardous substances might occur but only as a pleasant coincidence. Green chemistry elevates the goal of hazard reduction through technological innovation to an equal level with the goal of function.

Paul Anastas, who worked at that time at the Office of Pollution Prevention and Toxics at the EPA, and John Warner, then a faculty member at the University of Massachusetts–Boston, enumerated twelve principles of green chemistry,[9] which can be summarized as (1) prevention, (2) atom economy, (3) less-hazardous chemical synthesis, (4) design of safer chemicals, (5) safer solvents and auxiliaries, (6) design for energy efficiency, (7) use of renewable feedstocks, (8) fewer derivatives, (9) catalysis, (10) design for degradation, (11) real-time analysis for pollution prevention, and (12) inherently safer chemistry for accident prevention (Table 1). These principles reveal why green chemistry is unique within the field of chemistry: green chemistry is not just prescriptive but normative. Much of chemistry is descriptive. A descriptive proposition takes the form, "If you do A, then B will happen." A significant portion of chemistry (for example, synthetic organic chemistry) is prescriptive. A prescriptive proposition takes the form, "If you want B to happen, then do A." A normative proposition takes the form, "You should want B to happen, therefore do A." The distinction between prescriptive and normative propositions is that prescriptive propositions do not depend on the value of the result, whereas normative propositions require a value judgment about the worthiness of the result. Thus, normative propositions rest on particular ethical assumptions.

To be sure, green chemistry is no more able than any other science to justify its own ethical assumptions, but those assumptions are inseparable from the principles. Principle 1 assumes that preventing pollution is better than treating it after it is formed. Principles 2, 6, 8, and 9 assume that waste is bad and efficiency is good. Principle 7 assumes that resources may be used, but those that are nondepleting are superior. Principle 10 assumes that, if pollution must be generated, that which does not persist in the environment is preferable to that which does persist. Principles 3, 4, 5, and 12 assume that the welfare of the people who handle materials or oversee processes is at least as important as the welfare of the environment.

A less overt assumption deals with the approach green chemistry takes to risk reduction. Risk is a function of the inherent hazard and the probability of exposure to that

Table 1. Twelve Principles of Green Chemistry

1.	Prevention
2.	Atom Economy
3.	Less-Hazardous Chemical Synthesis
4.	Design of Safer Chemicals
5.	Safer Solvents and Auxiliaries
6.	Design for Energy Efficiency
7.	Use of Renewable Feedstocks
8.	Fewer Derivatives
9.	Catalysis
10.	Design for Degradation
11.	Real-Time Analysis for Pollution Prevention
12.	Inherently Safer Chemistry for Accident Prevention

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hazard. Most environmental regulations aim to reduce risk by reducing the probability of exposure. Green chemistry, however, assumes that chemists understand hazard (e.g., toxicity) sufficiently well to make reducing the inherent hazard possible and that doing so is a better way to reduce risk.

Green chemistry assumes that the profit motive is legitimate. Remediating waste and implementing exposure controls add cost to products and processes without adding value. Reducing waste, maximizing efficiency, and decreasing hazards have the potential to add value to products and processes. Thus, there is an economic incentive to implement the principles of green chemistry. Moreover, green chemistry assumes that economic and environmental goals can be mutually compatible, and that the accomplishment of these goals will contribute to sustainable development.

Professionally Derived Environmental Ethics

Green chemistry did not spring overtly from a particular ethical tradition. Rather, the effort to define green chemistry was for the purpose of encouraging the application of the concept of source reduction to the field of chemistry. It was a response on the part of the EPA to a directive included in the Pollution Prevention Act of 1990. In hindsight, the notion that source reduction is more desirable as a pollution abatement strategy than treatment and disposal might seem obvious, but the findings of Congress suggest that it was not obvious twenty years ago.[10] An interesting question, then, is, what circumstances led to the political decision to emphasize source reduction?

Congress found that the regulatory framework that was in place prior to 1990 was not sufficient for stemming pollution. Congress also recognized that liability costs had increased but worker safety had not. The findings imply that effective incentives and rewards for pursuing source reduction initiatives were not available to industrial companies because of institutional barriers.[11] The Pollution Prevention Act aimed at providing information and technical assistance that would enable companies to overcome such barriers so those companies could begin to realize the potential rewards of reduced costs of materials, compliance, and liability. In this sense, the legislation was rooted in the behaviorist idea of operant conditioning. Source reduction would become conditioned because it produces the reward of higher profit (or grant money in the case of individual academic researchers).

Operant conditioning still requires a judgment about what behavior to condition. Yet, the enactment of legislation results from political solutions that represent negotiated agreements among constituencies. Therefore, the judgment of what behavior to condition through legislation typically rests on ethical assumptions that are shared broadly by the citizenry. Consequently, these ethical assumptions are not likely to encounter objections on a pronounced scale. Because the Pollution Prevention Act was approved by a Democratic-controlled congress and signed into law by a Republican president, the ethical assumptions of source reduction—and, by extension, the ethical assumptions of green chemistry—are likely to be consistent with the ethical traditions that are most prevalent in the U.S.

If the ethical assumptions of green chemistry are likely to be consistent with the ethical traditions that are most prevalent, it stands to reason that those same assumptions are likely to be consistent with the ethical positions of most chemists, too. My experience lends support for this induction. My first involvement with green chemistry was as a graduate student in 1995. The EPA-funded project centered on using water as a safer solvent for certain organic addition reactions (Principle 5). The project appealed to me because I immediately saw a correspondence between the ends and means of green chemistry and my Christian perspective on the environment. I was not the only student in our research group working on an aspect of the project. I was, however, the only evangelical Christian working on it. In other words, the normative character of the green chemistry was at least tolerable if not appealing to several group members with varied backgrounds. In fact, the normative nature of green chemistry has not been a source of controversy in the chemistry community at large. (The most controversial aspects of green chemistry have been what role it should play in education and whether a process must be viable on an industrial scale to be considered green.)

In summary, green chemistry was not so much the fruit of one particular ethical paradigm as it was the outgrowth of political negotiation. As such, it is predisposed to reflect the ethical values common to the various constituencies involved in the negotiation process.

Theologically Derived Environmental Ethics

Given the normative character of green chemistry, an examination of how these ethical assumptions compare to the environmental ethics of various religious traditions is in order.

Environmental ethics tend to reflect a dichotomy, suggested by Jordan Ballor of the Acton Institute for the Study of Religion & Liberty, between preservationist stewardship and productivity stewardship.[12] These viewpoints differ in what place humanity occupies within creation and what mandate God gave to humanity. For example, advocates of preservationist stewardship within the Christian tradition generally argue that humankind is supposed to tend the garden of creation with a pre-Fall ideal in mind. Indeed, one organization is named "Restoring Eden."[13] In contrast, advocates of productivity stewardship within the Christian tradition generally argue that humankind is to act in the capacity of bearers of God's image to use the resources of the earth to build and to improve the world.[14]

Articulation of theologically derived environmental ethics has occurred primarily in the last four decades, largely in reaction to modern environmentalism. Therefore, an overview of the development of modern environmentalism will help provide a context for the contemporary religious viewpoints that follow. The contemporary viewpoints include the preservationist and productivity stewardship models within the Abrahamic religions of Christianity, Judaism, and Islam. In each section, I will highlight the environmental ethics of that religion as expressed by commentators. To the greatest extent possible, the environmental ethics presented consist of what those commentators derive from the canonical sources of their respective religions as opposed to the individual or collective behavior of adherents of those religions. The aim of this survey is to present a cross-section of viewpoints. More exhaustive reviews are available elsewhere.[15] After the comparison, I will conclude with an analysis of the overlap/similarity between those ethical propositions and the ethical assumptions of green chemistry.

One caveat worth noting is that the most influential contributors to the development of environmental ethics within a given religion might constitute a small minority of followers of that religion. This limitation is especially acute for Islam but by no means exclusive to it. In addition, most commentators are Western-educated individuals addressing predominantly Western audiences.

The Development of Modern Environmentalism

In 1940, Walter Lowdermilk's essay on land usage, "The Eleventh Commandment," helped usher in the modern environmental movement as a matter of moral consequence.[16] Aldo Leopold elaborated on this theme in his 1949 book, *A Sand County Almanac*.[17] The first explicitly Christian contribution to the discussion was an article in 1954 by Joseph Sittler, Jr., a Lutheran seminary professor.[18] Sittler rejected a neo-orthodox separation of humanity from the nonhuman world. Instead, he echoed the argument of St. Francis that the relationship between humanity and nature is that of siblings. Nature, therefore, also bears God's image. In other words, all created things are equal, and people should treat nature as such.

Perhaps the seminal moment in environmentalism was the publication of an article by Lynn White, Jr. in 1967.[19] White blamed religion, namely Christianity (but by extension Judaism and Islam as well), for the crisis in ecology. He asserted that Christianity established the very dualism that Sittler rejected, so the purpose of creation became to serve humanity's ends. In addition, Christianity destroyed animistic beliefs, so usage of natural objects could take place without a consideration of the objects' feelings. White concluded that, because religion caused the problem, only a religious remedy could fix the problem. This remedy, though, would need to involve a new or different religion than what was practiced previously (that is, a new religious paradigm).

Francis Schaeffer responded to White in 1970 with the book, *Pollution and the Death of Man*.[20] He agreed with White that the way people think about nature determines how they treat nature. Furthermore, he supported White's contention that Christian acceptance of a dualistic view of nature and grace was harmful. Schaeffer, however, argued that the only answer to the environmental problem was the form of Christianity that properly emphasizes nature. In this view, according to Schaeffer, nature has value in itself because God created it. Humans are unique within creation by virtue of bearing God's image but are united to all other creatures by virtue of being created. In the same way Christians are to love non-Christians as neighbors, Christians should deal with non-image-bearing creatures with much respect and with an aim toward bringing about healing.

Contemporary Environmental Ethics: Preservationist Stewardship

People who hold to a preservationist view of stewardship generally stress what humankind has in common with the rest of nature as part of the created order. They often characterize the relationship of humankind to nature in egalitarian terms or in the language of service. They also

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tend to focus on the consumptive role that humankind plays with respect to nature. They consider the present situation to be a distortion of equilibrium or a state of unbalance that is in need of correction. They emphasize the word "sustainable" in the phrase "sustainable development." They try to prevent the present generation from externalizing its environmental costs to future generations and to prevent the populace of one region from externalizing its environmental costs to people in other regions of the globe.

In terms of policy recommendations, people who hold to a preservationist view of stewardship tend to gravitate toward national and supranational legislative remedies. Although they do not always define the term, proponents of the preservationist stewardship model call for "economic justice" with some frequency. They seem to mean redistribution of wealth and/or re-allocation of resource use in approximate proportion to population.

Preservationist Stewardship within Christian Perspectives

Christians who conform more closely to the preservationist stewardship model follow the lead of Joseph Sittler as described above. Unlike with some theological issues, a Catholic/Protestant divergence in terms of environmental ethics is not evident, so Catholic and Protestant perspectives will be treated together. The Orthodox perspective will be treated separately because of the sacramental role nature plays in Orthodox theology.

Catholic/Protestant Perspectives

Two organizations aligned more closely with the preservationist stewardship model are the Academy of Evangelical Scientists and Ethicists (AESE) and Restoring Eden. Both are members of the Noah Alliance and the National Religious Partnership for the Environment (NRPE), which includes the Evangelical Environmental Network (EEN), the U.S. Conference of Catholic Bishops, and the National Council of Churches of Christ. Other outlets include the Evangelical Climate Initiative (ECI), the Christian Environmental Studies Center (CESC), and the Au Sable Institute for Environmental Studies. For the AESE, stewardship involves "raising our voices against attempts to weaken public policies that protect the common good."[21] According to the EEN, human sin has led to a perverted stewardship, and poverty both causes and ensues from environmental degradation. Consequently, the EEN sees economic justice (i.e., reduction in the gap between rich and poor) as an important aspect of sustaining the environment in a just fashion.[22] The ECI adds that "any damage we do to God's world is an offense against God himself."[23] The CESC also emphasizes just relationships as an essential part of stewardship. Although humans may appropriately use creation to meet our needs, we ought "never destroy creation's ability to be replenished."[24]

One of the themes in preservationist stewardship ethics that has risen to prominence in recent years is *creation care*. This theme dictates that stewardship must allow creation to serve as a witness to God. Richard Cizik, the vice president for governmental affairs for the National Association of Evangelicals (NAE) and a leading proponent of creation care, maintains that thinking our interests and the interests of nature are in conflict with each other is erroneous.[25] Calvin DeWitt, professor in the Nelson Institute for Environmental Studies at the University of Wisconsin–Madison, president emeritus of the Au Sable Institute for Environmental Studies, co-founder of the EEN, and an ASA Fellow, elaborates that creation care focuses on the restoration and reconciliation of all things. This focus stems from a triad of science, ethics, and praxis. Valid discoveries in science pertaining to nature and the damage it suffers, regardless of who discovers them, must inform ethics and behavior.[26]

Sallie McFague, a now-retired professor of religion at Vanderbilt University, follows in the mold of Lynn White, Jr. by criticizing the historical ties between Christianity and classical liberal economics.[27] Consumerism in Christendom exploits nature as well as poor people. Jesus ministered to the oppressed and overturned conventional hierarchies. In McFague's view, Christians need a new worldview that extends Jesus' ministry to nature and overturns the hierarchy of humans over the nonhuman world.[28]

Orthodox Perspective

Orthodox Christianity derives its environmental ethics on the basis of its sacramental theology. According to a 2003 faith state-

ment, "The Orthodox Church teaches that humanity, both individually and collectively, ought to perceive the natural order as a sign and sacrament of God."[29] Just as the Incarnation and icons open a connection between this world and the next, so, too, does creation itself. Earth is a place of encounter with Christ. Therefore, the entire created order is sacramental in that it discloses the experience of the uncreated kingdom of Heaven. As a result, a chief ethical obligation of humans is to allow room for the Spirit to act continually in this world. To fulfill this obligation, stillness and inaction are necessary to keep vigil without interfering in the Spirit's work. This stillness is known as *ascesis*.[30] Asceticism is a communal social attitude of respectful use of material goods because we are never alone in this world.[31]

Preservationist Stewardship within Jewish Perspectives

Some Jewish commentators are circumspect about what humanity's role as steward of creation means. For example, the Coalition on the Environment and Jewish Life (COEJL), a legislation advocacy organization and a member of both the Noah Alliance and the NRPE, says that the commandment given to Adam and Eve was to serve and protect the garden of Eden and that there is a relationship between economic justice and ecological sustainability.[32] Daniel Fink identifies "[W]e are only tenants on this earth" as the fundamental premise of all Jewish environmental ethics.[33] Aloys Hütterman invokes the Talmudic thoughts of Rashi, who analogized the relationship between humanity and nature with marriage. The covenant God made with people includes creation, and the dominion humankind was given over nature is strictly limited. If the dominion is not exercised properly, humanity can and will lose its supremacy.[34]

In a similar vein, Tikva Frymer-Kensky describes humanity as the "avatar of God" whose essential role in creation is that of executive, to keep everything running properly. When humans fail in this duty, we pollute the earth directly and indirectly. Direct pollution results from moral misdeeds, and indirect pollution results from the divine reaction our moral misdeeds inspire.[35] Ecologically beneficial virtues include humility, modesty, moderation, and mercifulness.[36]

Arthur Waskow points out that the Jewish festival cycle correlates with the seasons and involves both consuming food from the earth and resting with the earth as sacred acts. He adds that consumption and production are not opposites but complements. If we, as individuals or as a society, become addicted to consumption of a natural resource, such as petroleum, we are guilty of idolatry. He somewhat ominously notes that Leviticus says that the earth will rest one way or another; we can rest with it, or it will kick us out in order to get rest.[37]

Preservationist Stewardship within Islamic Perspectives

Though most attempts to describe Islamic environmental ethics have occurred in recent decades, Seyyed Hossein Nasr foreshadowed Lynn White, Jr.'s critique in 1966 when he wrote that humankind's domination of nature resulted from and contributed to a desacralization of nature that led to a disharmonious relationship in which nature was no longer humanity's wife but a prostitute.[38] Islamic contributions since then have typically focused on the concept of *khilafa*, or vice-regency, along with the concept of justice.

Islamic authors express different viewpoints as to how responsible guardianship of nature is to be determined. Hyder Ihsan Mahasneh, in an Islamic Faith Statement written in 2003 on behalf of the Muslim World League for the Alliance of Religions and Conservation,[39] and Fazlun Khalid[40] agree that the human capacity to reason is the main factor in Allah's giving such duty to people. By contrast, Saadia Khawar Khan Chishti maintains that a responsible approach to the environment is intuitive. She argues that thoughtful consideration of nonhuman creatures and conservation of resources are innate traits that need to be reawakened. From her standpoint, we as humans should balance our needs with the needs of other human, plant, and animal communities.[41]

Although Abdul Aziz Said and Nathan Funk affirm humanity's role as custodians of nature, they paradoxically claim, "All things are necessarily *muslim* because, consciously or unconsciously, they perform the will of Allah."[42] Nawal Ammar opposes such predestinationism on the grounds that reason provides a basis for human action within the moral parameters established by revelation. Ammar states that the guiding principles for human action with respect to the environment should be dignified reserve, justice in transactions, and the primacy of community over individuals.[43]

In terms of barriers that stand in the way of a fully implemented Islamic environmental ethic, Khalid identifies "Cartesian" dualism and skepticism,[44] whereas K. L. Afrasiabi identifies Islamic humanism.[45] Khalid also identifies the global banking system, which creates the "illusion of economic dynamism."[46] Yasin Dutton expands on this theme when he says that usury (i.e., credit) creates an incentive to use resources exhaustively.[47]

Contemporary Environmental Ethics: Productivity Stewardship

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language of management. They also tend to focus on the fecundity of humankind with respect to nature. They consider the present situation to be a point along a trajectory that describes an ever-evolving system. They emphasize the word "development" in the phrase "sustainable development." They try to prevent the present generation from imposing costs on the welfare of future generations and to prevent the populace of one region from imposing costs on the welfare of people in other regions of the globe in exchange for reduced environmental costs.

In terms of policy recommendations, people who hold to a productivity view of stewardship tend to gravitate toward market-based remedies. Proponents of the productivity stewardship model caution with some frequency that legislation often has unintended side effects.

Productivity Stewardship within Christian Perspectives

Christians who conform more closely to the productivity stewardship model bear greater resemblance to Francis Schaeffer than to Joseph Sittler. (Note: I do not mean, however, to imply that Schaeffer held to the productivity stewardship model.) Within this group, no sectarian divergence in terms of environmental ethics is evident, so Christian perspectives will be treated collectively.

Two organizations that promote a productivity stewardship model are the Interfaith Council for Environmental Stewardship (ICES) and the Interfaith Stewardship Alliance (ISA). The ICES composed the Cornwall Declaration on Environmental Stewardship, which states that humans are primarily producers who add to the abundance of the earth rather than consumers and polluters. Humans are the most valuable resource because only humans can enrich creation. Environmental stewardship includes attention to human well-being. The Declaration also asserts that "growing affluence, technological innovation, and the application of human and material capital are integral to environmental improvement."[48] The ISA holds that God's commandment to humans to exercise stewardship "strongly suggests that caring for human needs is compatible with caring for the earth."[49]

Pope John Paul II said in his 1999 World Day of Peace Message, "Placing human well-being at the center of concern for the environment is actually the surest way of safeguarding creation."[50] In a 2002 common declaration with Patriarch Bartholomew I, the Pope also held that humans are at the center of creation and should use science and technology in a constructive manner in order to enhance the spiritual and material welfare of future generations.[51] Pope Benedict XVI and Patriarch Bartholomew I issued a common declaration in 2006 that cited economic, social, and cultural development as part of the Christian calling.[52]

The productivity stewardship model avoids a fundamental flaw of the creation care version of preservationist stewardship as described by DeWitt: the creation care triad of science, ethics, and praxis does not include economics as a source of knowledge that can inform praxis unless economics is regarded as a science on a par with the natural sciences (an assumption that might not command universal agreement). In contrast, productivity stewardship systematizes knowledge from economics along with knowledge from the natural sciences. For instance, Gerald Zandstra writes that economic development is empirically demonstrated to be key to environmental improvement in almost all countries. Economic growth is expected to furnish environment-friendly goods and services just as it has in Western Europe and North America.[53]

Biesner et al. explain that economic development and environmental improvement correlate directly and positively. According to them, pollution declines in a country once economic growth progresses enough to secure the basic needs of the people, to allow more efficient use of resources, and to enable the populace to afford environmental solutions.[54] Beers et al. note the similar etymologies of *economics* and *ecology* and argue that development and wealth make environmental care easier. They also write that, because we as humans can make new things that creation on its own cannot from that which God has created, we can infer that God's giving us stewardship over creation meant to empower us to sustain and enhance our existence.[55]

Proponents of productivity stewardship look more cautiously on governmental solutions to environmental problems. Whereas the AESE celebrates legislative achievements such as the Endangered Species Act,[56] the official statement of the NAE says:

> Because natural systems are extremely complex, human actions can have unexpected side effects. We must therefore approach our stewardship of creation with humility and caution.[57]

Productivity Stewardship within Jewish Perspectives

According to a Jewish Faith Statement written in 2003 for the Alliance of Religions and Conservation, "Man is commanded not to spoil the creation, but rather to improve and perfect it."[58] The statement notes that the environment includes the people who live in it. The statement also warns that love for other people takes precedence over love of nature, but wasteful destruction of nature is prohibited.[59]

Hava Tirosh-Samuelson affirms this hierarchy of humanity over nature when she writes that "a Jewish environmental philosophy and ethics cannot give up the primacy of the human species in the created order."[60] Other authors note that because humanity is the apex of creation, the rest of creation is available for humans to use and develop. Use of resources in a beneficial manner is permissible. We may make an impact on creation as long as the impact represents an improvement. Hence, pollution is considered a serious offense.[61] In addition, the Cornwall Declaration includes Jewish signatories.[62]

Productivity Stewardship within Islamic Perspectives

Mahasneh wrote in the aforementioned Islamic Faith Statement that "man is invited to make use of the nourishing goods that Allah has placed on earth for him, but abuse—particularly through extravagance and excess—is strictly forbidden."[63] Similarly, S. Nomanul Haq identifies "In everything that lives there is a reward" as an underlying principle of Islamic environmental ethics.[64]

Abdur-Razzaq Lubis defines *khalifa* as "one who inherits a position, a power, a trust, and who holds it responsibly and in harmony with its bestower."[65] According to Said and Funk, "The earth and its resources are placed in the care of human beings as custodians for their preservation, development, and enhancement."[66] They elaborate that spiritual development is the highest purpose for using nature and the surest foundation for environmental ethics.[67]

Conclusion

Preservationist Stewardship and Green Chemistry

Preservationist stewardship ethics assume that people's use of natural resources is acceptable; wasteful use or depletion of resources is bad; and preventing pollution is superior to treating it. In these respects, the model is consistent with the ethical assumptions of green chemistry. Advocates of preservationist stewardship are likely to disagree with the green chemistry assumptions that emphasize the primacy of the welfare of people, the legitimacy of the profit motive, and the compatibility of economic growth and environmental improvement. They are, however, likely to agree that chemists have sufficient understanding of chemical hazards to predictably reduce those hazards and that sustainable development is possible.

Of all the Christian variants, the Orthodox preservationist perspective is among the least compatible with the ethics of green chemistry. The liturgical character of the natural world does not encourage resource consumption, whereas green chemistry does not discourage it. Furthermore, green chemistry requires human action that could contravene the Orthodox approach of asceticism. On the other hand, if nature is sacramental, then pollution prevention follows as a moral imperative, and wasteful use or depletion of resources is an offense.

Muslims who assert that the global financial system is illusory and usurious will view the green chemistry assumptions regarding economic incentives and rewards with skepticism, if not hostility. Islamic commentators who hold a strong view of predestination would not see any particular need for green chemistry but would not have any particular objection to its implementation, either.

Productivity Stewardship and Green Chemistry

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Article

A Comparison of Green Chemistry to the Environmental Ethics of the Abrahamic Religions

Summary

The environmental ethics of the Abrahamic religions all incorporate an anthropocentric concept of stewardship of an intrinsically valuable creation. Within this framework, use of nature is permissible, but abuse of nature through pollution, waste, and depletion is prohibited. The environmental ethics diverge over what characteristics creation shares with humanity. They also diverge over the quality and extent of the relationship between economic and environmental health. The ethical propositions of the productivity stewardship model of religious environmentalism bear the greatest resemblance to the ethical assumptions of green chemistry. The environmental ethics of all the religious perspectives examined in this article support those ethical assumptions of green chemistry that deal with pollution prevention and improved safety. The only point of direct conflict is between the position of certain Islamic environmentalists that the world economic system is a sham and the assumptions of green chemistry that deal with economic goals. With the exception of this latter sub-set, followers of the Abrahamic religions can practice green chemistry in good conscience.

With the exception of certain Islamic environmentalists who think that the world economic system is a sham, followers of the Abrahamic religions can practice green chemistry in good conscience.

Notes

[1]U.S. Code. www.access.gpo.gov/uscode/title42/chapter133_.html (accessed March 7, 2007).
[2]U.S. Environmental Protection Agency, "Green Chemistry," www.epa.gov/opptintr/greenchemistry/pubs/whats_gc.html (accessed March 7, 2007).
[3]Lois R. Ember, "Strategies for Reducing Pollution at the Source Are Gaining Ground," *Chemical and Engineering News* (July 8, 1991): 7.
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