BOOKS & ARTS

Real concerns, false gods

Invoking a wrathful biosphere won't help us deal with the problems of climate change.

The Revenge of Gaia: Why the Earth is Fighting Back — And How We Can Still Save Humanity
by James Lovelock
Allen Lane: 2006. 192 pp. £16.99

Tyler Volk

James Lovelock, the renowned scientist who pioneered the measurement of atmospheric trace gases, here offers his take on the future of energy. In brief, a vigorous turn towards nuclear power will be necessary to prevent the catastrophic climatic changes caused by an increase in atmospheric carbon dioxide, a by-product of burning fossil fuel.

Several decades ago, Lovelock developed an idea called the Gaia hypothesis, named after the ancient Greek goddess of the Earth. He postulated that "life on Earth actively keeps the surface conditions always favourable for whatever is the contemporary ensemble of organisms". Evolutionary biologists such as Ford Doolittle and Richard Dawkins countered, by showing that neither life as a whole nor specific living things could be selected by evolution to create favourable global surface conditions, and Lovelock has conceded this point. He soon developed what he now calls Gaia theory.

What is Gaia and what is the theory? Gaia is the system consisting of all life and the environments that life affects — soils, atmosphere, oceans and surface rocks. The theory states that Gaia is a closely coupled, evolving system that has the goal of keeping the climate favourable for life as it currently stands. This idea of a goal parts company with how virtually all Earth and environmental scientists see the world, and is important here because Lovelock's new book blends Gaia theory and metaphor with a viewpoint on energy and the greenhouse effect.

The concerns are truly massive. Our planet is in crisis. Rising atmospheric carbon dioxide is affecting the biosphere's radiative balance, ecosystems and ocean acidity. According to Lovelock, we have inadvertently declared war on Gaia, and she "now threatens us with the ultimate punishment of extinction". I submit that such anthropomorphic language does more harm than good to the author's arguments. But more on that later.

In *The Revenge of Gaia*, Lovelock evaluates the candidates for energy sources that do not emit carbon dioxide. Spreading inherently huge networks of solar, wind or biomass farms only further desecrates the vital and increasingly scarred landscape of the biosphere and should be limited to small doses. Carbon sequestration deserves trials but the scales required are stupefying. The only recourse is the large-scale deployment of nuclear fission, at least as a stopgap until nuclear fusion and an adequate portfolio of renewables comes along.

IMAGESTATE/ALAMY

Making peace with Gaia? Nuclear power stations can provide energy without destroying the biosphere.

Lovelock compares the tiny volumes of nuclear waste with the mountains of annually emitted carbon dioxide. He answers those he sees as fear-mongers about radiation and provides daunting numbers for renewables, such as the quarter-of-a-million wind turbines that would be required to power the United Kingdom. He is a systems thinker. His informed, often iconoclastic ideas are, as usual, worth pondering. There are gems here. For instance, we need to work out the technicalities to let us prepare to deploy macro-engineering fixes, such as sun-blocking reflectors in space, just in case the biosphere goes into a runaway mode of uncontrollable warming.

But beware the use of Gaia theory in all this. Lovelock says that he takes the goddess as a metaphor and a thinking aid, like a ship's captain referring to the vessel as 'she', and admits that Gaia theory is "provisional and likely to be displaced". These caveats, however, are overwhelmed by the unquestioned presence of Gaia.

Quite simply, the problem is that Gaia as portrayed here is false. Essentially the same criticism levelled by evolutionary biologists against the Gaia hypothesis holds for Gaia theory. There can be no goal for the biosphere, which, however extraordinary, is an understandable chemical mixture of air, water, soil and organisms. This system settles naturally into steady states, bounded by local negative feedback, and the current states are dear to our lives and worthy of protection. But Lovelock persists in using the language of goals and even intentions for the biosphere system.

For instance, he states that Gaia buries organic carbon "to keep oxygen at its proper level". Wrong. Gaia doesn't do things for reasons. The organic carbon that slips past the bacterial layers in ocean sediments has global effects, but such effects are not why the carbon is buried. The incorporation of carbon by plants and the emission of cloud-enhancing gases by marine plankton did not evolve as climatic air-conditioning mechanisms, as in another of Lovelock's discussions; they evolved because they enhanced the internal metabolic needs of specific organisms.

We are also told many times that Gaia likes it cool. But the biosphere (my preferred name

for Gaia) doesn't like or dislike anything. So why does Lovelock persevere with this language and mode of thinking? Why doesn't he let his analysis of energy systems and feedbacks in climate and the carbon cycle stand on its own? Lovelock is aware, with regard to his personalization, of the criticisms of scientists. Yet he claims to be unrepentant.

Certainly the language of goals and intentions gives emotional juice to the arguments. But when Lovelock promotes a metaphor that mixes in false science, the metaphor itself is tainted and must be dismissed.

He makes a case that metaphor is needed. But to pronounce that Gaia is "angry" with us, or that she will "eliminate those that break her rules" weakens the otherwise rational (albeit controversial) scrutiny of our complicated global jam. Too often, Gaia here seems less like science and more like one man's mythology elevated into the service of deeply felt environmental concerns. Lovelock likens the incomprehensibility of Gaia to that of God, valorizes those who declare allegiance to Gaia, and claims that Gaia theory is a seed from which an "instinctive environmentalism can grow; one that would instantly reveal planetary health or disease and help sustain a healthy world". What does "instantly reveal" mean?

Read this book for its thoughtful sections on global energy and climate, but steer clear of its web of Old Testament-like prophecy. ■

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Climbing Mount Schiehallion

Weighing the World: The Quest to Measure the Earth
by Edwin Danson
Oxford University Press: 2006. 289 pp.
£17.99, $29.95

Patricia Fara

The Enlightenment recluse Henry Cavendish is remembered for being eccentric, synthesizing water and determining the Earth's density. Notoriously taciturn, Cavendish apparently made one joke in his entire life: commiserating with the ill-health of his colleague John Michell, he hoped that "it may at least permit the easier and less laborious employment of weighing the world". Their efforts with a torsion balance eventually proved successful, but these heroes of mensuration make surprisingly brief appearances in *Weighing the World*. Instead of describing their laboratory experiments, Edwin Danson focuses on a far less famous line of investigation — measuring the attraction of mountains.

Danson, a civil engineer, has coined a misleading title for his book, which turns out to be mainly a history of surveying in Britain and India during the 'long eighteenth century'. He starts his account in seventeenth-century France, when perplexing results from accurate instruments forced cartographers to challenge the long-standing assumption that God had made the Earth a perfect sphere. They concluded that the Earth must be slightly squashed — but, as Voltaire put it, battles raged about whether it resembled a melon or a lemon. Several expeditions later, it seemed that the Earth was more like a pear. Surveyors faced an additional challenge to accuracy. Isaac Newton himself pointed out that, according to his gravitational theory, mountains must be centres of attraction. But Newton was wrong to doubt that instruments would ever be sensitive enough to detect this influence — large mountains can affect readings strongly enough to yield mapping errors of more than a mile.

Danson's book revolves around an expedition to Mount Schiehallion in the Scottish Highlands, which he interprets as a key founding event in the science of geodesy. Organized by the Royal Society, an underpaid team set out with the finest available equipment, but tempers flared during long weeks of arduous labour. Sleeping in cramped tents and hampered by atrocious weather, astronomers and surveyors quarrelled about their duties, and personality clashes were further exacerbated by class differences — although the astronomer royal, Nevil Maskelyne, redeemed himself by sending a Stradivarius to the ghillie whose fiddle had been burnt during the farewell celebrations. Back in London, Maskelyne calculated Schiehallion's attraction by comparing the astronomical and land measurements of its width. Armed with this result, and thanks to the surveyors' astonishing feat of triangulating the whole mountain to find its volume, he estimated its density.

This is a handsome book, brimming with original images as well as modern diagrams, although someone at the publisher apparently believes that the secondary in "secondary sources" means less important. An alert editor might have prevented Danson from dating experiments to test Newton's gravity to 15 years before he published the *Principia*, and also toned down phrases such as "Mother Nature was not about to let her foolish children exploit her oblate body." But this modern surveyor's love for both his craft and his historical material emerges strongly. Danson not only explains technicalities clearly, but also gives readers some notion of the endurance and attention to detail involved in drawing maps before satellite systems removed the hard work — and the romance — from surveying.

Danson is a narrative rather than an analytic author, who intersperses scientific discussions with ample background information of varying relevance. His generosity in reproducing the minutiae of his research unfortunately obscures the plot-line leading to today's theories of Earth's structure, and this emphasis on presenting facts precludes a discussion of their significance, which would have given his work a wider appeal. Although the dust-jacket blurb highlights the novelty of Danson's narrative, his text skates around the interesting question of why Maskelyne's strenuous activity on Schiehallion has been forgotten, whereas Michell and Cavendish have acquired canonic status. To say they got a better answer is too simple: Danson's work implicitly illustrates how the theoretical work of scientists was — and still is — more esteemed than the practical contributions of engineers. ■

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DAVID NOTON PHOTOGRAPHY/ALAMY

Weighing up the evidence: Mount Schiehallion was the focus of an early attempt to measure the world.