# ONE HUNDRED SECONDS TO MIDNIGHT

Sounding the Alarm for Climate Change

Peter Harrington



#### **Foreword**

By Dr Jonathan Barnard, CEO of World Land Trust (WLT)

From Aristotle's Meteorology to Apollo 8's photograph of Earth from space in 1968, a long chain of knowledge connects us all over the centuries to a past we must learn from; and this is where projects like this come in. As the incredible One Hundred Seconds to Midnight collection attests, understanding of planetary challenges – and the power of collective action to address them – goes back much further than we sometimes think.

WLT are proud to be partnering with Peter Harrington for this collection because it encapsulates, like few others, a maxim that we have seen many times over in our decades of action alongside our conservation partners: people are the driving force of climate change but they can also be its solution. At a time when global warming feels more real than ever, this is a headline people don't often read – a headline it's worth not losing sight of as we all too frequently wake up to news coverage of catastrophic events such wildfires in Siberia or deadly floods in Germany.

Treatises, printed accounts, research papers – over the centuries they have charted a story of humankind's devastation of its home, but the next chapter is as yet unwritten. A chance for a better future still exists and championed by WLT Patrons such as Sir David Attenborough – whose writings are part of this project – we will continue to fight for it by saving the land that all life on Earth relies on. That spirit of hope for a positive next chapter is something that the purchaser of this extraordinary collection will also be supporting, so from WLT and our partners, our thanks to you, and to Peter Harrington for choosing us as their charity partner.

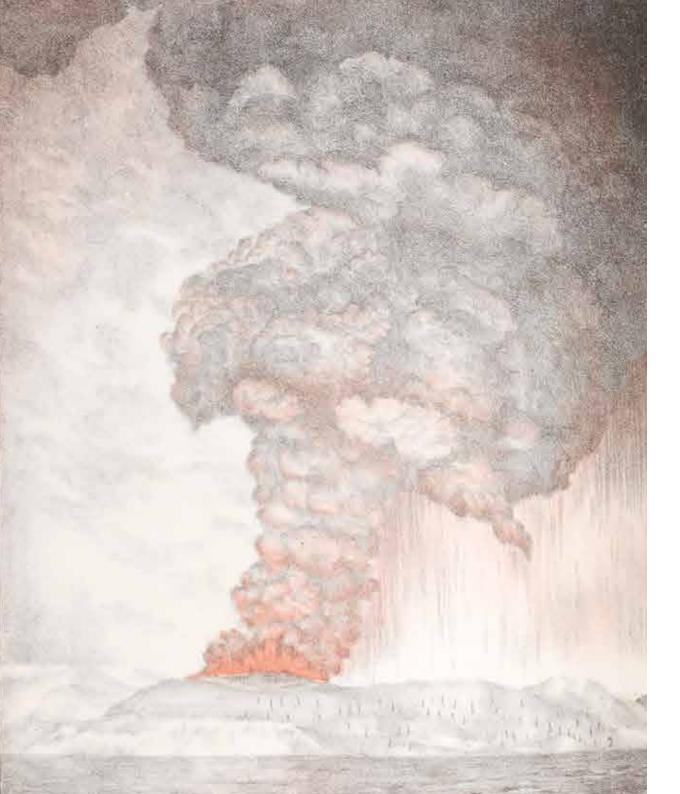




The slow realization of the most urgent crisis facing humanity

Presented on the eve of the 2021 United Nations Climate Change Conference, One Hundred Seconds to Midnight is an unparalleled assemblage of original books, maps, manuscripts, photographs, ephemera, and art chronicling the long history of climate change and environmentalism.

In 2015 the World Health Organization declared climate change "the greatest threat to global health in the twenty-first century". This collection traces the long journey that has brought us to our current, pivotal moment.



# Final \* Environmental Statement

#### Five centuries of climate science

This remarkably comprehensive collection documents over 2,000 years of human thought and experimentation, curiosity and anxiety, action and inaction.

Featuring more than 800 works from the fifteenth century to the present day by the world's greatest scientists, writers, artists, and activists, it comprises rare first editions, signed and association copies, and iconic visual materials.

Books are the ideal prism through which to examine our shared history with the climate: how we have understood, measured, recorded, and changed it. It was in printed works that scientists first announced and debated their discoveries, introducing the ideas and terminology that we are so familiar with today: "greenhouse effect", "global warming", and "climate change".

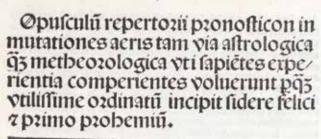
A particular strength is the collection's outstanding coverage of nineteenthand twentieth-century climate science, the fruits of a decade of rigorous curation by the distinguished private collector David L. Wenner.

All the publications mentioned in this leaflet are included in the collection, overwhelmingly in first edition. A full list of all the items, complete with edition statements, condition reports, and further notes, is available on request.

Left: Lithograph from the British meteorologist George James Symons's report on the 1883 Krakatoa eruption, an event which caused dramatic changes in global climate

Above: Detail from the US Air Force's Agent Orange report of 1974, which attempted to mitigate the harmful effects of herbicides







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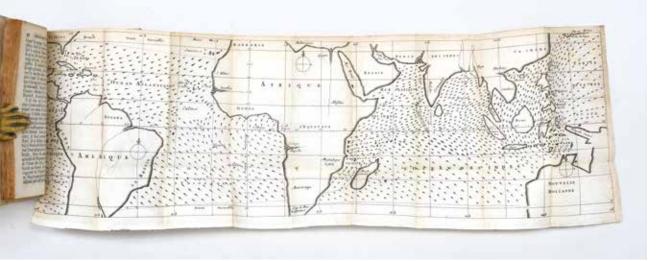
### Aristotle the first climate scientist

Humans have been studying the climate for nearly 2,000 years. Aristotle, the first natural scientist, wrote Meteorologica as long ago as 350 BCE, a text which remains "the cornerstone of the growth of meteorology into a science" (Frisinger, p. 634). Kept alive in manuscript through the medieval era, Aristotle's text was introduced to a mass readership when first printed during the Renaissance and helped inspire the nascent climate studies of that new age of discoveries.

However, Aristotle's *Meteorology* was beaten to the press in the age of printing by one of the earliest printed works on weather forecasting and a precursor to modern meteorology, In mutationes aeris (1485), compiled by the French astrologer Firmin de Beauval. By pairing contemporary popular knowledge with observations made by his classical and Arabic predecessors, the author used science and folklore to explain the reasons behind local and global climate changes.

Above: Aristotle reached a new readership in the print era, in this case, the first edition in Italian, 1554

Left: Firmin de Beauval's book is one of the first meteorological works ever published





## **Understanding the Earth**

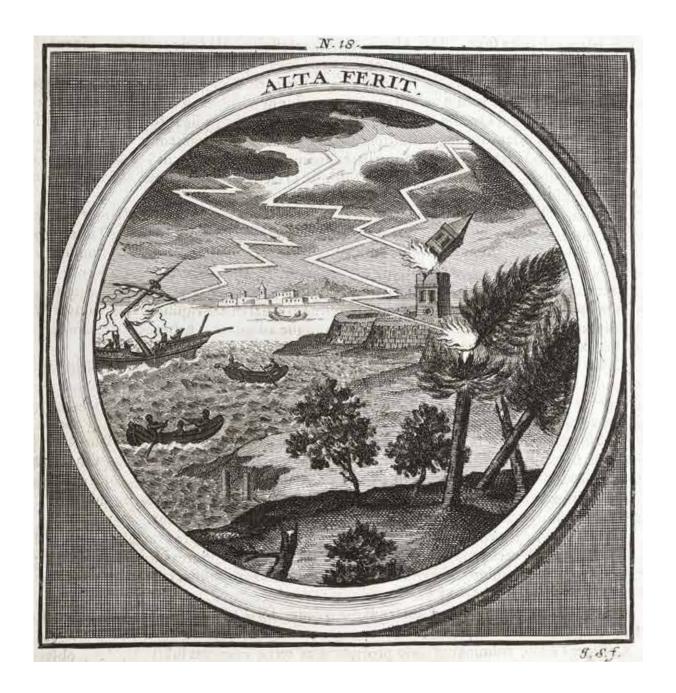
A new wave of research into the Earth's mechanisms swept across Europe in the fifteenth and sixteenth centuries. In 1596, the Flemish cartographer Abraham Ortelius developed an early version of what has since become known as continental drift theory – the idea that the Earth is subject to changes in land distribution over time, triggering significant alterations in the climate. It took more than three centuries for the Austrian meteorologist Alfred Wegener to confirm Ortelius's hypothesis, becoming the first to gather the geological



evidence for continental drift in Die Entstehung der Kontinente (1912). Such tectonic movements were later recognized as the underlying cause of global-scale glaciation – a "Snowball Earth" – and seafloor spreading.

The first comprehensive study of the wind since Aristotle's Meteorologica was Francis Bacon's Historia ventorum (English translation, 1653). Close on his heels was Ralph Bohun, who had been resident tutor to the diarist John Evelyn's son. His Discourse Concerning the Origine and Properties of Wind (1671) was the first systematic attempt to explain air in all its forms, including trade winds, waterspouts, tornadoes, and hurricanes.

Top left: The first printed meteorological map Above: Wegener showed the evidence for continental drift Bottom left: Copperplate engravings depicting cloud formations and air currents from Bohun's Discourse





About the same time, the English polymath Edmond Halley hypothesized that air currents were the result of solar heating. To illustrate this, he drafted the first meteorological map ever printed (1687).

Besides meteorologists, medics took great interest in climate. Nathaniel Henshaw, a London physician who practised in Dublin, published Aero-Chalinos (1664), a treatise on the importance of clean air for human health. Others concentrated on the health of the body politic. In his Meteorologia philosophico-politica (1697), the Austrian Jesuit professor Franz Reinzer provided a richly illustrated and encyclopaedic inventory of the geo-physical environment and its effect on morality and politics.

Both: Reinzer's work is dramatically illustrated with fine large copperplates of meteorological events

# SYLVA.

Or A DISCOURSE OF

# FOREST-TREES.

ANDTHE

Propagation of Timber





# FUMIFUGIUM:

OR THE INCONVENIENCIE OF THE

AER AND SMOAK OF LONDON DISSIPATED.

Increased wood-burning in the seventeenth century created two crucial problems: air pollution and timber shortages. Both issues were tackled by John Evelyn in two outstanding environmental texts: Fumifugium (1661) and Sylva (1664). The former, which Evelyn called his "old smoky pamphlet", is the first English book on pollution. Ambitiously envisioning a beautified London free of choking smoke, Fumifugium is "the most extensive, sophisticated, and ambitious analysis of urban air pollution produced anywhere during the early modern period" (Cavert, p. 174). In Sylva, "the first western publication on forestry" (Williams, p. 89), Evelyn appealed for a national scheme of reforestation. Landowners like the following century's Francis Mundy defended ancient woodland from enclosure.

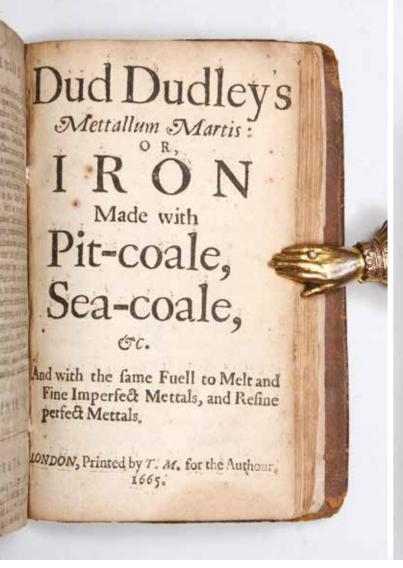
Evelyn's work was part of a wider understanding of the importance of environmental conservation that developed during this period. In 1653, Izaak Walton published The Compleat Angler, a celebration of the undisturbed English countryside marked by a keen appreciation of the harmony between living creatures and their habitats. In addition to being the most famous book on fishing, its advocation for methods of sustainable wildlife management makes it "one of the most important, formative environmental texts in the English language" (Swann, p. x).

Top left: Sylva was the first book published by the Royal Society

Top right: Walton's Compleat Angler, a formative environmental text

Middle: The frontispiece to Mundy's The Fall of Needwood Forest laments the newly barren landscape

Bottom: Evelyn's wonderfully optimistic Fumifugium



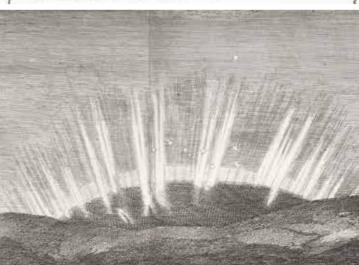


But just as Evelyn and Walton were pressing for conservation, fossil fuel extraction was starting to transform the English landscape. In 1665, the English ironmaster Dud Dudley published Mettallum Martis. Marking a pivotal movement in the history of industrialization, this is the first printed account of the use of raw coal in place of charcoal in iron production.

Above: Dudley's pivotal book ends with a crude woodcut diagram of the coalfield around Dudley Castle, the earliest recorded example of a printed geological map

# RATIONAL ACCOUNT OF THE WEATHER,

Changes and Alterations, together with the Philosophical Reasons of them.







Top left: Pointer's early guide to weather forecasting

Bottom left: Mairan unveiled the secrets of the Northern Lights

Middle: The ocean floor, rich in aquatic flora, from Ellis's survey of corals

Right: Deluc designed new precision instruments for measuring atmospheric data

## Global understanding

New methods and tools for explaining natural phenomena were unveiled in the eighteenth century. The English antiquary John Pointer published A Rational Account of the Weather in 1723, and a decade later the French geophysicist Jean-Jacques d'Ortous de Mairan was commissioned by the Royal Academy of Sciences to give a scientific explanation of the sun's role in creating the aurora borealis.

Early surveys of coral – now known to be so crucial to our ecosystems – appeared, such as the British linen merchant and naturalist John Ellis's Essai sur l'histoire naturelle des corallines (1756).

Vast quantities of experimental research circulated, a prime example being Recherches sur les modifications de l'atmosphère (1772) by Jean-André Deluc, a Swiss meteorologist who spent his life perfecting the design of instruments that were critical for measuring atmospheric data.



TABLE of the Monthly Mean Temperature of the Standard from lat. 80° to lat. 10°.

Latitude	180°	79°	78°	77°	76°	175°	74°	73°	72°	710	70°	69°	68°	67°	66°	165°	164°	63°
January	22,	22,5	23,	23,5	24,	24,5	25,	25,5	26,	26,5	27,	27,5	27,5	28,	28,	28,	29,	30,
February		_		_			-								_			_

Top left: Nakanishi's book on Japanese meteorology contains volvelles to track the passage of the sun

Bottom right: Benjamin Franklin explained how volcanoes and meteors affect climate

Bottom left & top right: Kirwan compiled data from his own daily records collated with available data worldwide

In Japan, Takafusa Nakanishi published Min'yō seiu benran (1767), the earliest attempt to present a scientific account of the meteorology of Japan based on local observations. One of the earliest Japanese books to contain revolving paper discs (volvelles), it allowed readers to track the passage of the sun and predict the occurrence of precipitation.

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,5	51,	51,	51,	51,5	52,	52,5	53	53,5	53.5	53,5	540	54,5	54
,	<b>41,5</b>	12,	12,5	+3,	43,5	14>	4455	+5,	45,5	46,	+7,	48,	48

METEOROLOGICAL IMAGINATIONS and CONJEC-TURES. By BENJAMIN FRANKLIN, LL.D. F. R. S. and Acad. Reg. Scient. Paris. Soc. &c. Communicated by Dr. Percival. Read December 22, 1784.

THERE feems to be a region higher in the air over all countries, where it is always winter, where frost exists continually, since, in the midst of summer on the surface of the earth, ice falls often from above in the form of hail.

Hailstones, of the great weight we sometimes find them, did not probably acquire their magnitude before they began to descend. The air, being eight hundred times rarer than water, is unable to support it but in the shape of vapour,

In America, Benjamin Franklin's article "Meteorological Imaginations and Conjectures" (1785) is considered "a milestone in geographical thought" (Payne, p. 1). Franklin was the first to suggest that natural phenomena such as volcanoes and meteors could directly affect the climate. Meanwhile, in Ireland, the geologist and chemist Richard Kirwan made an important contribution to early comparative climatology with his Estimate of the Temperature of Different Latitudes (1787).

## L'HOMME DU MIDI

ET

L'HOMME DU NORD,

OU

L'INFLUENCE DU CLIMAT;

PAR CH.-VICTOR DE BONSTETTEN.

# HISTORICAL ACCOUNT

THE CLIMATES AND DISEASES

OF

THE UNITED STATES OF AMERICA;

AND OF

THE REMEDIES AND METHODS OF TREATMENT, WHICH
HAVE BEEN FOUND MOST USEFUL AND EFFICACIOUS, PARTICULARLY IN THOSE DISEASES WHICH
DEPEND UPON CLIMATE AND SITUATION.

COLLECTED PRINCIPALLY FROM PERSONAL OBSERVATION,

AND

THE COMMUNICATIONS OF PHYSICIANS OF TALENTS AND EXPERIENCE, RESIDING IN THE SEVERAL STATES.

AN ESSAY

DW THE

#### PRINCIPLE OF POPULATION;

on,

A VIEW OF ITS PAST AND PRESENT EFFECTS

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HUMAN HAPPINESS:

# Systematischer Grundriß

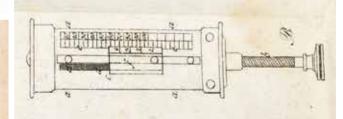
ber

# Atmosphårologie,

nod

## Wilhelm August Lampadius,

Profesor der Chemie und Suttentunde an ber Frenberger Bergacademie, Oberhattenamtsaffeffor, mehrerer gelehrten Gefellichaften Mitglied.



THE

#### CLIMATE

OF

#### GREAT BRITAIN;

OR

REMARKS ON THE CHANGE IT HAS UNDER-GONE, PARTICULARLY WITHIN THE LAST FIFTY YEARS.

ACCOUNTING FOR

THE INCREASING HUMIDITY AND CONSEQUENT CLOUDINESS AND COLDNESS OF OUR SPRINGS AND SUMMERS;

With the Effects such ungesial Seasons have produced upon the Vegetable and Animal Economy.

INCLUDING

VARIOUS EXPERIMENTS TO ASCERTAIN THE CAUSES OF SUCH CHANGE.

INTERSPERSED

Concerns about climate-induced viruses and resource management led to a proliferation of late eighteenth- and early nineteenth-century pamphlets discussing "climats médicaux", and William Currie produced the first substantial American study of climatology and epidemiology (1792).

At the turn of the century T. R. Malthus published his hugely influential Essay on the Principle of Population (1798), arguing that, as human population increased inexorably, the planet would be stripped of its resources, leading to pestilence and plague.

#### Climate science finds its voice

The year 1806 saw the earliest printed use of the term "climatology" in Wilhelm August Lampadius's Systematischer Grundriss der Atmosphaerologie, as well as one of the first books to use the term "climate" in its title: John Williams's The Climate of Great Britain.

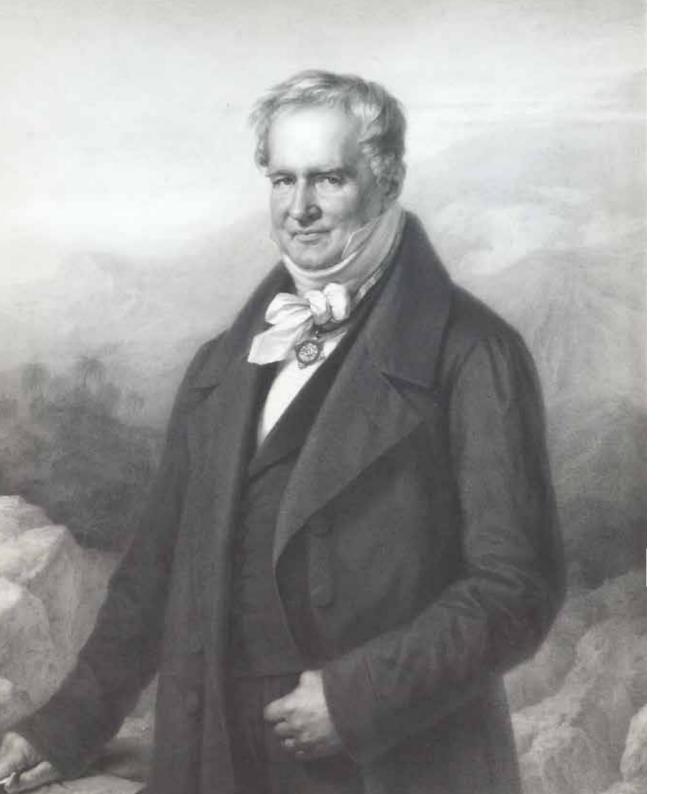
Top left: French scientists were active in considering the influence of climate on health

Middle left: Currie's Historical Account was the first substantial American study of climatology and epidemiology

Bottom left: Malthus's concerns about exponential population growth were widely influential

Top & middle right: Lampadius's Systematic Outline of Atmospherology established climatology as a separate scientific discipline

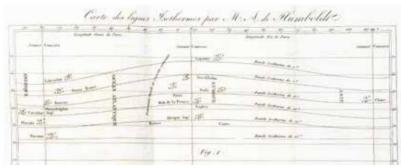
Bottom right: Williams's study was one of the first books in English to use the word "climate" in its title



#### The father of environmentalism

At the forefront of the rise of modern climate science was the Prussian polymath Alexander von Humboldt, the first person to conceive of the planetary ecosystem as a connected whole and to develop the idea of human-induced climate change. Today he is remembered as the "father of the environmental movement" (Wulf, p. 58).

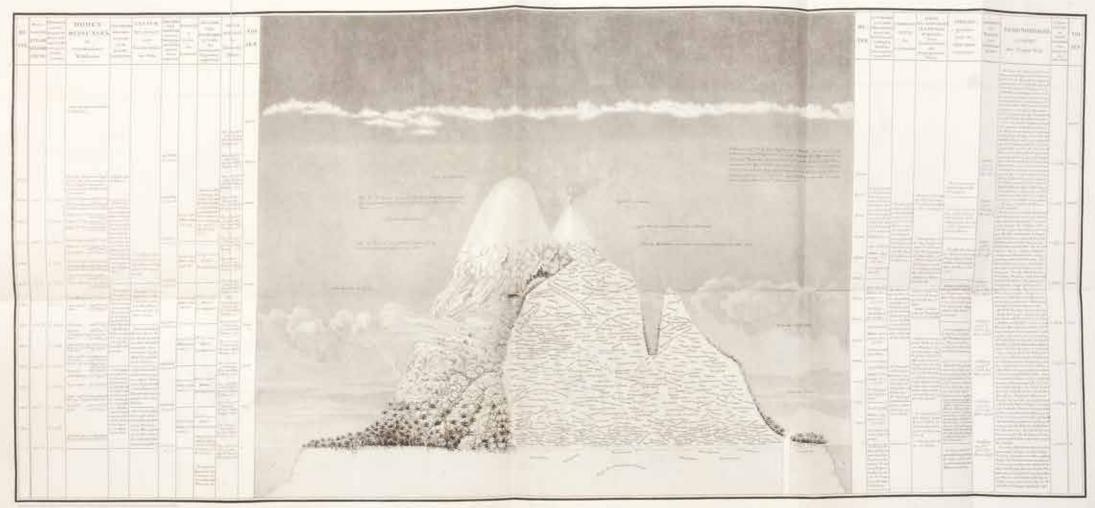
Humboldt's exploration of the Americas and his cross-continental comparisons resulted in *Ideen zu einer Geographie* der Pflanzen (1807), "the world's first ecological book" (ibid., p. 127). It includes the magnificent large folding plate presenting Humboldt's "Naturgemälde", his concept of a holistic, interconnected web of life. Published a year later, Ansichten der Natur, Humboldt's best-selling work, was heralded by contemporaries as the very "poetry of geography" (Martin, p. 152). Revolutionizing physical geography, Humboldt also devised the concept of the isotherm – contour lines which indicate areas of matching temperature – and published the first map to illustrate them (1817).



Left: This proof lithographic portrait of the great environmentalist Humboldt is from the estate of Charles Lyell, author of Principles of Geology (1830–33), who drew heavily on Humboldt's observations for his work on climatic change

Above: Humboldt's chart of isotherms

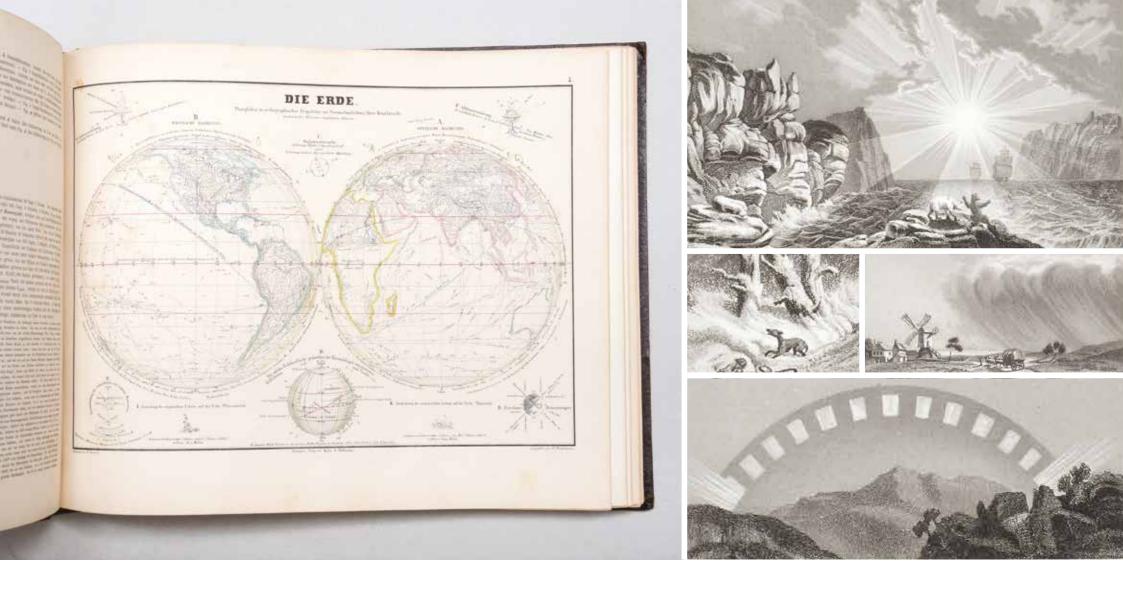
Overleaf: The "Naturgemälde" plate, depicting Chimborazo. "Naturgemälde" translates to "painting of nature"; Humboldt later called the graphic a "microcosm on one page"



Georgraphie der Manzen in den Vropen-Vändern;

gegrundet mef Berlinchtungen und Morningen welche vom in Greek weitlicher his som in Greek millicher Brote singstellt werden sind in die Julien zugebis sons

ALEXANDER VON HUMBOUDT and A.G. BONPLAND.



Above: Humboldt's magnum opus Kosmos was accompanied by a striking atlas volume, which features engravings of natural phenomena such as the midnight sun at the North Cape, snowstorms and monsoons, lunar rainbows and the northern lights at Breuille-Pont

Humboldt's genius was extrapolating a global perspective from his fieldwork. In this regard, the monumental Kosmos (1845–62) was his crowning achievement, revealing nature to be a "living whole" with organisms bound together in a "net-like intricate fabric".

#### JOURNAL OF RESEARCHES

INTO THE

## GEOLOGY

AND

# NATURAL HISTORY

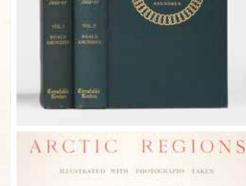
OF THE

VARIOUS COUNTRIES

VISITED BY H. M. S. BEAGLE,
UNDER THE COMMAND OF CAPTAIN FITZROY, R.N.
FROM 1832 TO 1836.

BY

#### CHARLES DARWIN, Esq., M.A. F.R.S.

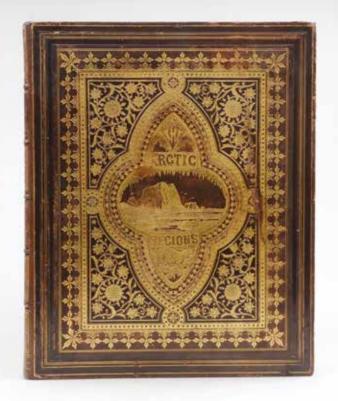


Birds and insects—Ebbing and flowing springs—Coral formations re-

sisting power of ocean—Fields of dead coral—Stones transported by roots of trees—Great crab—Stinging corals—Structure of lagoon islands







Humboldt was at the centre of a vast international network of scientists, many of whom also embarked on major voyages to study the natural world.

Among the most significant of these were Charles Darwin, who took Humboldt's Personal Narrative with him aboard the Beagle, and the many intrepid adventurers of the north-west passage, a sea route that at the time was permanently ice-logged but has now become easily accessible due to rising temperatures — a dramatic indicator of our current crisis. Darwin's contribution to the Narrative of the Surveying Voyages of His Majesty's Ships Adventure and Beagle (1839) is his first published book. It is not only the genesis of the Origin of Species but also contains valuable notes on coral reef formation.

Milestone accounts by Robert McClure and Roald Amundsen mark, respectively, the first traversal and first all-water crossing of the north-west passage (1856 and 1908).

Inspired by accounts of the Franklin search expeditions through the northwest passage, the American artist-explorer William Bradford undertook seven Arctic expeditions between 1861 and 1867. The result was The Arctic Regions (1873), a monumental record which remains "one of the nineteenth century's most spectacular photographically illustrated travel books" (Parr & Badger, p. 31). Comprising some of the best polar photographs in existence, it is also one of the earliest examples of what one might call "eco-art tourism" (Books on Ice, p. 145).

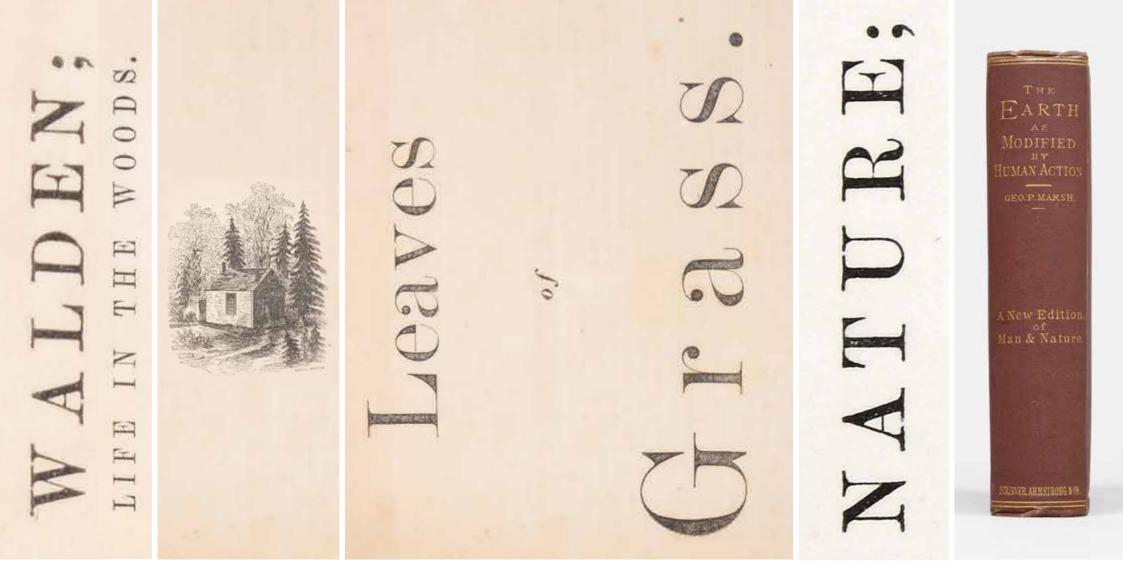
Top left & middle: The voyage of the Beagle proved to be the most important in the history of biological science

Bottom left: In 1854 Robert McClure was the first captain to successfully traverse the frozen north-west passage

Top right: Only fifty years later Amundsen was able to navigate the passage by boat

Bottom right, details, & overleaf: The opulence of Bradford's Arctic Regions





Left: Thoreau's back-to-nature classic made him one of the prophets of the American environmental movement, alongside [middle & right] Whitman and Emerson

Far right: Marsh's work was one of the first to document how human action modifies the physical world

As well as being read by scientists, Humboldt's work was immensely popular among artists, poets, and politicians. The American transcendentalists revered Humboldt: Walden (1854) was Henry David Thoreau's "answer to Kosmos" (Wulf, p. 250). Leaves of Grass by Walt Whitman (1855) and Nature by Ralph Waldo Emerson (1836) were similarly indebted to Humboldt, and were themselves remarkable contributions to the literature of ecology.

A decade later, the American diplomat George Perkins Marsh wrote Man and Nature, now celebrated as the fountainhead of the conservation movement. It was "the first book to recognize the environmental perils of human agency, the first to assess the damage done, and the first to set forth a program of reform" (Lowenthal, p. 227).

Ö. 1901: 4.

ARRHENIUS, S., Wärmenbsorption der Kohlensäure,

# DÉCOMPOSITION DES MINÉRAUX

PAR M. EBELMEN,

# NILS EKHOLM.

samma sätt som glasfönstret öfver en drifbänk, i det att den lätt

ART. XXXI.—Circumstances affecting the Heat of the Sun's Rays; by Eunice Foote.

(Read before the American Association, August 23d, 1856.)

Remarques générales sur les Températures du globe terrestre et des espaces planétaires.

PAR M. FOURIER.

# LA CHALEUR SOLAIRE,

#### PAR M. POUILLET.

February 7, 1861.

The Bakerian Lecture.—On the Absorption and Radiation of Heat by Gases and Vapours, and on the Physical Connexion of Radiation, Absorption, and Conduction. By Professor TXNDALL, F.R.S. 100

In Com	non Air.	In Carbonic	In Carbonic Acid Gas.			
In shade.	In sun	In shade.	In sun.			
80	90	80	90			
81	94	84	100			
80	99	84	110			
81	100	85	120			

## Living in a greenhouse

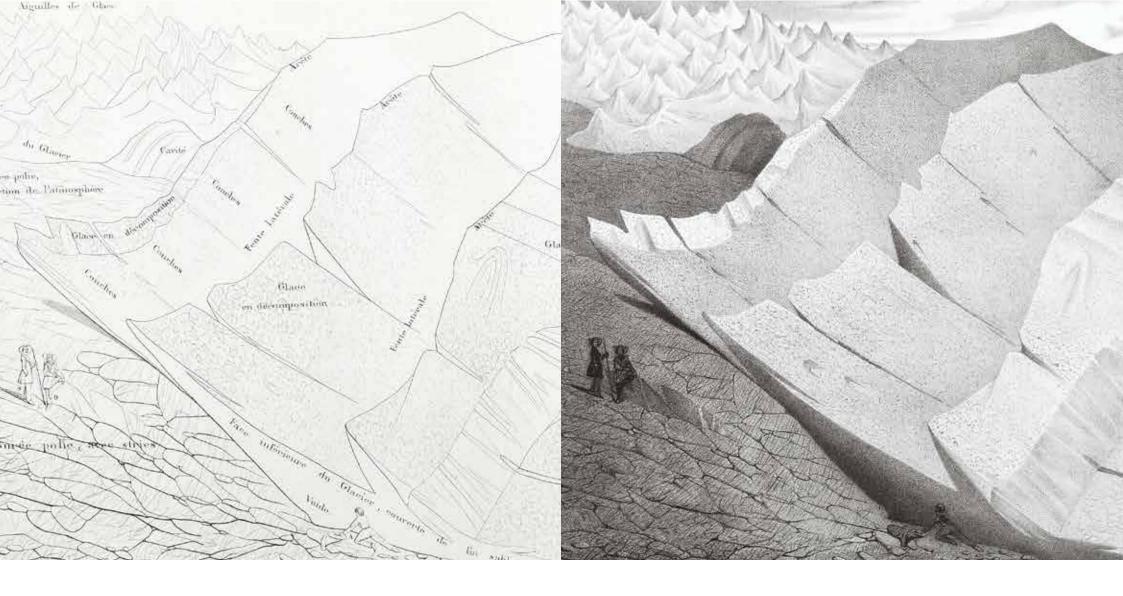
The majority of our knowledge of climate change can be traced back to the beginning of the nineteenth century, when two independent streams of scientific inquiry emerged: concerning the greenhouse effect, and glaciation.

As early as 1856 the "First Lady of Climate Science", American scientist Eunice Newton Foote, theorized that carbon dioxide directly affected atmospheric temperature in her landmark paper "Circumstances affecting the heat of the sun's rays". A few years later, across the Atlantic, Irish physicist John Tyndall demonstrated conclusively the physical basis of what we now call the greenhouse effect. Their work was built on foundations provided by continental scientists such as Joseph Fourier and Claude Pouillet.

In the 1890s two Swedish academics, Svante Arrhenius and Nils Ekholm, paved the way in proving that increases in industrial carbon dioxide emissions specifically were driving global warming. Arrhenius's climate model, however, was called into question by the physicist Knut Ångström, which hindered research into greenhouse gasses for decades. Ekholm was the first to apply the greenhouse metaphor to the phenomenon (1899), although it was not until 1907 that the exact English phrase "greenhouse effect" was coined by the English physicist John Henry Poynting.

Left: A selection of the most famous names in nineteenth-century climate science

Above: Foote's table showing her measurements of the greenhouse effects of carbon dioxide



Above: In his revolutionary Études sur les glaciers (1840), Agassiz demonstrated the effects of glacial ice on the landscape of the Alps, thus challenging the legitimacy of the Great Flood myth

At the same time, a second group of scientists were investigating another driver of climate: glaciation. The Swiss-American paleontologist Louis Agassiz drew widespread criticism when he advocated for the existence of a European-wide glaciation, a theory delivered in his very rare Neuchâtel Address of 1837. Many of his contemporaries, including the geologist Charles Lyell and evolutionists Charles Darwin and Alfred Russel Wallace, worked to verify or disprove the new glacial hypothesis.

harvest, some of which is sommantly ripe. It might be said that electific law is so powerful that it will administer

less name knew it by experiment to be false. I refer to no chemical questions. This is a subject requiring a separate beture, one not agreeable because revealing princi-



An Act for the more effectual Condensation of Muriatic Acid Gas in Alkali Works.

[28th July 1863.]

present in early frequently makes the path of method present in early frequency clear the judge expounds the law to the jury-The judge stands as an example of Proposition 1, the sower of law. The separation man is no a similar position. The jury is an example of Proposition 2. the free action of the spirit. The position of the witness is very vague; he stands as one in a man of combuett facts, funcion and tabeleathurs, out of which the missente shall being onlor

Again, as the batraction of the judge may show that he from a wild mose without a read, the (welve incremen, each a control of instinct, at over take the lead, and first out the path he showed although localdicalds guesses. I speak of the ideal and perfect jury that like other things.

Courtainty sound true Passers Santa .- The following are to my mind some of the objections against the present plan. When a furrister examines a witness he asks such questions as set his case and best directly in the line of argument which he adopts. To do this he exaggerates some points and by dimunished or passes were others. We cannot be not the bereither the this, it is his duty to sein the cause if possibly, and his interest is as strongly set in the direction that it would be too much to find, as commission y mornadalatory, as advising your

case they would take the place of assessors properly speak ing, and their appointment must be separately discuss

It was my belief that if the electific withouts, on the appointment by either side, met and arranged their point of agreement, and arrived at their exact points of disagreement or divergence, much time would be saved to the courts. I believe that this will gradually become practice, although I son many sufficilities in forming into a law. It is frequently so difficult to tell what point are most required, that a harrister would be afraid to endanger his case by allowing any portion of it to be managed either out of his hearing or out of the position in which is second tell best. This will I believe only come into practice when selections and berrieters learn their place better, and tearn more thoroughly to contide in each other As present time is wasted by the most miserable trivialities

with which this system would entirely dispense.

4. As Juny.—This has already been spoken of, but no in its relation to a jury of eclentific man or "experts." The principle of such a jury is partly recognized in special paries. I suppose it to be successful where more information is meded on special subjects, but not where all the jurymon have arrived at the stage of being scientific men The limits of information on a jury are not to be defined intelligent are better than non-intelligent men amongs parymen as amongst others. A little knowledge is a dan ecroses thing, but a little less to more so. It is not the knowledge of the scientific man that is objected to on jury, but the habits of mind he acquires by his mode of life and study. He would introduce as was said too much law, and isave our mutual considerations. He would increase formal law and diminuch instance. He would enlarge the head of the court and leave no room for it

5. As Apvocers -I have ulroidy thoun, when speak

# Public Health.

[38 & 39 Vict. Ch. 55.]

A.D. 1875.

of the individual and social rights involved; and thes this are the exact province of the judge, demanding the



#### CHAPTER 52

An Act to make provision for abating the pollution of the air. [5th July, 1956] the air.

man. Must the eclentist not also shade off into the ba rister? It is probable that he will always be found some what inclined to do so, and especially after having give his opinion. It is for that very reason that it become important to neest him in keeping his place independenti and prevent him from being driven where circumstano and temptations impel that. At present he only appea through the barrister, who is an advocate. He appear therefore in reality as an advocate. To this we mu object. I comifier it time to mak for him a position of it own, to seek that he shall come into the court, not us mere tool of a barrieter or his client, but as a student. exact sciences, as one whose business it is to weigh such measure to small fractions, and to deal with Javos whi are not controlled by his emotions or juducaced by l promines. The is the representative in a court of the laws which caused the bills to be weighed in a balance The further he moves out of this, the further does I leave his province; but he is also a mun, and must nev be expected to altern to himself from what is human. Th cases in which a well-regulated mind finds it impossible be both scientific and human (in the above sense) are ve-

A barrieter deals with human wants, feelings, and ca constances. If he become a merely adontific man he leave his province, but he is obliged to become to some extent scientific because his duties are wonderfully mixel. represents marrhird string for justice, as well as fighti against injustice; he represents all knowledge that can brought to bear on his side; he is compelled, like judge, to take the legal bearings of the esse, and h the jury, to take the non-professional view, whilst

some up in himself every witness. To asket the scientific near in retaining his true position I proposed the plan mentioned of making him entire independent of the barrister. I think this a most i

is still worthy of observation, first as a fact, and next as affecting the value of property. I was led to attribute this effect to the slow but constant action of the acid rain. If it affects substances with an areat an averse of silies it is not to be averated that

## Legislating for the future

This scientific focus was intensified, at least in part, by the increased grit and smog caused by the Industrial Revolution, which became a matter of concern for legislators.

A series of major British Acts of Parliament aimed to introduce environmental reforms, including the Alkali Act (1863) and its amendments, the Public Health Act (1875), and the Clean Air Act (1956), to name but a few.

The environmental chemist Robert Angus Smith is best known for discovering and coining the term "acid rain" in an 1850 paper. A year later, while campaigning for the regulation of factory-induced pollution in Manchester, he authored an important article on the role of expert scientific testimony in legal affairs (1860).

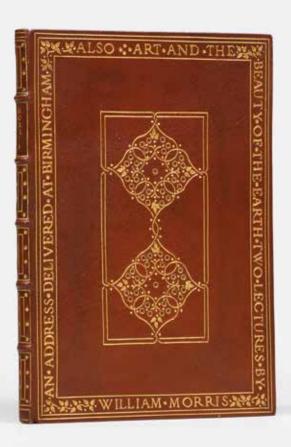
Working at the same time, the economist William Stanley Jevons wrote The Coal Question, a treatise questioning the wisdom of using a finite resource such as coal as the basis for English industry.

Above: Detail from Smith's 1859 paper "On the air of towns"

Left: Smith collaborated with fellow medicolegal experts to reform the British legal system's handling of scientific evidence, as seen in the proof copy of his 1860 article, "Science in our Courts of Law"

Also left: From the Victorian era onwards. a series of reforms were enacted by the British Parliament, attempting to clean up the environmental damage caused by

# So which shall we have, art or dirt?



The Storm Cloud of the Nineteenth Century.

## The squalor of pollution

William Morris saw the Industrial Revolution as the death knell of nature and, by extension, artistic expression. He asked the audience of his lecture Art and the Beauty of the Earth (1881): "So which shall we have, art or dirt?"

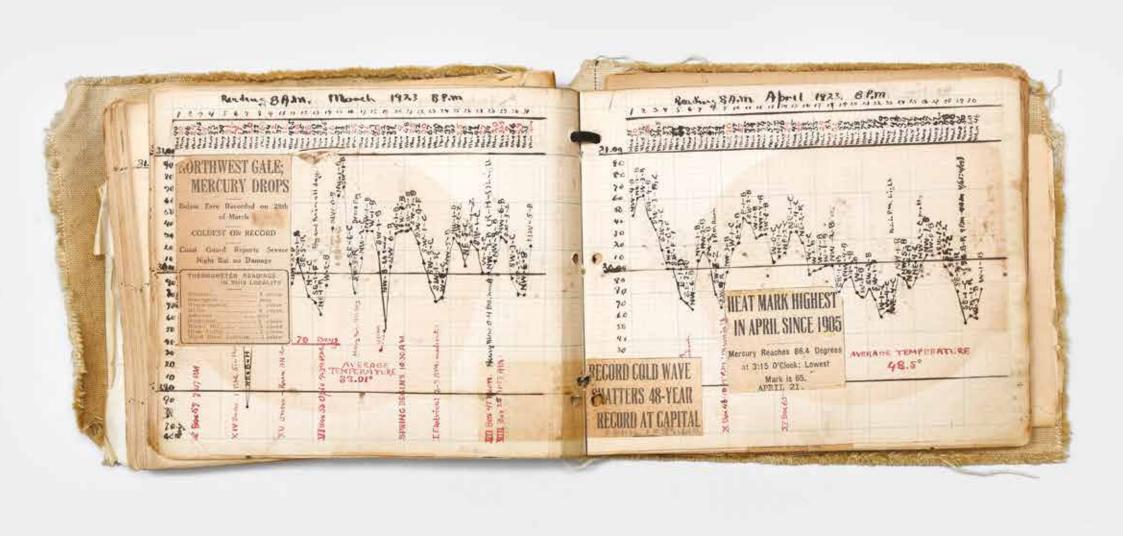
The great writer, philosopher and art critic John Ruskin, a profound influence on Morris, delivered a famous pair of apocalyptic lectures on modern weather that proved to be a prescient crusade against pollution (1884).

During a debate at the Parkes Museum of Hygiene the following year, the British civil engineer Professor Henry Robinson called attention to the ineffectiveness of current legislation on water pollution. He asked listeners to consider the balance to be struck between the conservation of rivers and the interests of industry.

The first truly global catastrophe catalysed a wave of unsettling and unprecedented climatic changes. The eruption of Krakatoa in August 1883 not only extinguished all animal and plant life in the region, but also triggered erratic weather patterns and a slew of far-reaching environmental effects. In the following months and years the world saw tsunamis, eerie sunsets, and a significant drop in global temperatures.

Top & middle left: As a leading member of the arts and crafts movement, William Morris was concerned to preserve the beauty of nature

Bottom left: Ruskin's tirade against the weather was a morbidly eccentric but prophetic environmental polemic

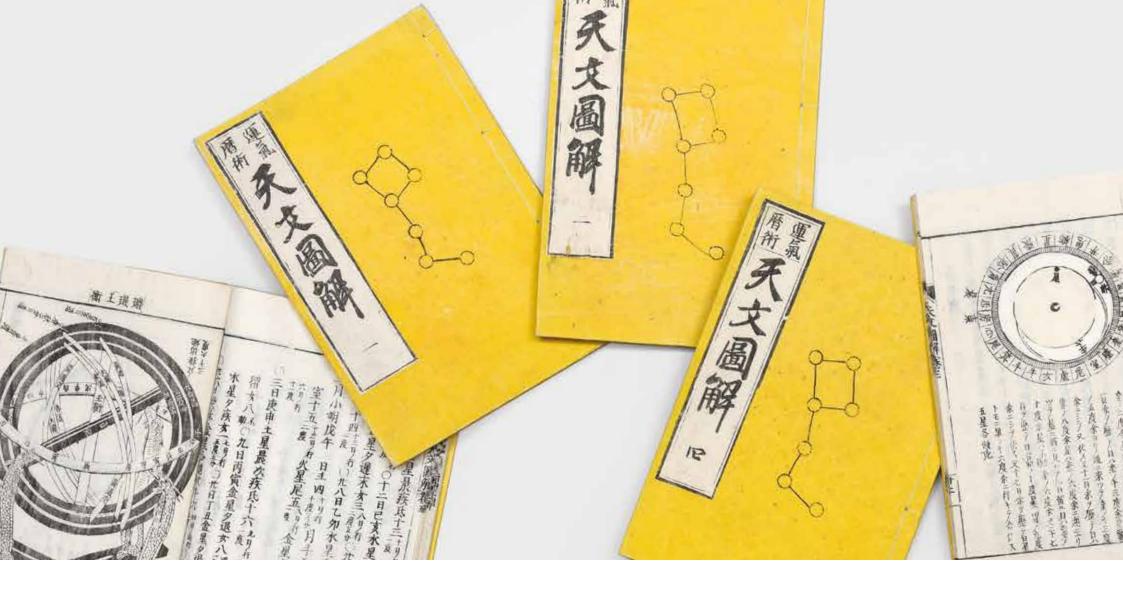


Above: Edwin Lewis's meticulous barometer readings record almost 40 years of weather data in Rhode Island

# Weather patterns around the world

Efforts to anticipate individual weather events and trace wider, overarching climate variability continued. Robert FitzRoy, former captain of HMS Beagle during Darwin's famous voyage and founder of the Met Office, was the first meteorologist to issue daily weather forecasts and champion prognostic methods (Weather Book, 1863).

A remarkable example of amateur climatology, Dr Edwin R. Lewis's handwritten Weather Record compiles twice-daily barometer readings taken over the course of nearly four decades in Rhode Island (1891–1930). These painstaking measurements are paired with contemporary news reportage that exclaims over record-breaking weather and speculates as to its causes.

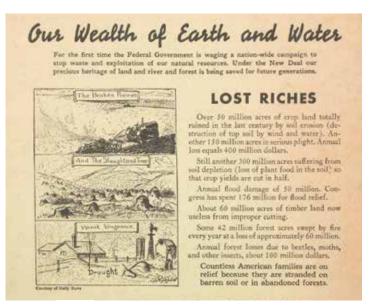


Above: First printed in 1689, when it was the first astronomy book published in Japan, this nineteenth-century edition of Tenmon zukai emphasised the importance of accurately predicting cycles of celestial change

The ability to accurately predict eclipses was of paramount importance to Japanese society, which believed historically that occurences in the Heavens directed mirrored and forecasted those on Earth. A beautiful late-Meiji edition of Tenmon zukai by the astronomer Tsunenori Iguchi (1897), who helped reform the lunisolar calendar, meticulously records cometary appearances and aids readers in calculating the positions of the planets, the moon, and stars using maps and volvelles.

These efforts culminated in works such as Weather Prediction by Numerical Processes (1922) by Lewis F. Richardson, which remains "the foundation upon which modern forecasting is built" (Lynch, p. 5). The mathematician's pioneering scheme, which far outstripped computing capabilities of the time, was finally realised with the development of ENIAC several decades later.





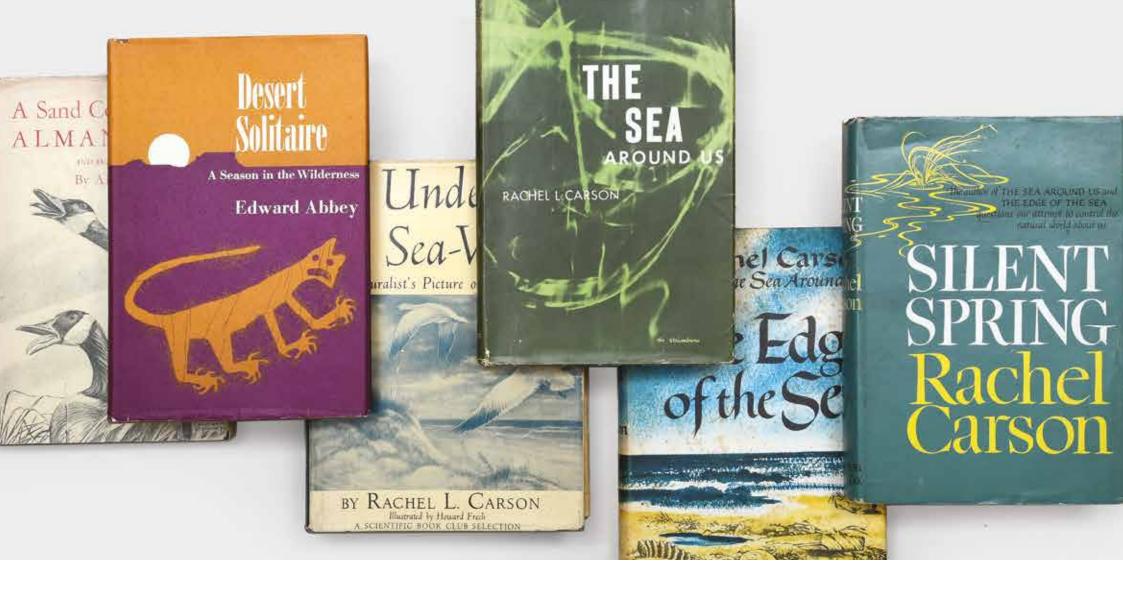
## A new age of concern

In August and September 1890, two historic articles on wilderness preservation by John Muir paved the way for the National Park System in the US. At around the same time, America's wilderness was immortalized by Mary Austin's acclaimed collection of nature writing, The Land of Little Rain (1903), and Alvin Langdon Coburn's The Cloud (1912). The latter pairs the photographer's original platinum prints of Yosemite and the Grand Canyon with Percy Bysshe Shelley's poem on the natural cycle of clouds.

The Dust Bowl of the 1930s was the first environmental disaster of the modern era in the United States, drawing public attention to the need for better land management and soil conservation.

Left: The great photographer Alvin Langdon Coburn captured the beauty of America's wilderness skies

Above: The conservation of soil and water resources became a political priority for Dust Bowl America



Above: Leopold and Abbey's key works, Carson's "Sea Trilogy", and Silent Spring The iconic texts of the modern environmental movement appeared from the mid-century: A Sand County Almanac by Aldo Leopold (1949), Desert Solitaire by Edward Abbey (1968), and Silent Spring (1962) by Rachel Carson. The latter, Carson's famous exposé of DDT and pesticides, is regularly referred to as the book that ignited the environmental movement.

Early but equally important works by Carson include the "Sea Trilogy" (1941–55), which established her reputation as a prominent naturalist and popularized marine ecology, and a speech from the same year, "Of Man and the Stream of Time".



# Climatic Change: Are We on the Brink of a Pronounced Global Warming?

Abstract. If man-made dust is unimportant as a major cat strong case can be made that the present cooling trend will way to a pronounced warming induced by carbon dioxide. B

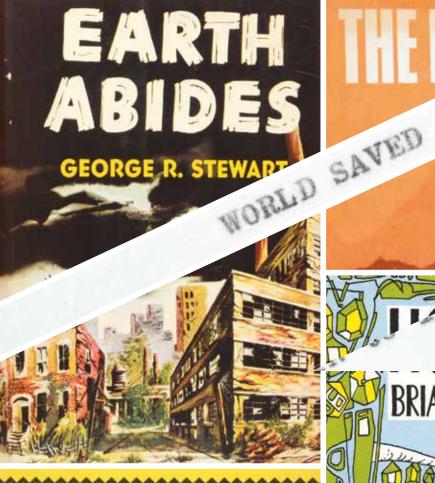
Nature and Science were the two major journals for modern climate change research where many seminal papers by scientists such as Guy Callendar, Charles David Keeling, Syukuro Manabe, Naomi Oreskes, Gilbert Plass, Roger Revelle, and Susan Solomon first appeared.

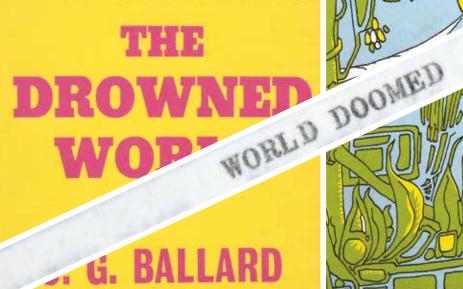
The phrase "global warming" was popularized by Wallace Broecker's "Climatic Change: Are We on the Brink of a Pronounced Global Warming?" (1975). Keeling's 1976 report from the Mauna Loa Observatory in Hawaii conclusively confirmed the rapid increase of global atmospheric carbon dioxide levels. The diagram illustrating this discovery remains "one of the most iconic visualisations of climate change" (Carbon Brief). Other pivotal moments include Esther Applin, Alva Ellisor, and Hedwig Kniker's 1925 paper on micropalaeontology and the oil industry, the 1956 article in which Plass accurately predicted rising global temperatures 50 years in advance, and research by Camille Parmesan and Gary Yohe on global warming's effect on living organisms (2003), which is the most cited paper on climate change to date.

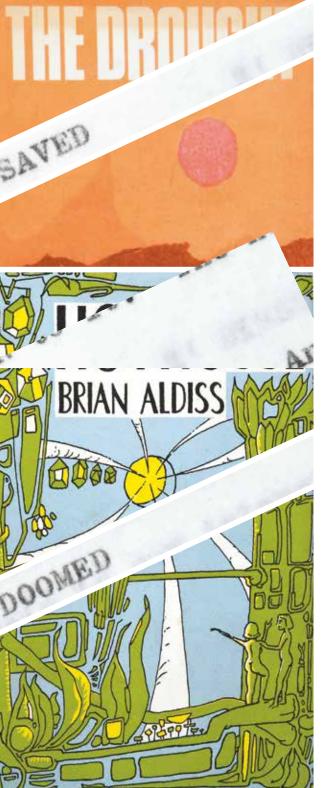
The First (1990), Second (1995), and Fifth Assessment (2013) Reports of the Intergovernmental Panel on Climate Change (IPCC) provided the scientific impetus for the creation of the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, and the Paris Agreement respectively.

Left: The alarming consensus on the reality of climate change began to fill the pages of scientific journals

Above: Detail from Broecker's 1975 paper







WORLD SAVED

CAMERA PANS to the opposite row of machines. Another Front Page Pull is hanging. The headline:

WORLD DOOMED

CAMERA PANS past the waiting machinists and up to the Machine Room clock. The hand clicks to 11.55.

## The apocalypse in the public eye

Despite this accumulation of crucial data, climate science remained incomprehensible to many. Climate fiction, or "cli-fi", made the consequences of climate change real to the popular imagination.

Published the same year as George Orwell's Nineteen Eighty-Four, Earth Abides (1949) by George R. Stewart portrays a chilling dystopia of an overpopulated world decimated by disease. The classic apocalyptic thriller The Day the Earth Caught Fire (1961) is considered by the BFI "one of the earliest – and still one of the best – examples of science-fiction cinema tackling ecological concerns". Similarly gripped by the visual of a sun-scorched earth is Hothouse (1962), a work of speculative fiction by Brian Aldiss. J. G. Ballard explored similar themes in a prescient series of novels written during the 1960s: The Drowned World, The Drought, and The Crystal World. Other cautionary tales include Anna Kavan's Ice (1967) and Jeanette Winterson's The Stone Gods (2007).

Top left: Stewart's apocalyptic novel features a universal plague that nearly wipes out humanity

Top right & bottom left: J. G. Ballard envisioned drought caused by industrial waste flushed into the ocean, and an Earth rendered uninhabitable by global warming

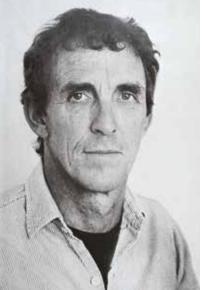
Bottom right: A linked sequence of five novelettes, Hothouse won the Hugo Award for Best Short Fiction

Details from: The Day the Earth Caught Fire portrays the societal fallout when nuclear bomb tests send the earth spinning closer to the sun's orbit











Alongside this cli-fi boom, best-selling non-fiction works such as The Population Bomb (1968) by Paul R. and Anne Ehrlich rang neo-Malthusian alarm bells. Bill McKibben's The End of Nature (1989) was the first book about climate change written for a general audience. The Greenhouse Effect (1980) by Harold W. Bernard provided equally important access to the topic, though it is less well-known today. Later non-fiction such as Al Gore's milestone book An Inconvenient Truth (2006), released concurrently with the film documentary of the same name, was instrumental in keeping the issue in public view.

The popular consciousness was also stirred by legendary natural historians like David Attenborough and Peter Matthiessen, who advocated a more harmonious balance between human beings and nature. Written to accompany the historic BBC television series of the same name, Zoo Quest to Guiana (1956) is Attenborough's first book. Matthiessen's The Snow Leopard (1978), which won two National Book Awards, remains "a naturalist and a spiritual classic" (O'Connor). It shares its ethos with The End of the Game (1965), a landmark publication by photographer Peter Beard, whose images captured the horrors of game hunting as part of Africa's wildlife crisis.

Far left: Peter Beard's photographs lament the brutality of human destruction of wildlife

Top middle: A young David Attenborough

Middle: The End of Nature was the first book about climate change for the general reader

Bottom middle: Peter Matthiessen, author of The Snow Leopard

Top right: Ehrlich and Gore's key titles







# Activism in the face of delay

Despite this growing public awareness about environmental concerns, international policy was slow to respond. In 1965, President Lyndon B. Johnson received the first official briefing on the environmental risk of carbon dioxide. But it was not until 1979 that the US government published the first comprehensive assessment of global climate change due to carbon dioxide: the Charney Report.

While governments prevaricated, catastrophes ensued. The 1967 Torrey Canyon and 1969 Santa Barbara oil spills prompted influential works by David James Bellamy, Robert Easton, and Robert Bernard Clark, each foregrounding marine conservation. The US Air Force's 1974 official report on the safe disposal at sea of Agent Orange, one of the "Rainbow Herbicides" used by the US military in the Vietnam War, highlighted the damaging environmental effects of modern scorched-earth tactics.

The viability of alternative energies was more actively pursued. Early arguments for solar energy were written by the rocket scientist Konstantin Tsiolkovsky (1929) and in 1959 the first conference on thermonuclear fusion in Britain took place. Outside scientific circles, counterculture projects such as Seed: The Journal of Organic Living and the Planet Drum "Bundles" championed sustainable approaches to life.

Top left: Organic living with Seed (1972–74)

Bottom left: Planet Drum "Bundles" (1973–85), including seasonal poems by Peter Berg

Top right: The Pollution Show (1970)



Above: "Earthrise" – original red number NASA photograph

This fragile Earth

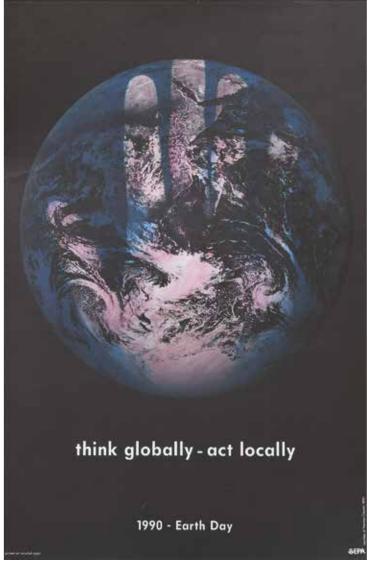
"Earthrise" (1968), the first full-colour view of our planet taken during lunar orbit, was photographed by NASA astronaut William Anders during the Apollo 8 mission. Photojournalist Galen Rowell celebrated it as "the most influential environmental photograph ever taken", and National Geographic photographer Brian Skerry called it "the most important photograph ever made". "Earthrise" is also renowned for inspiring James Lovelock and Lynn Margulis's Gaia hypothesis.















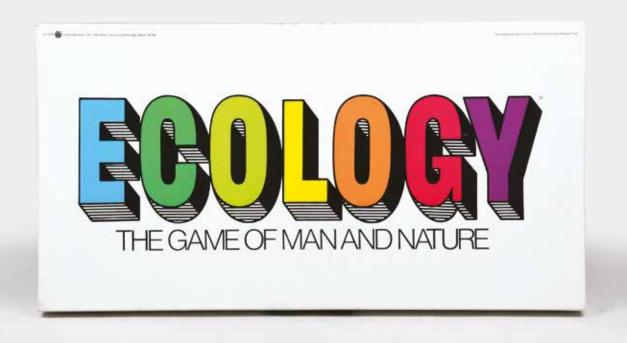


Above: a series of eye-catching original posters promoting environmental awareness, including work by leading designers such as Tom Eckersley and Seymour Chwast

The striking imagery of the international and regional environmental movements owed a debt to NASA's photography, with "Earthrise" and the "Blue Marble" featuring prominently. Original posters for events like Earth Day and the Whole Earth Festival, and for organizations such as the Environmental Protection Agency, World Wildlife Fund, and Greenpeace, were designed by established graphic designers and amateurs alike.



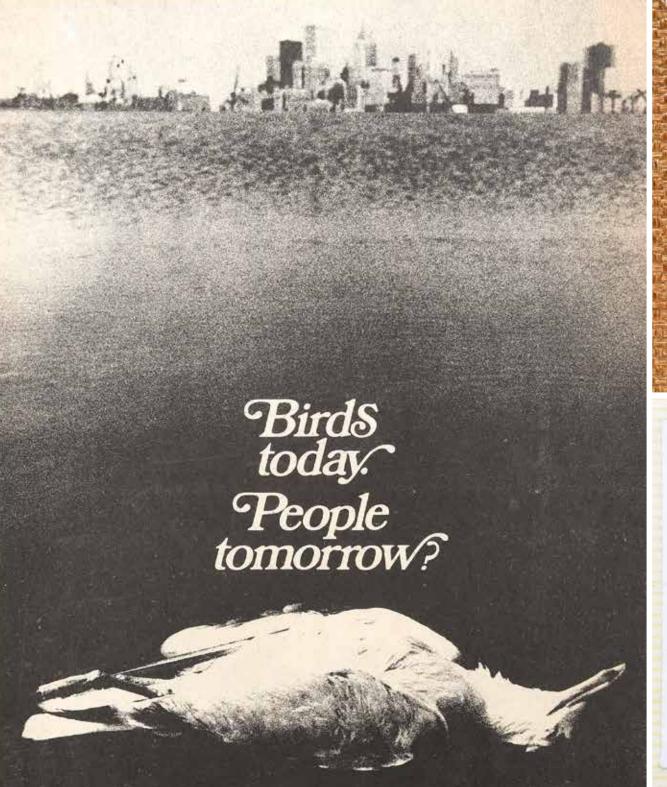




Badge pins were mass- and hand-produced to protest everything from nuclear waste and landfill to DAPL and salmon farming. Photograph albums documented grassroots activism and newspapers featured disturbing images of polluted waters and forest fires. Environmental board games hoped to educate players about smog, overpopulation, polluted water, and ecology.

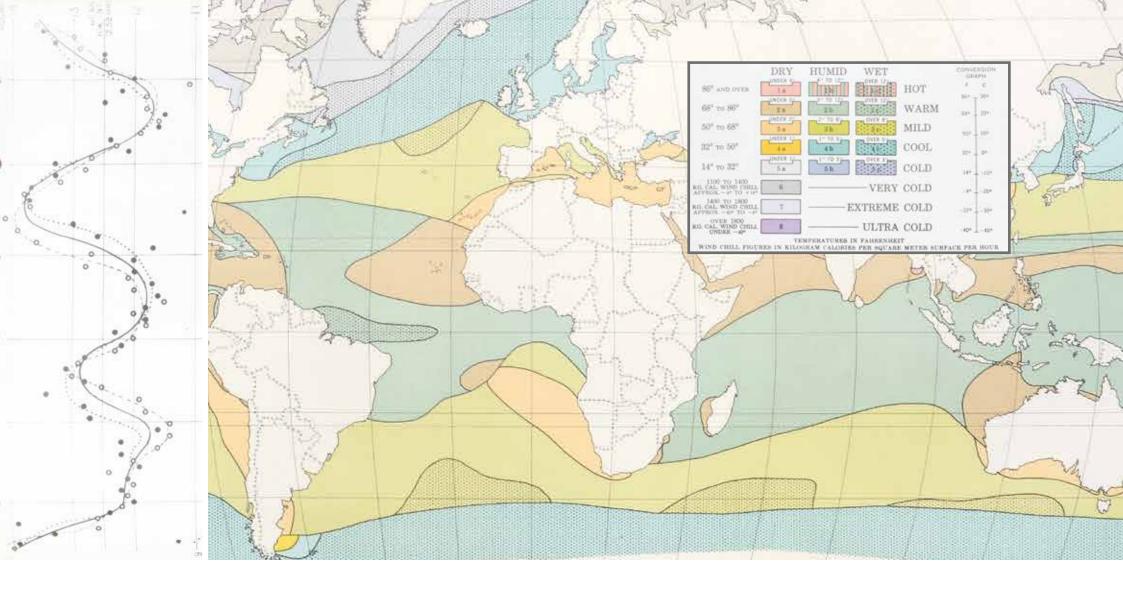
Left & above: The late twentieth-century environmental movement was characterized by bold, attention-grabbing graphics

Overleaf: Those concerned about the alarming messages circulating in the news made concerted efforts to educate themselves and others about the negative impact of humans' actions on the planet









Left: David Nutt's important expeditions to Labrador launched the modern study of climate change in the polar regions

Right: Detail from a group of 76 US Climatology Unit maps The collection includes a number of rare assemblages and unique personal archives which chart efforts to record climate change. The complete set of seasonal and monthly maps issued by the US Climatology Unit (1943–4) signalled a new approach to climatic zones in cartography.

An album of four scarce reports (1949–51) on the Blue Dolphin Labrador Expeditions record the work of Arctic oceanographer David Nutt, who led the team that first analysed ancient atmosphere in Greenland ice.

The meteorologist Kenn Back's manuscript log, written during his first posting to Adelaide Island (1963–6), is an outstanding example of early polar science research. Back was part of the British Antarctic Survey, the organization which would, in 1985, discover the hole in the ozone layer.

The papers of British environmental activist Roger Horsley are representative of one individual's advocation for change at both local and international levels during the 1980s and 1990s.

# HOW TO AVOID A CLIMATE DISASTER











events claim Peoplet Stema's "Dispense" policies in revenue el assemis nos para lacif les placements en la segui policies in revenue del mente de la segui policie del proper de la segui policie de lacif la segui policie del proper de la segui policie de la segui fina del proper de la segui policie de la segui policie de la segui fina de la segui policie del proper de la segui policie del para la finale de la segui policie del proper del proper del para la segui policie del proper del proper del proper del para la segui policie del proper del proper del proper del policie del proper del proper del proper del proper del policie policie del policie pol









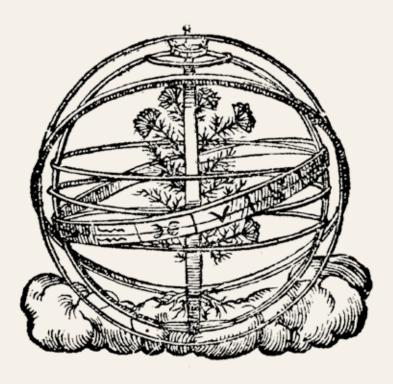
Top left: Bill Gates offers his prescriptions
Top middle: Banksy protests deforestation

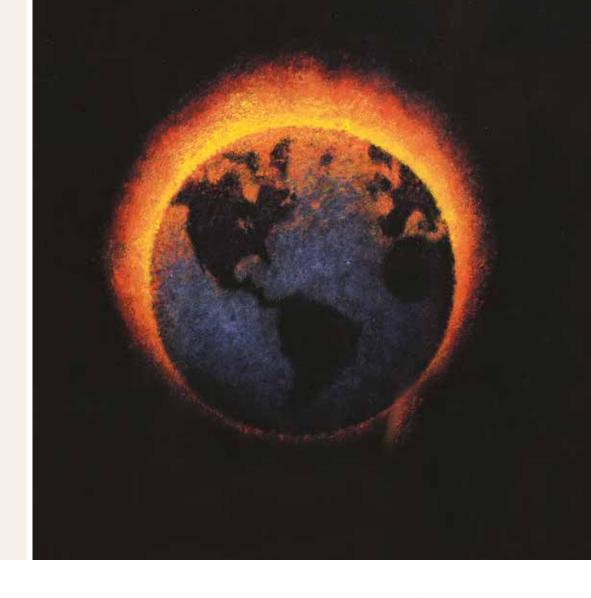
Right: Swedish activist Greta Thunberg

Bottom left: Contemporary street artist Shepard Fairey subverts mass media climate change denial

Bottom middle: Extinction Rebellion was formed in response to the sixth mass extinction event Gen Z rebellion

Contemporary art criticized the public's indifference to climate change: Banksy's controversial Save or Delete (2002) poster for the Greenpeace campaign against deforestation and Shepard Fairey's Global Warning and The Daily Sun (2009) are two such examples. Activism and philanthropy continue to play a large role in stimulating real change, from the words of Extinction Rebellion and Greta Thunberg to Bill Gates.



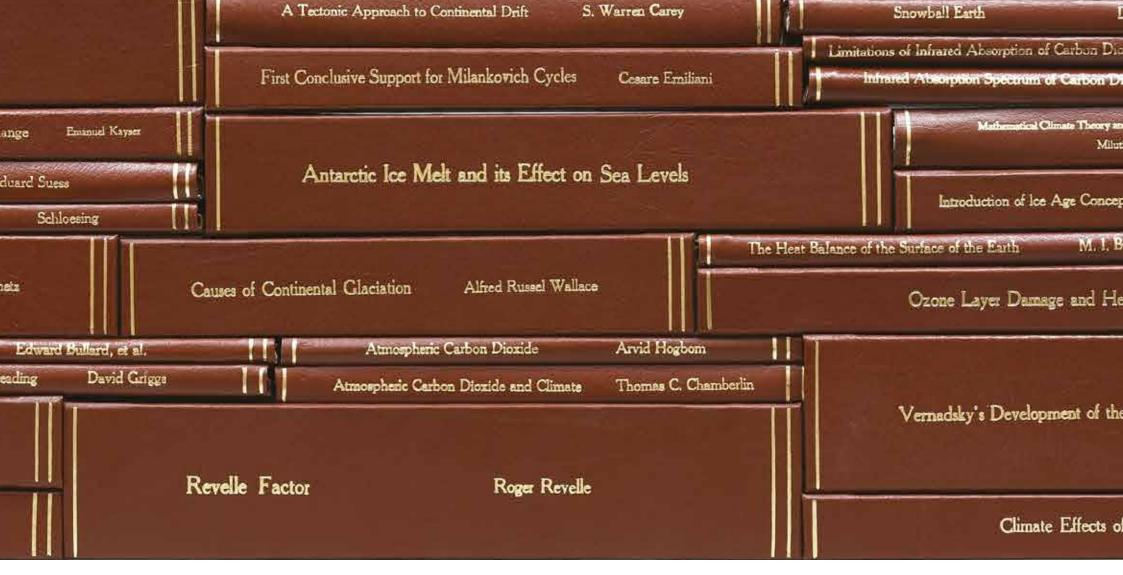


Left: The world in harmony, as pictured in the woodcut printer's device (an armillary sphere with ecliptic circle enclosing the tree of life arising from a cloud) from the title page of Aristotle's Meteorologica (Venice, 1554)
Right: The Earth on fire, from the cover design for McKibben's The End of Nature (New York, 1989)

### The time is now

Countless words about the climate have been written, edited, printed, shared, and read. The collection offered here encapsulates the highs and lows of this history: the curiosity and horrors; successful experiments and ignored warnings; opportunities and failures. Across more than 500 years of print culture, it charts the slow accumulation of human knowledge against an escalating crisis.

Today, that crisis is upon us. We live in a world of rising temperatures, melting ice caps, extreme weather events, and reduced biodiversity caused by our addition of carbon dioxide to the atmosphere. Whether or not these effects can be reversed, this collection tells the story of how we arrived here, at precisely one hundred seconds to midnight.



Above: Examples of the custom boxes housing material from the Wenner collection

### David L. Wenner

A large part of the scientific component of this collection was formed by the noted private collector David Wenner, whose collection of rare books on the history of modern physics is now held in the Niels Bohr Library & Archives at the American Institute of Physics.

David's approach to collecting is characterized by exceptional focus, ingenuity, and a decade's worth of invested time. This has resulted in an unrepeatable collection of original documents on climate science.

His expertise has ensured outstanding coverage of early investigations into the principal drivers of climate change in the nineteenth and twentieth centuries: continental drift, plate tectonics, seafloor spreading, variations in solar luminosity, giant impacts, the greenhouse effect, and Milanković cycles.

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#### Public launch

The One Hundred Seconds to Midnight collection will be publicly exhibited at Frieze Masters, which takes place 13–17 October 2021 at Regent's Park, London. With the intention of sharing the collection with a broader audience, Peter Harrington commissioned multi award-winning wildlife documentary producer John Ruthven to create a ten-minute video. Ruthven has written, produced, and directed numerous award-winning shows for the BBC, Discovery, and National Geographic, including the BBC's Blue Planet series.

The video is available to view at: www.OneHundredSecondsToMidnight.co.uk

## Charitable partnership & price

We at Peter Harrington are proud to partner with the World Land Trust on this project. We will donate a portion of the sale proceeds of this collection to help fund their efforts to protect the world's most biologically significant and threatened habitats and wildlife.

The collection is priced £1,650,000.

#### Contact

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# Peter Harrington

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CHELSEA