

A multidisciplinary systematic review of Gaia: From mythical Earth Goddess to a scientific concept

Raman and Narinder K. Sharma*

Abstract: Gaia has undergone a stunning evolution over millennia from a primordial Greek Goddess representing the Earth, to a more scientific hypothesis suggesting that the planet operates as a self-regulating organism, has sparked the imagination of generations. This study aims to shed light on the historical pathway of Gaia through a systematic review capturing its progress from a myth to a scientific theory, being portrayed in different types of literature throughout history, in addition to studying how the notion of Gaia has impacted human views of the Earth and their role in it. This review assists an exploration study, drawing on cross-disciplines, covering mythology, science, literature, and arts, to acquire a better understanding of the cultural and academic relevance of Gaia from a broad range of literature sources. Building on this understanding, the outcome of this study is to contribute to a deeper understanding of Gaia, thereby enriching its academic significance in contemporary scientific, artistic, mythical, and cultural discourse.

Keywords: literature, mythology, Gaia, Gaia hypothesis, Gaia theory, Earth system science

Introduction

In recent years, Gaia has received considerable attention as a mythological paradigm and a scientific hypothesis, leading to a multidisciplinary exploration across literature, environmental science and philosophy. James Lovelock's Gaia hypothesis, developed in the 1970s, imagines Earth as a self-regulating, interconnected system that has become a radical way of thinking about the environment and has fascinated many ecological and environmental conversations. Simultaneously, the myth of Gaia, the ancient Greek earth goddess or

* Raman (✉)

I.K. Gujral Punjab Technical University, Kapurthala, Punjab, India
Narinder K. Sharma
Central University of Punjab, Bathinda, Punjab, India
e-mail: kramanpreet360@gmail.com (corresponding author)

mother goddess, has made a comeback in culture and literature, mirroring the renewed engagement with nature and planetary consciousness.

The Gaia myth presents a potential avenue for bringing myth back to the physical world in a way that is compatible with science, offering a new paradigm for understanding global environmental politics and complex systems of Earth (Segal 2015). Gradually, this constructed Gaia has developed into both a scientific model and a cultural symbol, triggering profound interest and academic explorations that reach from science to the humanities and the arts as:

An Internet search for 'Gaia theory' yields over 63,000 results, and a search for 'Gaia' yields 1,420,000 websites. Of the latter, most are about environmentalism and various forms of spirituality, but their topics also include the arts, urban planning, tourism, feminism and even sporting goods. Gaia is most often invoked by environmental activists and spiritual seekers...Language matters, and the ancient image of the Earth mother is far more compelling to most people than the comparatively cold language of systems theory. Gaia theory at once revives this ancient symbol and endows it with scientific legitimacy, synthesizing empiricism with poetic inspiration. (Litfin 2005, 515)

Despite this growing attention, the field is fragmented, with studies focusing on narrow aspects, rather than providing a comprehensive understanding and the challenge of understanding the multifaceted significance of Gaia, both a scientific construct and a cultural metaphor. In response to this existing gap, this systematic review synthesises existing research on Gaia, charting its evolution and relevance across disciplines. By delineating the current landscape of Gaia-inspired work, this review highlights emerging trends and themes, and the interdisciplinary possibilities presented by this notion, by following the research methodology, including:

1. Comprehensive literature search: Identifying scholarly articles, books, and artistic works through academic databases using terms such as 'Gaia', 'Gaia hypothesis', 'Gaia theory', and 'mythology of Gaia'.
2. Inclusion criteria: Selected works that explicitly engage with Gaia as a mythological entity, scientific hypothesis, or cultural metaphor.
3. Thematic categorisation: Analysing the selected materials through thematic categories-mythological, scientific, literary, and artistic dimensions to identify recurring patterns and interdisciplinary connections.

This review demonstrates the increasing relevance of Gaia by offering a structured synthesis to contribute to a deeper understanding of Gaia's role as a bridge between myth and science.

Mythological origins of Gaia

Gaia (Gaea) or Gē in Greek Γαῖα or Γῆ is one of the ancient Greek Primordial deities according to Hesiod's ancient Greek work *Theogony* (730-700 BC), which elaborates on the origin and genealogy of various Greek gods and goddesses. She is one of the gods from ancient Greece and often relates to fertility, nature, and the cycle of life. Douglas Harper's 2018 *Online Etymology Dictionary* defines 'Gaia' or 'Gaea' as "a goddess, from Greek Gaia, spouse of Uranus, mother of the Titans, a personification of gaia 'earth'...sometimes used in English poetically or rhetorically for 'Earth personified' or the 'Earth as a planet'". Since ancient Greek tradition 'Gaia' is worshipped along with 'Demeter' (the goddess of agriculture) as William Smith (1870) in *A Dictionary of Greek and Roman Biography and Mythology* states: "She had temples or altars at Athens, Sparta, Delphi, Olympia, Bura, Tegea, Phlyus, and other places...The surnames and epithets given to Ge have more or less reference to her character as the all-producing and all-nourishing mother".

The identical of Gaia in Roman mythology is 'Terra Meter' or 'Tellus Meter', whereas in Hindu Mythology, the identical is 'Bhumi', also called 'Bhudevi' and 'Vasundra'. Derek Wall (1994, 78) in his prominent work *Green History: A Reader in Environmental, Philosophy and Politics* (1994) rightly emphasises: "The concept of an Earth goddess is nearly universal and certainly ancient. Egyptian, Greek, Indian and Jewish traditions, to name but a few provide us with female Earth deities". The twentieth century witnessed an evolution of a religious movement termed 'neo-paganism' (religion derived from the beliefs of pre-modern people), which reclaimed as a priestess named Morgan McFarland states: "a return to those values which see an ecologically balanced situation so that life continues and the great Mother is venerated again" (qtd. in B.Urban 2015).

Precedents of scientific Gaia

The concept of Earth as a living and spiritual being Gaia, continued to flourish throughout the Middle Ages and Renaissance. The ancient Greek philosopher Aristotle, in his *Politics* (350 BCE) and Plato in his *Timaeus* (360 BCE), a dialogue, describes the Earth as a living

organism, with a soul that animates and controls it. The Roman poet Lucretius depicts the Earth as a living entity in his epic poem *De Rerum Natura* written in the first century BC and describes the planet as having a ‘soul’ that permeates all things. The Renaissance artist and inventor Leonardo da Vinci also believed that the planet had a natural balance and harmony, and humans had a responsibility to preserve it. The Stoic philosophers and the German astronomer Johannes Kepler also bear a resemblance to Earth as a living being or living cosmos and in their point of view, Earth as a whole is greater than the sum of its parts. Throughout the eighteenth century, the mythical goddess Gaia consolidated in modern sciences as James Hutton, Alexander von Humboldt and Vladimir Vernadsky proposed that the Earth’s living organisms, atmosphere, and geology were all interconnected, encapsulating the contemporary Gaia hypothesis. Aldo Leopold pioneered Land Ethics and Wilderness Conservation in his work *A Sand County Almanac* (1949), wherein he states: “A land, ethic, then, reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land. Health is the capacity of the land for self-renewal. Conservation is our effort to understand and preserve this capacity.” (Leopold 1949, 258) In 1968, during the Apollo 8 mission, a photograph of the Earth was taken by astronaut William Anders, called ‘Earthrise’ (Figure 1). It was the first time when the world saw how Earth looked like an integrated whole from space and “inspired contemplation of our fragile existence and our place in the cosmos” (100 Photographs). These precedents illustrate how ancient philosophers and scientists have long recognised the interconnectedness of different aspects of the Earth system, including organisms, the environment and human activity.

Figure 1. Source: <http://digitaljournalist.org/issue0309/lm11.html>



The scientific formulation of the Gaia hypothesis

The mythical Gaia emerged as Gaia hypothesis in 1965, when it was formulated by an independent British scientist, environmentalist, and futurist, James Ephraim Lovelock, while working on a project for NASA at the Jet Propulsion Laboratory, California. He hypothesised that life had created a self-regulating system on Earth that maintained the conditions necessary for its existence and named it as ‘Gaia hypothesis’ at the suggestion of British novelist William Golding. Lovelock introduces the hypothesis initially in his 1971 journal article “Gaia as Seen through the Atmosphere” and got critical and scientific attention through his 1974 article “The Quest for Gaia” in which he claimed: “It appeared to us that the Earth’s biosphere was able to control at least the temperature of the Earth’s surface and the composition of the atmosphere...the system seemed to exhibit the behaviour of a single organism, even a living creature” (Lovelock and Empton 1975, 304-305).

After the publication of this initial hypothesis, the scientific community got interested in the details of the Gaia hypothesis and Lovelock published a full-length book named *Gaia: A New Look at Life on Earth* and defined Gaia as “a complex entity involving the Earth’s biosphere, atmosphere, oceans, and soil the totality constituting a feedback or cybernetic system which seeks an optimal physical and chemical environment for life on this planet” (Lovelock 1979, 10).

Though the environmental community readily accepted the Gaia hypothesis yet Lovelock had to face extensive criticism from the scientific community, as they believed that the Gaia hypothesis is not a scientific theory but a metaphor. Stephen Jay Gould criticised the Gaia hypothesis in his article “Kropotkin was no crackpot” (1988), wherein he states: “Gaia strikes me as a metaphor, not a mechanism” (Gould 1988, 15).

On this claim, Lovelock argued that Gaia is a useful metaphor for understanding the complex interactions between living organisms and the physical environment. American ecologist and philosopher David Abram (1991, 1) defends the Gaia hypothesis by arguing: “what Gould failed to state is that “mechanism”, itself, is nothing more than a metaphor. It is an important one, to be sure. Indeed, the whole process of modern science seems to get underway with this metaphor”.

Gaia theory

After receiving critical and scientific attention for his first book on the Gaia hypothesis Lovelock further tested the Gaia hypothesis and developed it into Gaia theory in his work *The Ages of Gaia: A Biography of Our Living Earth* and remarked: “thoughtful criticisms of this first book led to new and deeper insights into Gaia...much new evidence has accumulated, and I have made new theoretical models...as a consequence this second book is a statement of Gaia theory; the basis of a new and unified view of the Earth and life sciences” (Lovelock 1988, 10).

The fascination with this theory has led to the development of ‘Earth System Science’. The theory has continued to be influential in the study of global environmental change and the origins of life. The Amsterdam declaration of four prominent International Global Change Research programs acknowledged Lovelock’s Gaia theory and is concerned with human activities that are constantly influencing the Earth, resulting in Global Warming and Climate Change. John Turney remarks: “Research carried out over the past decade under the auspices of the four programmes to address these concerns has shown that: The Earth System behaves as a single, self-regulating system comprised of physical, chemical, biological and human components” (Turney 2003, 139).

Thus, the concept of Gaia has evolved from a mythological belief in a mother Earth goddess to a scientific theory of Earth as a self-regulating system. Both interpretations offer insight into the relationship of the human species with the natural world. Though his Gaia hypothesis was initially criticized yet he expanded it to the Gaia theory that has now become a vital part of Earth System Science as Toby Tyrrell, a professor of Earth System Science in his work *On Gaia* (2013) while considering the modern evidence from relevant various disciplines remarks that:

I believe Gaia is a dead end. Its study has, however, generated many new and thought-provoking questions. While rejecting Gaia, we can at the same time appreciate Lovelock's originality and breadth of vision, and recognize that his audacious concept has helped to stimulate many new ideas about the Earth, and to champion a holistic approach to studying it. (Tyrrell 2013, 209)

Gaia in arts: Literature and cinema

Nature has been a recurring theme in literature from ancient times to the present, and its depiction has evolved with significant

representations in classical works as well as in contemporary times in various fields such as arts, paintings, poetry, fiction, non-fiction, music, films, and games.

Figure 2. Source: www.theoi.com/Gallery/Z15.2.html



Figure 3. Source: www.theoi.com/Gallery/T1.7



In classical Greek vase paintings (Figure 2), Gaia is occasionally portrayed as a full-bodied matronly figure, graced with an embellished crown made of spring flowers and bulbs carrying her infant child Erichthonius. (“Birth of Erichthonius - Ancient Greek Vase Painting”). The Roman mosaic art (Figure 3) portrays ‘Gaia’ or Roman ‘Tellus’ wearing a crown made of fruit and with her four children named Theron (Summer), Cheimon (Winter), Phthinoporon (Autumn) and Eiar (Spring). (“Aeon, Gaea & the Carpi - Ancient Greco-Roman Mosaic”)

Ancient Greek and medieval literature often personified and imbued nature with divine qualities. There is a portrayal of Gaia as a divine

character in Homer's *Illiad* and Pinder's *Odes*. Mircea Eliade, a Romanian religion historian and writer in his work *Essential Sacred Writings from Around the World* ([1967] 1992, 55) observes that the Greek notion of Gaia- the Mother Earth, is prayed for all sorts of happiness in The Homeric Hymns:

Hail, Mother of the gods, wife of starry Heaven;
freely bestow upon me for this my song substance
that cheers the heart! And now I will remember you and another song also.
(The Homeric Hymns, XXX, Eliade 55)

Three major movements which particularly focused on nature as a central theme and pastoral tradition are the Elizabethan Worldview, Romantic Pantheism, and American Transcendentalism. In Elizabethan literature, the poets Edmund Spenser, Philip Sydney, Ben Johnson and John Donne, etc. often emphasise the idyllic beauty and simplicity of rural life and nature. The Romantic poets William Wordsworth, P.B. Shelley, John Keats, Lord Byron, S. T. Coleridge, etc. often saw nature as a manifestation of the divine, and human beings were viewed as part of the natural world rather than separate from it. In William Wordsworth's poem "Lines Written in the Early Spring", the speaker contemplates the unity of all living things in nature.

The American Transcendentalists, including the prominent intellectuals Ralph Waldo Emerson (1803-1882), Margaret Fuller (1810-1850) and Henry David Thoreau (1817-1850), viewed nature as a source of spiritual renewal and a means of transcending the limitations of the material world. Various postmodern poets have made the effort to demonstrate the realistic and bitter plight of the human and non-human world and advocate for the restoration of both worlds at a normal stage. Gary Snyder, an American deep ecology activist, poet and lecturer, denotes the chapter "Little Songs for Gaia" of his work *Axe Handles to Gaia*:

Deep blue sea baby,
Deep blue sea.
Ge, Gaia
Seed syllable, "ah!"
(Snyder 1983, 54)

Spiritual entrepreneur Julie Tara's 2015 influential work *Songs of Gaia: Devotional Poems to Nourish the Heart* deals with finding solace in sufferings and turbulences that the Earth and the human race are going through and believing the presence of the infinite and divine:

Kiss the earth
and know her longing for your happiness.
Tell her you love her
And witness the faeries' beam.
(Tara 2015)

The great Indian scriptures such as *Vedas*, *Upanishads*, *Ramayana*, *Bhagwad Gita*, and *Mahabharata* contain hymns and tales dedicated to the worship of flora and fauna, their conservation and maintenance of ecological harmony. Roma Chatterji (2022, 14), in the journal article “Gaia and the Environmental Apocalypse in Superhero Comics and Science Fantasy” emphasises: “In Ramayan 3392 AD, the living earth that Lovelock conceives as a cybernetic system with feedback loops that coordinate the relations between its parts is given the persona of Sita – an animistic figure that embodies organic creativity”.

In fiction, Gaia is often used to convey a variety of meanings, such as the beauty and power of the natural world, the correlation between humans and nature, and the destructive impact of humans on it. John Varley's science fiction trilogy - *Gaea Trilogy* (1979-1984), which includes the novels *Titan*, *Wizard*, and *Demon*, portrays Gaea as the embodiment and God of the Wheel, a rotating space habitat. Issac Asimov's *Foundation's Edge* (1982), and *Foundation and Earth* (1984), illustrate a planet called Gaia where all living and non-living organisms take part in planetary consciousness. Brian Aldiss's *Helliconia Trilogy* (1982-1985) represents an Earth-like planet, Helliconia and the fragility of human civilisation.

In the milieu of environment and climate change, the novel Lovelock (1994) by Orson Scott Card and Kathryn H. Kidd describes ‘Gaiaology’ as a full-fledged interdisciplinary science. David Brin's novel *Earth* (1990), features a fictional Gaia ecology movement. Roger Lancelyn Green's *Tales of the Greek Heroes* (2009) also features Gaia as a central figure. Her role in the creation of the world, as well as her relationship with other Greek gods and goddesses, is explored in detail. In David Orrell's novel *Gaia* (2011) the characters encounter a Gaian cult. Claire Buss's *The Gaia Collection* (2020) is a post-apocalyptic trilogy of novels *The Gaia Effect* (2016), *The Gaia Project* (2018), and *The Gaia Solution* (2020) that presents a futuristic world where Earth's natural resources have been depleted, and Gaia emerges as a central character guiding humanity towards restoration. M.E. Ellington's novel *The Devolution of a Species* (2017) is based on the Gaia

hypothesis and illustrates the haunting consequences of damaging the planet. The novel *Guiding Gaia* (2021) by Tish Thawer features a reincarnated Gaia who wants to discover whether the world is worth saving.

Cinema, one of the most universal forms of artistic pursuits, plays a significant role in shaping cultural narratives by reflecting societal values. It provides a window into different perspectives and experiences and can provoke thought and discussion on a range of topics. The movies and television series based on Gaia or the Gaia theory are capable of sensitising the audience to honour ‘Mother Earth’ through audio and visual aids. An American animated Television series *Captain Planet and the Planeteers* (1990-1996) developed by Barbara Pyle and Ted Turner, featured a superhero named Captain Planet who was tasked with protecting the Earth from environmental threats. The premise of the series was rooted in the idea that Earth is an interconnected system that needs to be protected, echoing the Gaia hypothesis.

Hironobu Sakaguchi’s Sci-fi Movie *The Final Fantasy: The Spirits Within* (2001) in which Dr Sid and Aki are the promoters of the Gaia theory. James Cameron’s Sci-fi movie *Avatar* (2009), referred to a Gaian-like system called Eywa, a goddess worshipped by the natives. This movie is set on the fictional planet of Pandora, where the native inhabitants have a deep connection to their planet, while the human invaders seek to exploit its resources. Xavier Berenguer’s documentary *GAIA: The Big Mother* (2016) explores the evolution of Earth, the role of humanity and the threats to the sustainability of the planet. *Gaia* (2021) by Jaco Bouwer is an Eco-horror movie that portrays Gaia as a powerful and mysterious force of nature. R.Rathindran Prasad’s movie *Boomika* (2021) is also an Eco-horror thriller that focuses on Gaia and portrays the repercussions of deforestation and ecological imbalance on human lives, drawing attention to the consequences of neglecting Gaia. Hence, Gaia has become a framework for Scientists, artists, academicians and Environmentalists as they have looked to it to understand how the Earth responds to the impact of human activities on the planet Earth.

Conclusion

To conclude, Gaia is a concept that has captured the imagination of both scientists and artists across the wider cultures, from the ancient Greeks to modern environmentalists. The idea of a living and

interconnected planet has been a powerful and enduring myth. Lovelock, with the collaboration of microbiologist Lynn Margulis, redefined the planet not as a passive backdrop for human activity but as an active participant in maintaining the conditions necessary for life. In recent decades, however, scientific research into the Earth's biosphere and climate systems has increasingly emphasised the interconnectedness and complexity of the planet's systems, lending scientific credence to the concept of Gaia. This evolution of Gaia has developed a scientific grasp of the existential truth of the gift of life from Gaia, and the issue of our rightful place in the cosmos is once more brought up (Primavesi 2004). It radically shifts our perspective so that we see the entire planet community as something we depend on rather than something we control as "Gaia theory can be the model and the metaphor that guides us through the twenty-first century's most pressing problems, letting us emerge with a greater understanding of ourselves and the Earth of which we are a part" (Ogle 2009, 289).

References:

- 100 Photographs That Changed the World by Life - the Digital Journalist*. 2025. <https://digitaljournalist.org/issue0309/lm11.html>
- Abram, David. 1991. The Mechanical and the Organic - on the Impact of Metaphor in Science. *Scientists on Gaia*, 66-74.
- Aeon, Gaea & the Carpi - Ancient Greco-Roman Mosaic*. n.d. <https://www.theoi.com/Gallery/Z15.2.html>
- Birth of Erichthonius - Ancient Greek Vase Painting*. 2017. <https://www.theoi.com/Gallery/T1.3.html>
- Chatterji, Roma. 2022. Gaia and the Environmental Apocalypse in Superhero Comics and Science Fantasy. *Perspectives II*. <https://perspectives-jdmc.in/wp-content/uploads/pdf/1-Gaia-and-the-Environmental-Apocalypse-in-Superhero-Comics-and-Science-Fantasy-1-30.pdf>
- Douglas, Harper. 2018. "Etymonline." <https://www.etymonline.com/word/Gaia>
- Eliade, Mircea. 1992. *Essential Sacred Writings from around the World*. San Francisco: Harper.
- Emerson, R.W. 1849. *Nature*. J. Munroe. <https://books.google.co.in/books?id=G00hAAAAMAAJ>.
- Gould, Stephen Jay. 1988. Kropotkin Was No Crackpot. *Natural History* 97 (7): 12–21. <https://www.marxists.org/subject/science/essays/kropotkin.htm>
- Harding, Stephan. 2009. *Animate Earth*. Bloomsbury Publishing.
- Leopold, Aldo. 1949. *A Sand County Almanac*. Oxford University Press.
- Litfin, Karen T. 2005. "Gaia Theory: Intimations for Global Environmental Politics." In *Handbook of Global Environmental Economics*. <https://api.semanticscholar.org/CorpusID:19009090>
- Lovelock, James, and Sidney Epton. 1975. The Quest for Gaia. *New Scientists*.

- Lovelock, James E. 1979. *Gaia a New Look at Life on Earth*. Oxford: Oxford University Press.
- Lovelock, James Ephraim. 1988. *The Ages of Gaia: A Biography of Our Living Earth*. New York: Norton.
- Ogle, Martin. 2009. "Gaia Theory: Model and Metaphor for the Twenty-First Century." In *Gaia in Turmoil: Climate Change, Biodepletion, and Earth Ethics in an Age of Crisis*, edited by Eileen Crist and H. Bruce Rinker, pp. 275–92. The MIT Press.
- Primavesi, A. 2002. *Sacred Gaia: Holistic Theology and Earth System Science*. Taylor & Francis.
- Segal, Robert A. 2015. The Modern Study of Myth and Its Relation to Science. *Zygon* 50: 757–71. <https://api.semanticscholar.org/CorpusID:170384978>
- Smith, W. 1870. *Dictionary of Greek and Roman Biography and Mythology*. <https://books.google.co.in/books?id=yoBMAQAAMAAJ>
- Snyder, Gary. 2025. *Axe Handles: Poems*. <https://archive.org/details/axehandlespoems00snyd>
- Tara, Julie. 2015. *Songs of Gaia: Devotional Poems to Nourish the Heart*. <https://books.google.co.in/books?id=ITs7CQAAQBAJ>
- Tickell, Crispin. 2010. "Foreword." In *The Revenge of Gaia*, pp. x–xvi. Penguin.
- Turney, Jon. 2004. *Lovelock and Gaia: Signs of Life*. New York: Columbia University Press.
- Tyrrell, Toby. 2013. *On Gaia : A Critical Investigation of the Relationship between Life and Earth*. Princeton: Princeton University Press.
- Urban, Hugh B. 2015. *New Age, Neopagan, and New Religious Movements*. <https://doi.org/10.1525/9780520962125>
- Wall, Derek. 1994. *Green History: A Reader in Environmental Literature, Philosophy and Politics*. Routledge.