German Council for Sustainable Development

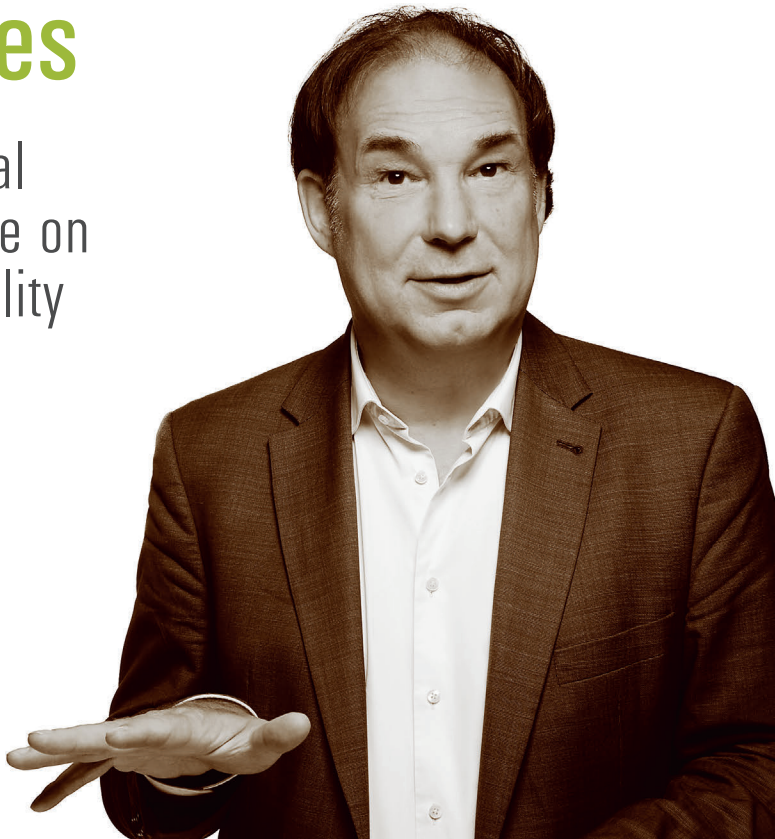
Rachel Carson Center
Environment and Society

Christof Mauch

Carl-von-Carlowitz Series

The Growth of Trees

A Historical Perspective on Sustainability



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Christof Mauch

The Growth of Trees

A Historical Perspective on Sustainability

Translated from German by Katie Ritson

Carl-von-Carlowitz Series Volume 3

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Carl-von-Carlowitz lecture 2013
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the Saxon Mining Office and the
Saxon Hans-Carl-von-Carlowitz society

Lecture by Christof Mauch:
Excursion through time and space—a historical perspective on sustainability

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Content

Foreword

Reflection and Sustainable Development: Looking Backwards to See Forwards

An Introduction to the 2013 Carl von Carlowitz Lecture

The time and venue of the fourth Carl von Carlowitz lecture in June 2013 could not have been more apt, for it was the third centenary of the publication of "Sylvicultura Oeconomica" by the superintendent of mines, Carl von Carlowitz. The event was held in Freiberg, not far from his former place of work. The home of the Mining Authority of Prince August the Strong, von Carlowitz's sovereign, is still that of the Free State of Saxony. This is more than a passing reminder of the roots of the concept of sustainability.

The writings of von Carlowitz mark a milestone in the history of sustainability. He focuses on the largely thoughtless destruction of nature, and gives us a picture of a sustainable use of nature that nurtures and maintains, is born out of ethical principles and requires a high degree of education and comprehension. Von Carlowitz was concerned with the welfare of his country, no less: for a short historical moment, the welfare of his Saxony was dependent on the natural resource of wood—explicitly on trees' means of growth, and whether more could be produced within ecological constraints.

Von Carlowitz makes clear that sustainability is a contentious term. Today we tend to forget this, when talk comprises entirely of "win-win situations," and, as a result of frequent dilution, the concept lacks the brilliance of its historical—and these days political—source.

Sustainability is not a fluffy idea. The concept derived from the conflict between exploitation and overuse: salt extraction, silver mining, and smelting ore were the drivers of wood scarcity. At the same time, the forestry industry serves as the perfect example of different aspects of sustainability and the inherent principle of common benefit. The longevity of trees and forests is far beyond that of a human lifespan. These are long production cycles, lasting generations. But other branches of the economy too—and ultimately all branches—will need to think long-term, analyze bad decisions and manage resources to secure the future of society. Not just natural resources, but social capital—as we know from Gro Harlem Brundtland's political concepts and von Carlowitz's ideas on forestry—must be managed in such a way that utilization does not become plunder, and use does not become using *up* to the end that future generations are placed at a permanent disadvantage.

Von Carlowitz's ideas are just as current and challenging today as when they were written: each generation is responsible for solving its own problems, and must not allow them to burden those of the future. There also exists a duty to avoid foreseeable future problems. In the case of renewable resources, use must be kept within the rate of regeneration; the use of non-renewables may not be higher than the amount that can be replaced by renewable production. Dangers and unjustifiable risks for human health must be minimized, and energy and resource use must be decoupled from economic growth.

The German Council for Sustainable Development is aware of the need to reflect on the historical and cultural development of sustainability, and to apply this to our current knowledge and action. The relationship between human beings and their environment, and the

decisions they are faced with in this context, are formative for the sustainability of societies and cultures: that much we know from history.

The German Council for Sustainable Development is immensely grateful to Professor Christof Mauch for accepting this invitation to give the fourth Carl von Carlowitz lecture and taking this "excursion through time and space", through which he will look back at sustainability in history.

Professor Mauch continues this lecture series exploring the foundations for, and pathways of, sustainable development. The first Carl von Carlowitz lecture was delivered in 2009 by the ecologist Professor Wolfgang Haber, who focused on the consequences of population dynamics for sustainable development. Climate scientist Professor Carlo C. Jaeger—from the Potsdam Institute for Climate Impact Research—sketched out a twenty-first century history in his 2010 lecture "Growth— Where Next?"

In 2011, Professor Gesine Schwan explored how sustainable development can be served by the political establishment, calling for new rigour in the cooperation between politics, business, science, media, and society.

At the heart of the lecture printed here is environmental history, which is also the history of humanity. It tells of decisions made by societies to regulate and shape their dependencies on, and relationship with, their environments—incorporating the history of the term "sustainability" and the lessons that can be learnt from it. Professor Mauch uses several examples to vividly express the risks and challenges faced by what we think of as sustainable societies, at a time when the systems of which they were part became too large or complex to handle. He outlines the rise of Europe in terms of the historical situation and peculiarities in the ways in which inhabitants have engaged with their environment, illustrating to a large degree why the world is the way it is today. By this means, he shows us that an understanding of historical change is of far greater importance for

shaping the future than merely observing what is happening around the globe at our moment in time.

Professor Mauch is director of the Rachel Carson Center for Environment and Society (RCC) in Munich. As a historian his focus has been largely on German and North American history of the nineteenth and twentieth centuries, and on international environmental history. He gained his doctorate in literary history at the University of Tübingen in 1990 and his second doctorate in modern history at the University of Cologne in 1998. Christof Mauch has taught at the universities of Tübingen, Bonn, Cologne and Georgetown University in the USA. From 1999 to 2007 he was director of the German Historical Institute in Washington, D.C. He took up the chair in American Cultural History at Ludwig Maximilians University (LMU) in Munich in 2007, and is currently director of the Lasky Center for Transatlantic Studies. He was President of the European Society for Environmental History (ESEH) 2011–2013. Christof Mauch has written and edited numerous scholarly books and articles, and has received numerous accolades for his work. His membership of international boards and committees reflects his engagement in his academic field and his interest in transdisciplinary research.

As director of the Rachel Carson Center, his aim is to write environmental history and contribute to the shaping of our world. The goals of the center are to advance the exploration and debate of the interactions between humans and nature; moreover, it tries to strengthen the role of the humanities in current political and scientific discussions on the environment and sustainability. Conceived as an international and interdisciplinary forum, the RCC has thematic foci such as *Natural Disasters and Cultures of Risk, Environmental Knowledge and Knowledge Societies, Resource Use and Conservation*, and *Environmental Ethics, Politics, and Movements*. To make its work accessible, the center holds conferences and workshops, manages an online portal of resources on the environment and society, publishes a book series in English and in German, and organizes exhibitions at

the Deutsches Museum and elsewhere. The Rachel Carson Center has thus succeeded in establishing its own take on the world, and in opening and stimulating new perspectives on research into the environment.

Berlin 2013,
Marlehn Thieme
Chair of the Council for Sustainable Development

Chapter 1

Excursions in Time and Space

A Historical Perspective on Sustainability

In the beginning was Venice: City of merchants, of wealthy bourgeoisie, of elegant facades, pompous palaces, scowling sculptures, elegant paintings, of riches put on display: Venice. The *Lion City* on the Mediterranean with its trading colonies in Flanders and Maghreb and Contantinople and Trebizond. Venice: Towards the end of the thirteenth century it was the wealthiest city in Europe, and a hundred years later it had become the world leader in printing books. And, at the heart of Venice, its arsenal. Here its ships—war galleons and large-bellied merchant ships—were built and overhauled. One hundred ships per year were made seaworthy by some 16,000 workers. The ships' sterns were made of oak, the oars of beech. The Venetians had an insatiable hunger for wood. For without wood there could be no ships. And without ships, no trade, no defence, no power, no wealth.[1]

Nothing, we might assume, would have alarmed the Venetians more than the spectre of a wood shortage. Therefore the Great Council made laws in the fourteenth century that were designed to secure the supply of wood for shipbuilding: the arsenal had first pick of oak, price limits were set, and captains paid a fine for every broken or damaged oar. But although the list of laws grew ever longer and the punishments ever stricter, the depletion of the forests in the vicinity of Venice continued to increase, and nothing seemed to stop it. The lawmakers were convinced that the local population, whose cattle grazed in the forest and who used it for firewood, were the cause of the decrease in the available wood stock. Thus, as the fifteenth century drew to a close, they devised a new strategy: large forested areas with the best oaks and beeches were reserved for the arsenal; the state forestry guard *(provveditori ai boschi)* developed elaborate

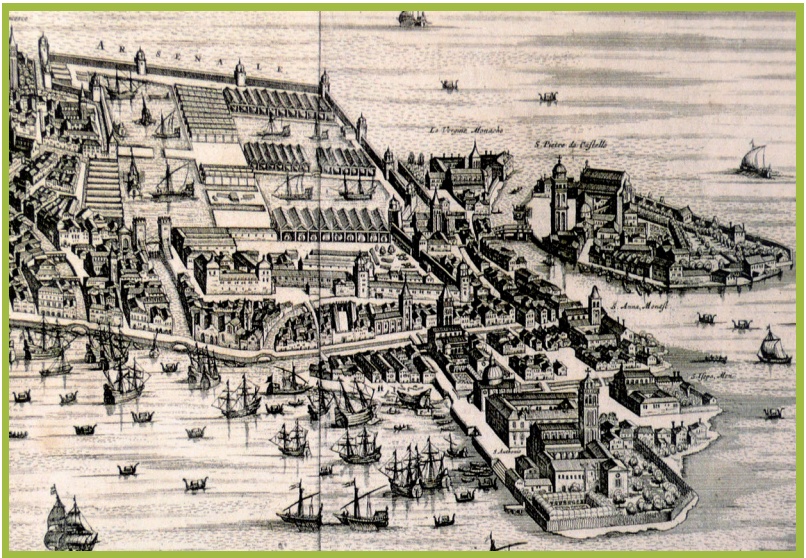

Figure 1
The Venetian Arsenal
The shipyard, erected on two marshy islands, is regarded as Europe's largest production base prior to industrialization. The serial production of ships and galleys took place with great efficiency during the fourteenth and fifteenth centuries. Demand for timber from the forests surrounding Venice was correspondingly high.

methods of measuring, counting and mapping the individual species of tree. A report written in 1471 tells us, for example, that a particular section of the forest held enough oak for one hundred excellent galleons. Interestingly, the Venetian forest authorities began to change their thinking in the sixteenth century; they began to observe the forest not just in terms of space, but also in terms of time. The comparison of the inventory at the end of the fifteenth century with documents from half a century later shows that a radical change in the way the forest was understood had taken place: "If we fell all the beeches that are contained in this forest," says the 1548 inventory, "we can supply the arsenal with oars for thirty years. With good manage-

ment, however, we will be able to meet demand for many centuries to come." The Venetians were advocates of sustainability before this term existed. Carl von Carlowitz praised the "particular cautiousness of the Most High Republic of Venice […], that She provides for all other Things and shows herself to be good/in her provinces, not just in planting Shipbuilding Wood/but also in conserving it […] and in observing it for the needs of its famous Arsenal."[2]

The Venetians were advocates of sustainability before this term existed.

The Venetians seemed to be doing everything right. When they needed one thousand stacks of oak wood for the construction of the devotional church Basilica Santa Maria della Salute, the Senate made sure that the wood was acquired from the Hungarian king, so that Venice's own stocks were reserved for the maintenance of canals and construction of breakwaters. This made no economic sense, but the Senators' decision was based on sustainability. The Venetians marked each individual tree to show its future use, beginning when the trees were saplings; some trees were then marked a second time when they had reached three feet in height. But reality did not correspond to the lists and the maps, and the future did not correspond to the prognosis: there were fewer and fewer trees, and nobody in Venice understood why.

Today we know that the Venetians were more successful than they realized. The story of what actually happened is too complex to be summarized in a few short sentences. But the fact remains that the stocks of the state forest decreased, whereas the intensively used forests, in particular the forest commons from which the local population took underwood, berries and fruits, and leaf mould as fertilizer, saw a steady increase in wood growth.

History offers us numerous examples of cultures that died out because they exhausted their resources. The Mayas, we believe today, are an example of this; but the most remarkable case is probably that of Easter Island, where entire forests were felled in order to transport

Figure 2
Moai, the colossal monolithic statues on Easter Island
The statues in the South Pacific are up to 9.8 metres high and weigh on average 12 tons. The levering out, transportation and erection of the statues consumed large amounts of wood. Transporting of the stone giants was carried out by means of rolling tree trunks, which often had to be replaced by new ones.

colossal stone statues, meaning that there was ultimately a shortage of firewood and wood for boat-building that the local population, which subsisted mainly from fishing, needed to survive.[3] The Venetians—with their hierarchies of use and their rules on forest conservation—had set better priorities. The perceived and real scarcity of wood had little to do with the end of Venice's thalassocracy. The Venetians, who had galleons but no ocean-going vessels, lost their lucrative spice trade to the Por-

History offers us numerous examples of cultures that died out because they exhausted their resources.

tuguese; and ultimately it was Napoleon who dealt the death blow to the Lion City, not the decline of the forests. If anything, the Venetians had managed their forests in exemplary fashion; far better, in any case, than the English, who exploited their forests systematically and exhausted the wood stock. That Great Britain was able to rise to the position of great power is, in view of its forest politics, a miracle I will discuss later.

Chapter 2

Hans Carl von Carlowitz

Hans Carl von Carlowitz, with whom we are concerned here, was born during the Thirty Years' War. The town with which his name is linked, Freiberg in Saxony[4], attracted the greedy attention of the advancing Swedish army due to its silver mines, but the Freiberg miners knew how to defend themselves; the Swedish general Lennart Torstensson in his frustration nicknamed the town a "nest of rats," because the miners were repeatedly able to drive their enemies from the shafts and tunnels of the mines by diverting water into them. Carlowitz must have been brought up on these stories of pillage and plunder.

He was a child of his time, a time in which hunger, disease, and destruction were rife and the knowledge of *vanitas*, the transience of all earthly things, was one with the desire for rebirth and divine salvation. No one put this into words better than the baroque poet Andreas Gryphius:[5]

You see / where'er you look / mere earthly vanity
What man today has built / will fall upon the morn
This place where cities lie / will hence be turned to corn
And there a shepherd boy with sheep and cow play free

The flow'rs that bloom will soon be trod into the clay
The flesh which beats and throbs will turn to ash and bone
Not one thing shall endure / not precious ore, nor stone
Today our fortune smiles / tomorrow comes dismay

The glory of fine deeds will like a dream be gone
Should then this earthly game / by fragile man be won?
Oh! What is earthly life, that we hold dearly yet

Figure 3
Gabriel Ehinger: The Mourning Philosopher. Etching around 1660, after a painting by Johann Heinrich Schönfeld

The phrase "Vanitas vanitatum et omnia vanitas" (English: "Vanity of vanities, all is vanity."), is attributed to King Solomon (Ecclesiastes 1:2). It refers to the vanity of everything that is earthly and it characterized the experience and worldview in the seventeenth century, when Hans Carl von Carlowitz grew up. Carlowitz's pleas for conservation and sustainability are an expression of a fundamental tension with regard to the dominant philosophy of his time.

If not a futile thing / mere shadow, wind, and dust.
A little meadow flow'r / found once, forever lost.
Upon eternity no eye has e'er been set.

For Gryphius and his contemporaries, all earthly life was fleeting. Life moved between the poles of *carpe diem* and *memento mori,* between pleasure in life and knowledge of death. For Carlowitz too, this man with his baroque wig, the terrors of the earthly vale of tears were little more than an expression of God's plan. On his travels, which took him from Scandinavia and England to Malta, the young nobleman recognized that "within few scant years […] more wood is used than grown in many lifetimes" and he feared the "jealous judgement of our great God" at the end of the world as prophesied by Philipp Melanchton, in which "man would suffer greatly for lack of wood."[6] Against this experience of fleeting and futile human existence, the idea of sustainability, which extends into a far-off future, is especially pronounced. Fear of death can amplify the enjoyment of pleasure, but also the drive to resist fate and invest in the future.

Carlowitz conceived his *Sylvicultura*, his magnum opus on forestry as a "domestic message," written "out of love for the fostering of the greatest good."[7] The household patriarchs at whom it was aimed were in the main noble landowners and estate managers,[8] but ultimately his work became something of a foundational text for the science of forestry.[9] For cohorts of economists and foresters, the *Sylvicultura* was required reading and became a canonical text. In 1761, Duchess Anna Amalia of Saxony-Weimar used the *Sylvicultura* as a model for her creation of a comprehensive forestry plan (regulating the taxation and inventory of her forests, the soils, the animals and plants), which centred around the idea of sustainability and projected the forests' growth three centuries into the future, up to the year 2050.[10] The principle of sustainability was on

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Mit GOtt!
SYLVICVLTVRA OECONOMICA,
Oder
Haußwirthliche Nachricht und Naturmäßige
Anweisung
Zur
Wilden Baum-Zucht,
Nebst
Gründlicher Darstellung/
Wie zu förderst durch Göttliches Benedeyen dem allenthalben und insgemein einreissenden
Grossen Holtz-Mangel/
Vermittelst Säe- Pflantz- und Verletzung vielerhand Bäume zu prospiciren/
Alles zu nothdürfftiger Versorgung des Hauß- Bau- Brau- Berg- und Schmelz-Wesens/
Vorbey zugleich eine gründliche Nachricht von dem in Churfl. Sächß. Landen
Gefundenen Turff
Dessen Natürliche Beschaffenheit/ grossen Nutzen/ Gebrauch und nützlichen Verkohlung.
Aus Liebe zu Beförderung des algemeinen Besten beschrieben
Von
Hanuß Carl von Carlowitz/
Königl. Pohl. und Churfl. Sächß. Cammer-Rath/ und Ober-Berg-Hauptmann.
Mit Königl. Pohl. und Churfürstl. Sächß. allergnädigsten PRIVILEGIO.
LEIPZIG/
verlegts Johann Friedrich Braun 1713.

Figure 4
Title page of "Sylvicultura oeconomica"
Carlowitz's work was published in 1713 and consists of two volumes, with 30 chapters and 429 pages. The "Sylvicultura oeconomica" pleads for a prudent consumption of wood as a renewable resource. Carlowitz's book is regarded as the first cohesive German work on forestry.

the rise; soon it would become popular in other countries as well. The Prussian Bernhard Fernow (1851–1923), who emigrated to the United States following his studies at the Forestry Academy in Münden, exported the theory of sustainable forest management to the USA, becoming the first forestry director of the US Ministry of Agriculture in 1886; in the spirit of Carlowitz, he harshly criticized the market-oriented tendencies of his elected homeland, which he described as being focused on "cash flow"[11] and "private exploitation."[12] The influence of the botanist and forester Dietrich Brandis (later Sir Dietrich Brandis) from Bonn was even greater. Brandis became forestry advisor to the Indian central government in Calcutta in the middle of the nineteenth century, in turn in-

The principle of sustainability was on the rise; soon it would become popular in other countries as well. .

fluencing Gifford Pinchot, the first head of the United States Forest Service, who is known in history as the "father of tropical forestry."[13] The *Sylvicultura* provided the Germans with a forestry textbook at an early date; it would play a pioneering role (both direct and indirect) in forestry management across Europe and around the world in the decades and centuries that followed.

The history of this work is *one* reason to remember Carlowitz. Another reason is his thinking, to which we of course cannot do justice by reducing it to the term sustainability and its economic virtues. Carlowitz's concern was to smelt silver ore effectively. Wood was needed in large amounts for the construction of tunnels and mine shafts, and to initiate the chemical processes needed. Just as in Venice a lack of wood would have meant no ships, no trade, and no wealth, in Saxony a dearth of wood and charcoal would have meant no silver mines and no resplendent promenades and palaces. But Carlowitz saw wood as more than just a resource. In his *Sylvicultura* the mining official reveals himself over and over to be a friend and admirer of nature, and the powers of the natural world. Carlowitz was just as concerned with the growth of trees as with economic growth, and just as interested in humus as in silver. He paid attention to soil, flora, wind, climate, and the incline of the land, the taste and scent of what his contemporaries called an "unlovely piece of earth," in which Carlowitz recognized a "miraculous, life-nurturing spirit" at work. He marvelled at the "life-giving force of the sun" and called the natural world a "great world-book" to be studied.[14] The value of the trees could not be reduced to the value of the wood. For him, they were "unspeakably beautiful." "The loveliness of the green colour of the leaves," he once wrote, "I cannot put into words."[15]

Carlowitz was just as concerned with the growth of trees as with economic growth, and just as interested in humus as in silver.

But let us not get carried away. The "sustainable" economic ideas of Carlowitz and the global idea of "sustainable development" mapped

out in Rio are worlds apart. At least from the moment that the atomic bomb was dropped on Hiroshima and Nagasaki, we humans have been aware of the enormous destructive power that we are capable of unleashing on the whole planet.[16] For Carlowitz, God was the dominant figure who commanded the earthly sphere, for us today it is Man. Carlowitz wanted to conserve *one* resource, wood, in order to exploit *another*, ore, even more effectively. With hindsight, it is evident that Carlowitz distinguished between sustainable and non-sustainable resources, and that his thinking drew a veil over a classic conflict of interests. For him as for his contemporaries, ore as a finite resource was of no immediate importance. Today, we think in terms of systems that take account of many different resources and the whole globe. Carlowitz connected the term sustainable with the forests of Europe, not with the North-South divide and the unequal distribution of natural resources on the planet. Carlowitz's worldview is no longer easy to understand, his prose is contorted and pompous; and the environment and climate summits of the twenty-first century would be incomprehensible to the mines administrator from Saxony. We need to keep this in mind, lest we are tempted to turn him into a sustainability pop-icon in 2013. So let us not get carried away. The loyal English patriot John Evelyn (author, architect, and horticulturalist) had already penned a bestseller decades before Carlowitz with his book *Sylva, or a Discourse of Forest–Trees and the Propagation of Timber in His Majesties Dominions*, and in this he laid the foundations for forest management aimed at both nurture and preservation: "Men should perpetually be *Planting*" he wrote, "so *Posterity* might have *Trees* fit for their Service…and *Felling* what we do cut down with great Discretion, and Regard of the Future."[17] Carlowitz was neither the first practitioner nor the inventor of sustainability, and in his monumental work *Sylvicultura oeconomica*, the word sustainable ("nachhaltend") appears, famously, only once.[18] Why, then, should we remember Carlowitz? Why do we have this Carlowitz lecture?

On the one hand, the *Sylvicultura oeconomica* has contributed to the genesis of modern forestry science as no other work has. The in-

Figure 5
Hans Carl von Carlowitz as an icon of pop culture
Carlowitz's deliberations on the protection of forests are worlds away from today's discourse on sustainability. He was moreover not the first to formulate ideas about resource consumption. Is Carlowitz being turned into an icon of pop culture through celebrations of "300 years of sustainability" in Germany?

sights of Venetian foresters and their methods of observing and conserving forest resources disappeared into registries and archives and were completely forgotten. The teachings of John Evelyn, too, had no long-term bearing on British forests. Admittedly, the "Tree-Planting" he advocated did become something of a national obsession amongst the English aristocracy, in parks and along avenues, but British forestry practices were largely ignorant of Evelyn's *Sylva*; ultimately, if all else failed, it was always possible to import wood to Merry Olde England from other parts of the globe. Colonies encourage avarice. Germany was different. A country with few resources notices more quickly when they start to decline. Richard Grove sees the beginnings of modern environmental consciousness in the colonial world of small

A country with few resources notices more quickly when they start to decline.

tropical islands, for example the Caribbean islands, or Madeira. There, the Portuguese, Spanish, and English colonists observed early on, in the seventeenth century, that economic growth had limits and could lead to ecological devastation.[19]

In history we see time and time again how important knowledge of local changes, which Carlowitz saw and intuited, has been, and how tragic the kind of tunnel vision that did not comprehend local changes and conditions. Venice is one example: then, the forest commons could be managed to achieve greater yield and used more diversely and effectively than the mapped state forests. A very different example is provided by the North Sea. During the transition from the rural societies of the late Middle Ages to the agrarian system of the Early Modern period, profitable landscapes for monocultures were created at the mouths of rivers. But the more orderly this geometrically composed, manipulated nature looked from afar, the more the gradual shifts in the landscape were ignored. The dikes were breached more often, instead of less. The new system proved to be unexpectedly fragile.[20] What could be behind it? A kind of agriculture based purely on profit?

In history we see time and time again how important knowledge of local changes has been, and how tragic the kind of tunnel vision that did not comprehend local changes and conditions.

America in the early twentieth century gives us an example of just such a process—with drastic consequences. The farmers who transformed the prairie into immeasurable, vast, uniform fields of wheat in the 1920s were able to make their land ten times more profitable than the ranchers who had farmed there before by using heavy combine harvesters with enormously wide teeth. They didn't even need to work the land themselves, but could manage the farm from afar, as "suitcase farmers." But technological progress and the distance between farmer and furrow exacted a high price, for they failed to notice the gradual changes in the landscape—in the soil, for example, that flaked and dried and turned to dust; and after a short period,

Figure 6
Dust Bowl in Dallas, South Dakota 1936
Non-sustainable use of agricultural land led to an insidious aridification of soil in the Southern States of the USA. The Dust Bowl disaster was one of the greatest natural catastrophes in North American history.

in 1935, a huge expanse that was almost twice as large as Germany, was transformed into a desolate wasteland. The Dust Bowl disaster was one of the greatest disasters in North American history.[21]

Chapter 3

Europe and the Globe

The scarcity of wood and the destruction of the environment were confined to small regions over millennia, simply because of the low population density across the globe. The situation only became precarious with the enormous demographic change that started in the eighteenth and early nineteenth century in Europe. What happened then was unprecedented in the history of humanity: the first population explosion on the planet. In Germany alone, the number of inhabitants tripled in the course of the nineteenth century.[22] Meanwhile energy demands grew exponentially in the wake of industrialization.[23] If England had powered the many factories and machines that sprung up for industrial production with wood alone, it would have needed more wood than the deforestation of the entire country could have provided.[24] Never mind Carlowitz: The rate at which Europeans demanded new sources of energy far exceeded the rate at which trees grow.

Rolf Peter Sieferle and his colleagues in Austria have shown that industrialization was only possible by means of its reliance on fossil fuels, by means of the decoupling of energy source and land area and by means of the shift from solar to fossil energy system; from wood to coal.[25] Coal was an important precondition for industrialization, but not the only precondition, as a comparison with China clearly shows. Today we know that China was in many ways at least equal with, if not superior to Europeans in the eighteenth century—in terms of culture, technology, administration and finance, land cultivation, quality of life, public health, and wealth.[26] By the same token, Western Europe in the eighteenth century was frequently beset by rebellions caused by hunger, and by energy crises. How was it possible that the exponential growth of the European population after 1800 did not cause any major

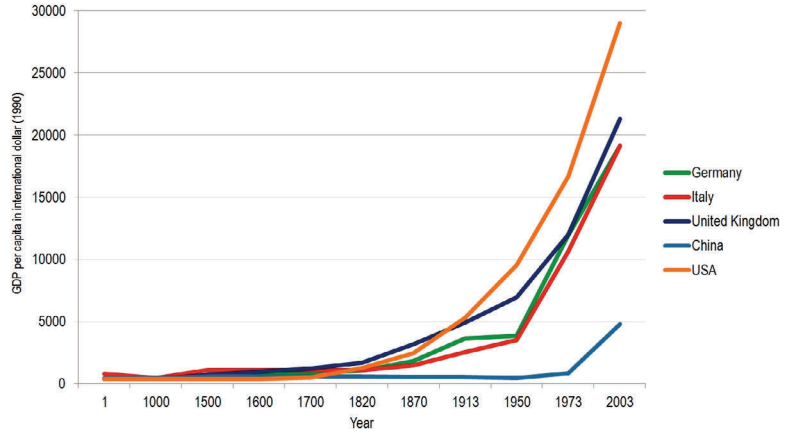

Figure 7
Economic growth of selected countries in comparison
Economic development in Europe and Asia ran parallel over the course of several centuries. The sharp increase in economic growth in Europe only took place in the eighteenth century, sparked by the industrial revolution. While China was still characterized by labour-intensive agriculture, Europe went through a period of radical economic and social change.

crisis in food security and energy provision? Why did such a deep gulf emerge so suddenly between East and West? Why did so many millions of Chinese remain in subsistence agriculture, while Europe saw such a radical change in economy and society? The use of coal is *one* of the reasons for this; a second can be found in the European discovery of the Americas. Without the discovery of the Americas, which incidentally Adam Smith also saw as one of the "greatest and most important events in the

The use of coal is *one* of the reasons for this; a second can be found in the discovery of the Americas. Without the Americas, Europe would have been like China, that is to say a rural continent.

recorded history of humanity" (alongside the "passage to East India around the Cape of Good Hope"), Europe could never have seen such social transformation, nor an industrial revolution.[27] Without the Americas, Europe would have been like China, that is to say a rural continent.

The discovery of the Americas presented Europeans with new horizons and enormous resources; Asia had nothing on this scale. Columbus had enlarged the map; and as navigation and shipping improved, Europe and the Americas moved ever closer.[28] The hope of fortune and a better life—which the Vikings, the first Europeans to discover the Americas, did not find there—were important motors for the European expansion across the Atlantic. But this was not enough on its own; nature played its part in the success of the European settlements. That ecology, the interaction between living creatures of all kinds and their environment,[29] has been and is such a major actor in this human story—better, in this human survival story—is only slowly dawning on us.

Up until recently, nature had no place in historical writing. But with the invention of environmental history, this has changed. Environmental historians have focused their attention on the presence and dynamics of the biophysical world; and on the shifting cultural perception of nature and its manipulation by people.[30] An environmental history perspective enables us to understand why the Europeans were able to settle whole continents, in particular North and South America, at such a rapid pace and with such astonishing ease. Technology and political developments, planning and ideology, the actions of leaders and nation-states—none of these are sufficient as explanatory factors. It is only the synthesis of ecological givens, human perceptions, and desires concerning ownership of nature and mastery over environmental resources that explains the big and small revolutions in the history of humanity. The Spaniards brought cattle, pigs, horses and hens to the Americas; without horses, the settlement of the Western hemisphere would have been incomparably slower, without cattle, the US Midwest would have been inhabited only by

nomads. (And what would the United States be without horses and cattle? There would be no cowboys and no hamburgers.) Nature played into the Europeans' hands. Bacteria and viruses from the Old World decimated the indigenous population of the Americas. The settlement of the New World was the scourge of the "Natives" (and many hundreds of thousands of Africans), and a blessing for the Europeans. The Europeans occupied the Americas, but nature played along; there was no progress without it. Nature transformed the New World radically and irreversibly, but the environmental resources of the New World also transformed Europe. Raw produce such as sugar and cotton from the New World, but also precious metals such as silver, were vital for the Old World.[31] Where else could the sheer tonnage of cloth to cover the backs of millions of industrial labourers have come from, if not from the New World? Europe had no huge expanses of land to cultivate. Where could it have found the capital to start all of the heavy industry without the enormous resources on the far side of the Atlantic? The discovery and conquest of the Americas made Europe into a New World too. But what kind of world was it? And what was so new about the Americas?

Chapter 4

American Space – Dreams without Limits

In the beginning was Venice? John Locke would have had another answer. "In the beginning," he wrote in 1690, "all the world was America."[32] During Carlowitz's lifetime, America served as a metaphor par excellence for the state of nature before the state intervened; the example of a continent that had an abundance of land, but no ambition to trade. The *tohuwabohu*—the primal disorder in the first book of Genesis—and the state of nature on the American continent had, in the eyes of Carlowitz' contemporaries, something important in common: they were in need of cultivation. The worries of the Old World

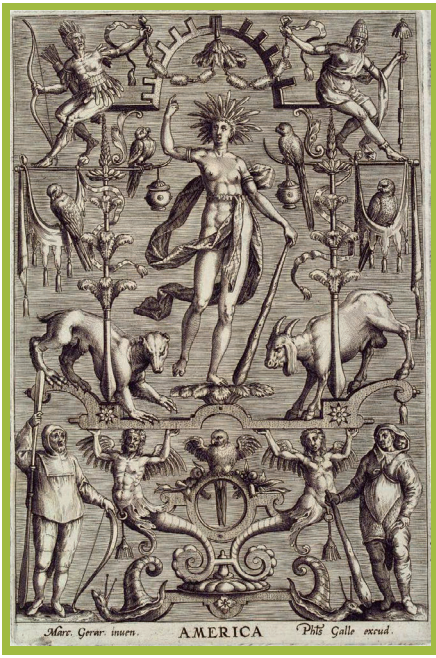

Figure 8
America (Philipp Galle)
The copper engraving by Flemish printer Philipp Galle (1551–1600) shows a personification of the newly discovered continent "America". The feminine nature of America and the surrounding flora and fauna evoke the exotic, wild, and foreign nature of the new continent. In the opinion of Galle's contemporaries, this continent had yet to be defeated, civilized, and cultivated. In the early modern era, America was regarded as a metaphor for the stateless state of nature.

concerning sustainability were simply conjured away by availability of land in the New. In America there were apparently unimaginably huge expanses of land and plenteous natural resources. The continent became an "immense gaming table" (James T. Callender). The winners of this gamble were those who could afford to play for the highest stakes. The plantation owners and the farmers pushed the frontier back at an enormous speed—whenever the profits from the harvests began to fall, there was new land further west, and new perspectives. The rapid cycles of cheap land acquisition, development, cultivation, and selling on—the transformation from land to commodity—was a most reliable formula for success. The creed of the "land of unlimited possibilities" had its roots in American space—in what was seen as the boundlessness of America.[33]

History is shallower than reality, but it hits the nail on the head. From the time of the European settlement of America up until World War II, the Americans had no interest in the limits to growth, let alone forecasts of doom. The "American way of life" was based on the belief in happiness through wealth, on the right to an ever better standard of living, on consumption, on economic growth.[34] "I am surprised that the world knows so little about itself," President Franklin Delano Roosevelt said in 1944 to the forest scientist Gifford Pinchot.

Indeed, what did Americans know about their relationship with the world, and with their environment? That prosperity is available to everybody (or at least for those who are on the political right) was and is the essence of the American Dream. This idea spread—initially from the New to the Old World, and then outwards in all directions, to Korea and Australia, to Brazil and China. Was the discovery of America, which gave us the sense and the philosophy of a world without limits, perhaps not a blessing after all?—not even for

Was the discovery of America, which gave us the sense and the philosophy of a world without limits, perhaps not a blessing after all?

Figure 9
Billboard in the USA, 1930s
The "American Way of Life" promised prosperity, consumption, growth and an ever-better standard of living.
The ideology of the pursuit of happiness—which dates back to the American Declaration of Independence—spread around the globe.

us Europeans? Is the ideology of the pursuit of happiness in fact a curse for all humanity? Without the discovery of America, our story would have developed very differently, and we would have recognized our limits sooner.

When Dennis and Donella Meadows started talking about the Limits to Growth, more than forty years ago now,[35] their forecasts sounded outlandish to most people, not just to US Americans. The trust in permanent growth, in the advance of the frontier, in the genius of engineers and scientists, had deep roots. History seemed to lend credence to the American Dream. The USA had managed most things better than other nations. With the founding of the National Parks (starting at the end of the nineteenth century) and the passing

of the Wilderness Act (in 1964), the United States even took up a leading position in environmental debates.[36]

But a critical look at history, or better, a critical look at environmental history (had it existed as a discipline) would have shown that the American Dream was never going to last forever and not for the whole world; the wealth of one was dependent on the destiny of another. It would have shown that nature and the availability of its goods had played into the hands of US Americans, far more than political power or creative flair. The population scientists Paul and Anne Ehrlich pointed out in 1989 that a baby born in the United States would have three times the environmental impact of a baby in Italy, thirty-five times that of one in Brazil and 280 times the impact of a baby in Haiti or Nepal.[37]

The enormous momentum enjoyed by US Americans could not be replicated in the rest of the world. It was only possible in the first place because the Europeans had learned survival strategies and the cultivation of crops (like maize and beans) indigenous from the inhabitants of North America; because ecological succession smoothed their path through the continent; because in one single stroke an enormous territory full of resources and cultivable land was available; and because coal turned out to be a radically new source of energy. The changes that had driven progress in the world in recent centuries were made possible by the conquest of the vertical (to mine precious minerals) and of the horizontal (in the new land of new worlds). Future dreams will be fulfilled differently from the American Dream. For we don't have a new source of energy with a revolutionary potency — compared with coal, solar and atomic energy have nothing like the same flexibility,[38] and so far there is no other hemisphere in sight. The

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The future will not be characterized by the advance on a new frontier.
The foundation and the hallmark of future transformations will be not extraction, but barter; not linearity, but cycles..

future will not be characterized by the advance on a new frontier. The foundation and the hallmark of future transformations will be not extraction, but barter; not linearity, but cycles.[39]

Chapter 5

Pasts and Futures

All the world is not America. Neither in the beginning nor at any time since was all the world America. But the history of the New World reflects the histories of other regions, compresses earlier colonizations into one as if in fast-forward, prefigures the global exploitation of non-renewable resources, anticipates a worldwide lifestyle predicated on consumption and economic growth, and also the opposition to this: the beginnings of environmentalism.

When the Europeans arrived in New England on the *Mayflower* a few hundred years ago, they saw American nature as something threatening, "a desolate wilderness […] full of wild beasts and wild men."[40] Since then, the tide has turned. Humanity threatens nature, and humans have begun to realize this. Humans have manipulated the environment to such an extent that some scientists, most notably the chemist and Nobel laureate Paul Crutzen, have called for the identification of a new epoch in the history of the planet, our epoch: the Anthropocene.[41] This term expresses the assumption that recent human activity in the natural world has affected the Earth's crust more significantly than volcanic eruptions, tsunamis, and earthquakes. Pop science or serious geology? The International Union of Geological Scientists is currently testing whether the Anthropocene is sufficiently distinct for its use to be justified as the term for a new geological age.

We have been sensitized, not least as a result of the environmental movement, to the fact that humans have turned almost two-thirds of the land surface of the planet into agricultural land, that 90 percent of plant life has been cultivated by humans, that cities are in the process of becoming the most frequently occurring ecosystem (thereby creating a new kind of soil layer), that plastic is becoming

Figure 10
Motorway intersection in Los Angeles, California
Mankind's impact on the environment, on geology, biology, and the climate, is so fundamental that some scientists speak of a new geological epoch: the Anthropocene, the "Age of Humans".

a new kind of sediment, and that our exploitation of the earth's surface—through agriculture, settlement, and the construction of roads and canals—is causing a level of soil erosion thirty times greater than the planetary average.[42] Scientists have shown that many of our actions are irreversible: CO_2 emissions lead to species extinction, acidification of the oceans leads to the death of ecosystems, forest clearance leads to loss of habitats, and so on. This is not new. As we know, "98 percent of all species that ever existed, according to fossil finds, have become extinct."[43] Extinction has always been part of the dynamics of life. Hunters and gatherers provoked the extinction of countless species, tens of thousands of years ago, in Australia, America, Asia, and Europe. Exploitation and overuse of the environ-

ment have always been the price for humanity's existence and survival on the planet. This is not new. Even the exploitation of non-renewable resources by humans is not new. What is new, of course, — and this is where the historian's perspective comes in — is the revolutionary acceleration and global scale of human intervention in the environment.[44] How many millions of years has it taken for dead marine organisms like algae to be transformed into oil? And with what incredible speed, over the past half-century, have humans used up this fossil resource? The Swiss environmental historian Christian Pfister dates the moment of acceleration to the period immediately after the Second World War, calling it the 1950s syndrome. "Never before," he wrote about North America and Europe, "have so many people become so wealthy within the space of a single generation, never before had the agency of broad swathes of the population been expanded overnight to such a giddy extent." Between 1950 and 1970, energy use and the concentration of greenhouse gases doubled. The dream of "eternal prosperity" spread. Yet it was to be a short-lived dream.[45]

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Chapter 6

The Age of Vulnerability

The time that humans need to exhaust supplies of oil compared to the millions of years it has taken to produce it is like the blink of an eye in comparison to a geological age. Carlowitz thought in terms of generations and centuries, and in categories of regeneration. He and his contemporaries knew only one other unit of time beyond the centuries: eternity. How different the categories of time look in which humanity must chart its impact in the Anthropocene. What does our world have in common with the world of Hans Carl von Carlowitz? Is sustainability—this deeply conservative term, encompassing a state of stability—even relevant to the twenty-first century?

Is sustainability even relevant to the twenty-first century? Let's think about the way that nature is manipulated by means of nuclear technology and radioactive waste. We produce these substances in such huge amounts and high concentrations that they can still be fatal after tens of thousands of years.

Let us think about the way that nature is manipulated by means of nuclear technology and radioactive waste. We produce these substances in such huge amounts and high concentrations that they can still be fatal after tens of thousands of years.[46] Several decades ago, a new subdiscipline of semiotics was developed, nuclear semiotics, whose single task is to warn our descendants of the dangers of atomic waste. Bearing in mind that there is no language of signs and there are no institutions that, as far as we can tell today, have the necessary expertise to transmit the necessary information about the risks of nuclear waste thousands of years into the future,[47] who can seal Pandora's box for the world to come? Or, to quote Spiegel magazine from summer 2012, "how can we conceal our waste from our ancestors?"[48]

We think today in different units of time to Carlowitz, but also in other spatial dimensions. The radioactive flotsam that was washed in all directions following the tsunami in Fukushima in March 2011, had, one year later, exploded over a space three times greater than the USA. Traces of the mercury used in the American West for hydraulic gold mining in the second half of the nineteenth century have travelled by remote streams and rivers, entered into marine organisms and fish and can now be found in the bodies of people in all corners of the globe.[49] The perils of the spread of the invisible "elixirs of death" (such as DDT), brewed up by humans themselves, was most powerfully put into words by the biologist Rachel Carson in her 1962 best-seller *Silent Spring*. Man, according to Carson, is the only species on the planet who has gained so much power that he can "alter the nature of his world." This power is exposed in *Silent Spring* to be an illusion, and something upon which nature gets its own back. For years, DDT had been regarded as a miracle solution.[50] Paul Hermann Müller was awarded the Nobel Prize for its discovery, because the substance killed anthropods (such as the potato beetle), saved harvests, and did no discernible harm to humans—within the normal, short medical test periods. That the insecticide became concentrated in the soft tissues of animals and humans, and caused birds of prey to lay softer-shelled eggs, thus contributing to a drastic decline in numbers—these unintended consequences were not noticeable after days, weeks, or months, but happened quietly, invisibly, gradually, over long time periods. The same is true of radioactive substances, contaminated waste, insecticides. Haven't we known, at least since Carson's *Silent Spring*, that we are living in an "Age of Vulnerability"[51] and that fragility is the hallmark of our world?

Haven't we known, at least since Carson's *Silent Spring*, that we are living in an "Age of Vulnerability" and that fragility is the hallmark of our world?

The desire to reduce our vulnerability was one of the most important drivers of the transformation of landscapes in the Anthro-

Figure 11
View from 'Isteiner Klotz' along the river Rhine river towards Basel (Peter Birmann, around 1819)
Altered river landscapes are prime examples of human intervention in the environment. In the course of the nineteenth century, the river Rhine was straightened by eliminating many of its islets.

pocene. To stabilize nature, as the supplier of our natural resources, humans have dramatically altered natural processes. River landscapes are a perfect example. In the nineteenth century, no less than 2,200 islands along the Rhine were eliminated, and the section of the river between Basel and Worms alone lost a quarter of its length. The advantages of this engineering vision were obvious: the removal of shallows, rocks, and rapids made the rivers navigable, and the water flowed faster along the straighter course and hollowed out a deeper bed, leading to less frequent floods and making it easier to plan land cultivation. One by one, in all corners of the globe, rivers were straightened and sluices and dams were built—complex technical

Figure 12
Aerial photo of the Upper Rhine near Breisach
Through the straightening of the Rhine, the river became navigable and could be used as a shipping canal. Locks in the canal (at the back of the picture) even out the changes in water levels of the artificially managed river (see front of picture).

systems and gargantuan projects like the Three Gorges Dam in China—all of which were designed to subdue nature and neutralize fluctuations. Improvements often had a high price: the rivers of the industrial age became "organic machines," as Richard White called them.[52] Along with the water meadows, flora and fauna disappeared, industry grew up along the banks, river water started to get warmer, disrupting the migration patterns of fish, and leading to the elimination of backwaters and their overspill function, which increased the risk of flooding. The transformation of river landscapes happened under the banner of better planning, progress and modernization, but the unintended consequences of these actions have caused new

vulnerabilities and disasters.[53] Stories of the technical conquest of rivers are anything but sustainable. Their protagonists are more like Sisyphus than "divine engineers,"[54] as nature has risen again and again against those who thought they could subdue it.

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Have we learnt nothing at all? Sometimes it seems so. How else can we explain the fact that a thousand years ago, the inhabitants of Baghdad "managed" the annual floods with ease: they diverted the water to the east, where the terrain was higher, taking it past the fortified city, unlike the British engineers of the twentieth century who channelled the river right through the middle of town. And they built their houses so that they could move into the upper floor in the event of an unusually severe flood. They lived *with* nature's agency, instead of throwing their weight *against* it.[55]

How can we explain the fact that in New Orleans in the 1960s, Hurricane Betsy only claimed a fraction of the human fatalities and caused much less damage than the twenty-first-century Hurricane Katrina, which was weaker by comparison—despite the billions invested in levees? The prioritization of economy over ecology is one of the reasons. To justify these investments, new cheap housing was built right behind the levees, in a high-risk area. It could have been predicted that these would be inundated if the levees were breached. Another reason is the one-dimensional nature of the city planners' approach: their reliance on technology meant that they neglected social and infrastructural factors that had served to mitigate the outcome of past catastrophes. New buildings were no longer built on the pilings used in prewar construction; the emergency refuges distributed throughout the city were gradually torn down (and replaced by a single evacuation point, the Superdome); cuts to the public transport system robbed socially disadvantaged inhabitants of the pos-

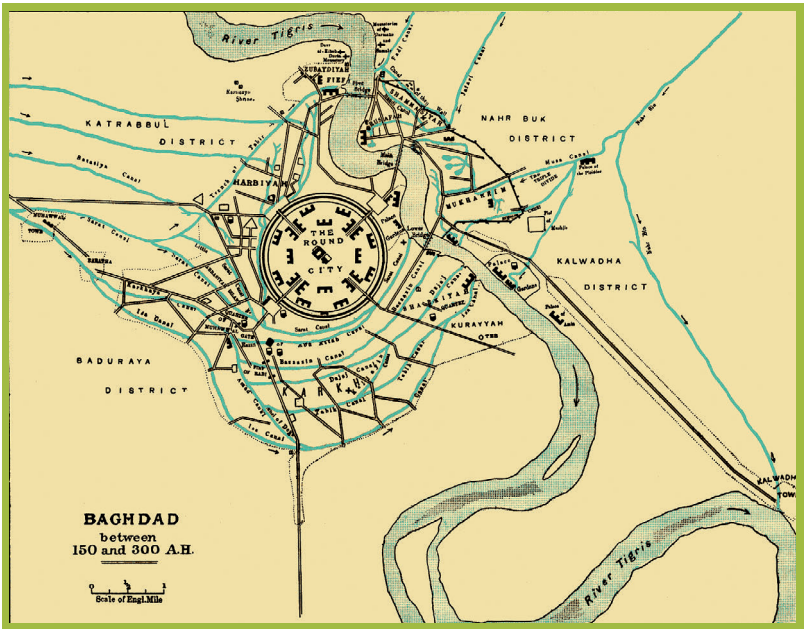

Figure 13
Baghdad between 729 and 879 AD
In the past, Baghdad's inhabitants utilized the natural terrain and diverted the Tigris past the walled city. They were living *with* the river instead of *against* it.

sibility to flee. The fact that oil companies had constructed canals through the swamplands over previous decades for the transport of workers and machinery was an additional factor. The erosion of the coasts accelerated dramatically; and the regulation of the water flow caused the land to contract and sink. It was not meteorology that was responsible for the Hurricane Katrina disaster, but the accrued human decisions, in some cases going back far into the past.[56]

The story of Hurricane Katrina is unique, like all historical happenings. But like a prism it also crystallizes the situation of humans in the age of vulnerability; the precarious interplay of natural

Figure 14
House on stilts in Cocodrie, Louisiana
This stilt construction was customary before World War Two and served as a buffer in cases of hurricane flooding. In high-risk areas, this disaster-tested method of construction was abandoned in favour of cheap new housing.

changes, cultural perceptions, political decisions, economic calculations, and social disadvantage. That human decisions were responsible for the extent of the catastrophe is on the one hand the tragedy of Katrina, but on the other the opportunity. History shows that there were moments in the past that gave room to lessen the human impact of the disaster. There is much in favour of us having become more sensitive over recent decades to the complex interaction of natural processes and human action, and that our visions of a better environment—not all of them, of course, but many of them—can be realized.

In an autobiographical essay, Franz-Josef Brüggemeier, an environmental historian at the University of Freiburg, tells of how in the

1970s he was unable to imagine how the Emscher—a drainage canal in the industrial Ruhr region that was fed with coal slurry—could ever become a river again. "When I first heard about this project, it seemed to me less a visionary dream than a crazy, impossible one. By contrast, I considered the plans being made around this time to fly to Mars to be entirely realistic." Today, the idea that a former river can be turned "back into an ecosystem in which fish live and which is safe for humans to bathe in again seems practically within our grasp."[57]

Environmental history is full of examples in which today's utopia becomes tomorrow's reality. Often—as in the case of Carlowitz—economic arguments were the driving force behind the eventual introduction of ecological sustainability.[58] The conservationist John Muir, founder of the Sierra Club, recognized more than a century ago—following an unsuccessful battle over the use of the romantic Hetch Hetchy Valley, which was turned into a reservoir for the city of San Francisco—that "nothing dollarable is safe."[59] Muir thus allied himself with the railway companies. His hope that tourism could bolster the nature conservation movement was fulfilled, initially at least. The greater the number of nature lovers who travelled, first by train, later in cars and caravans, to enjoy "unspoilt" nature, the more the environment was compromised with roads, motels, exhaust fumes, waste. The nature in the US national parks was literally loved to death. The plan backfired. History teaches us that there is nothing as constant as change. Sustainability does not exist as the constant enactment of a principle, but only on the basis of revision and adaptation. The fact that realizing environmental utopias gives rise to unintended consequences should not stop us from developing these utopias in the first place, although we need to be ready to adapt them to ever-changing circumstances.

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We should certainly make sure that we do not equate sustainable development with sustainable growth. Unless it is smart growth, growth itself—whether we are talking about the expansion of an urban area, like in New Orleans, the construction of infrastructure to feed national parks, or the inflation of stocks and shares—is per se not sustainable, but, with the weight of history behind it, must lead to collapse.

If we want to learn from Carlowitz, we need to emphasize to ourselves that he was not interested in boundless growth, nor a lucrative gamble in "Nature's casino," but in re-growth, in providing for the future, in laying up reserves.

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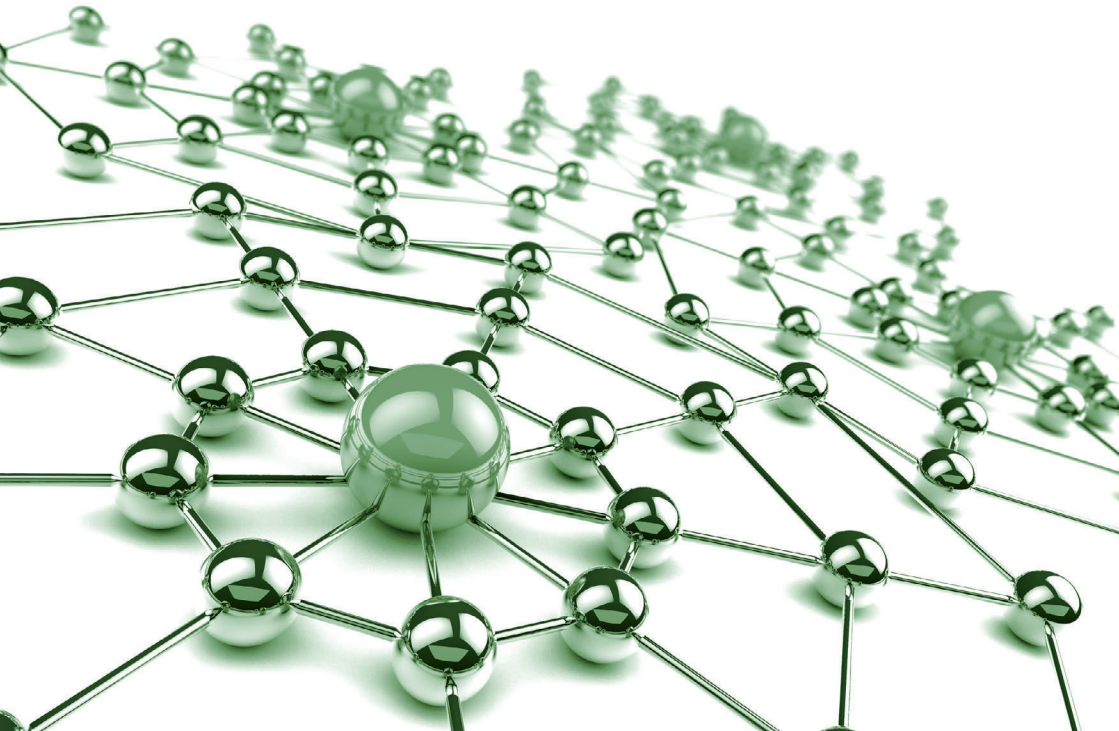
Chapter 7

Sustainable Societies?



Has there ever been a society that was able to survive over a long time period in difficult environmental conditions? The Hohokam, a pre-Colombian indigenous culture from modern-day Arizona, provides us with the perfect example of a sustainable society that endured for more than a thousand years. Hohokam people lived in an extreme climate, a low-lying desert region with very little precipitation that was at risk of flooding during the rainy season. Over the centuries, they developed a complex irrigation system that centred around the

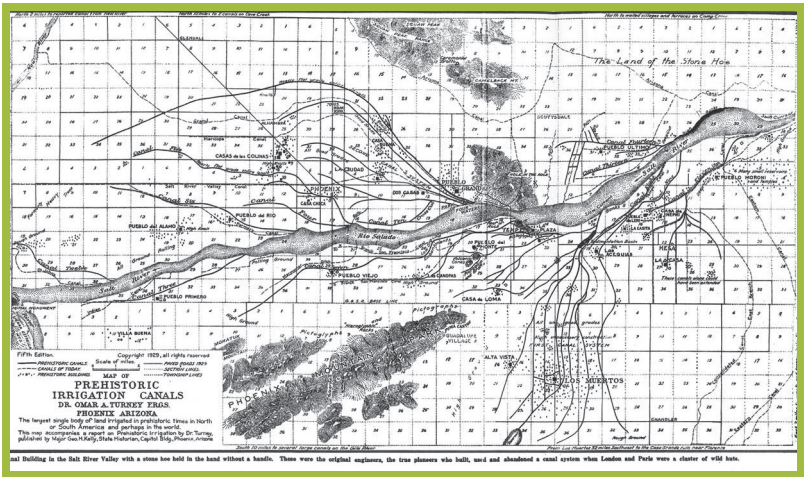


Figure 15
Prehistoric irrigation canals of the Hohokam people
The Hohokam is a prime example of a society that lived sustainably for more than a thousand years. Life in the extreme climatic conditions in the desert lowlands of today's Arizona was made possible by the development of a canal system.

Figure 16
Irrigation agriculture of the Hohokam People
It was the success of the Hohokam's irrigation system, of all things, and the social infrastructure that had grown up around it, that brought about the relatively sudden collapse of their culture, as recent scientific studies show.

diversion of a river; they were able to increase the proportion of clay soil, which retained the water better and also made the soil more fertile.[61] The details of this are not relevant. But it is important to note that the Hohokam people, as we know from archaeologists, developed an open society and a thriving culture (enjoying ball games and dance events); economic growth was provided by trading in ceramics; they developed technologies, social institutions, and an irrigation-based system of cultivation; and that they became more specialized, and wealth and population steadily increased, although the walls between plots of land that display "a clear definition of private prop-

erty," also increased during the later period. John Martin Anderies, one of the foremost experts on Hohokam culture, who teaches in the School of Sustainability at Arizona State University, has used mathematical and sociological modelling to show that it was the success of the irrigation system and the social structure that this created that also caused the relatively rapid collapse of Hohokam culture in the fifteenth century. Local, minor drought disasters could be absorbed by the large system without difficulty. But at the same time, vulnerability to larger environmental threats (such as regional drought, large floods, and climate change, which took place over longer time periods and greater areas) grew. In other words: vulnerability was not eliminated by the expansion of the system, but transformed from a small-scale risk to a large-scale one. In the event of a problem, the big system was less versatile and adaptable than the small one. But above all, once the whole of the Phoenix Basin had been settled and cultivated, there was no space left in reserve. Small problems could have a big impact. Hohokam culture, it seems, was ultimately a victim of its own success. Even if it is difficult to extrapolate from a distant past to our own society and its future, the Hohokam story has at least two lessons to teach us: firstly, the inventive irrigation system, the careful use of resources, and the spatial expansion guaranteed the culture's survival for long periods of time. Secondly, there is no proof, either in the Hohokam example or anywhere else in history, of the formula "too big to fail."[62] Quite the opposite—the size of the system was one of the main reasons that Hohokam culture died out. We do not know whether parts of the Hohokam were destroyed by floods or whether a longer period of drought laid waste to the culture. But we can surmise that adaptation to extreme conditions (climate and greater population density) was too great a challenge in the long run. There is some evidence that the Hohokam people did indeed

In the event of a problem, the big system was less versatile and adaptable than the small one. Small problems could have a big impact.

meet a sudden, if not catastrophic, end. They might well have migrated to other parts of North America. It would be another lesson for us from history, that thinking in alternatives and having reserves of space might be one of the most important strategies of a sustainable human existence.

The Swiss parish of Törbel, the subject of an examination by US historian Robert McC. Netting,[63] provides us with an example of how the common pasturing of animals *(allmende)* combined with strict rules about common resource use, could allow a community to stay socially and ecologically intact over centuries. From the Middle Ages until well into the twentieth century, the village collective, which had already developed an intricate system of irrigation during the fourteenth century, was able to remain stable, not least because the inhabitants of Törbel had developed complex rules regarding the use of the *allmende*. The rules had grown out of the needs of the community and were such that all could profit, and all were obliged to support each other; a failure to abide by the rules was met with severe punishment.[64] The environmental economist Elinor Ostrom has shown that there are sustainable collectives like the one in Törbel all over the world in various different forms. Examples include villages such as Hirano, Nagaike, and Yamanoka in Japan; the nutrient-rich, artificially watered *huertas* in Spanish Valencia, Murcia, and Orihuela; and the irrigation societies in the Ilocanos region of Ilocos Norte in the Philippines. In fact, these vulnerable communities, which have managed themselves sustainably over centuries, are only starting to crumble now, in our age of globalization.

Learning from history does not mean that we have to hold on to everything we have ever established, nor should we aim to turn back the clock. But our actions will profit from the historically grounded, forward-looking orientation that comes from identifying and studying the commonalities between sustainable, collectively governed institutions, and help us in creating similar projects for the future. The first step could be the recognition that the complex *allmende* systems in different parts of the world have a lot in common: relatively small

Figure 17

Törbel in the canton of Valais in Switzerland

The inhabitants of Törbel developed complex rules governing the use of their commons. All users benefited and supported each other. The rural community was able to remain stable into the twentieth century.

areas and a close connection between inhabitants and their environment,[65] as well as an institutionalized and strictly controlled cooperation between members of the community that has been developed mutually over a long period of time—in short, a system that is fair and profitable because it exports neither advantage nor damage, and acknowledges and accepts responsibility for a shared future. Indeed, we may be sure that environmental justice and sustainability are more likely to be found in the semi-collective institution of the *allmende*, as Elinor Ostrom has shown us, than in state institutions or privatized initiatives. The former is in line with Carlowitz's message of thoughts and deeds that are sustainable, responsible, and mindful of the public good for future generations.[66]

In the beginning was neither Venice nor America. In the beginning was the Earth. Hans Carl von Carlowitz had travelled widely in Europe; he knew Italy, England and France; as is well known, his *Sylvicultura* even displays knowledge of forest politics of the silver-mining city of Potosi in the Spanish colony of Peru.[67] But the problem that he was concerned with was the shortage of wood in the Ore Mountains (Erzgebirge). The spatial context that he wrote about was limited. That the planet might one day not provide enough nutrients and energy for its human population was beyond his powers of imagination. Until a few decades ago, it was beyond the power of the human collective imagination. Only when an astronaut started taking pictures of the blue planet, only when humans were able to see their habitat from the outside, did the limits to growth, the constraints of life on Earth and the hermetic nature of the global system, enter the collective consciousness in all of their drastic reality. The discovery of a New World to provide us with new resources and new wealth is nowhere in sight. The moon and Mars are not alternatives to Earth.

Three hundred years have passed since the publication of *Sylvicultura*. Seen against the whole of human history, let alone the whole of the history of the planet, three hundred years are nothing. And yet

this nobleman with his French wig and his knight's armour seems so strange to us. We shouldn't gloss over this strangeness, for an understanding of historical change is more instructive than an ahistorical attempt to assimilate different worldviews. "Sustainable," the term that Carlowitz used only once in his *Sylvicultura*—although he uses synonyms such as fostering, constant, conserving—is a world away from the inflationary "sustainable development," that has practically become an incantation since the Earth Summit in Rio in 1992. Today, diatribes against the sustainability creed are in fashion, such as Wolfram Eilenberger's exaggerated description of sustainability as a "strategic marketing term for a collective feel-good guarantee."[68]

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This criticism is not weighty, and it is not without justification, for "sustainable development" is a dual term which can mean all or nothing: sustainability and development, stasis and momentum, conservation and growth. But the paradoxical essence of the term is both its strength and its value, for nothing could be more fatal to the dynamism of the human-environmental relationship and the acceleration of our world than a philosophy of fixed, static principles.[69] In history it is often precisely these principles that cause the collapse of a system designed for permanence—such as the alternative-less expansion of the Hohokam irrigation culture. A process is triggered that one might, in a loose reference to Jack Hexter, describe as "Galloping Gertie syndrome." Galloping Gertie was a bridge in Washington State that was extremely sensitive to gusts of wind; it was the elements designed to stabilize the construction that brought about its collapse.[70]

Today, in contrast to Carlowitz's time, we know that there were very few cultures in human history that were able to maintain their

leading technologies, their forms of organization and economy, and their institutions for more than a few centuries, as has been discussed by environmental historian Donald Worster. Societies were forever coming to the end of the resource bases on which they depended, or they destroyed the environments that maintained them, ending in crisis.[71] All talk of "sustainable development" needs not only to take account of the risks that humans have created and maintained over millennia in the Anthropocene, but also to be mindful that the contexts in which we live tend not to endure for long; we need to reflect on the fragility of the system. We have increasingly been focused on the future, and on dealing in ever-smaller increments of time. Unlike Carlowitz, who took nature's timescale—the duration of human life and the time it takes for forests to regenerate—seriously, we measure our time from week to week, schedule to schedule, from one election to the next, and in the milliseconds that determine the exchange rates on Wall Street. But looking to the past is at least as important as looking to the future: looking back reminds us what we have achieved, and, more importantly, what we have lost—both in the short term and in the longue durée.

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Our intellect allows us humans alone, of all life forms on the planet, to recognize that we (like all other life forms) must eventually die out. We want to avoid this, but alongside actions that will extend our existence on Earth, there are many that will bring about our extinction all the sooner. In the classically-inspired hymn "Patmos," the poet Friedrich Hölderlin evokes human hope in the face of the fragility of Creation: "But where the danger lies, also grows the saving power."[72] Looking back at history, we might surmise that the reverse is often also true—"where the saving power lies, also grows danger." If we want to utilize historical experience for our future, then it is

important not only that our narratives reflect the permanent flux in the relationship between humans and their environment, but also that we inscribe the ambivalence of danger and salvation into our history and its interpretation. Sustainable stories are the ones that, while they warn about destructive changes in the world, also invoke positive images, opening new horizons out of poor decisions. The story of the Venetians that we heard at the beginning, their decision to adopt a radical new way of thinking and secure the regeneration of their forests rather than stick to inefficient old rules, is an example of this. We would also do well to employ the insight that communally used forests grew back better than state-managed (but neglected) ones.

Even if history never actually repeats itself, it does have abundant lessons for us. The history of the settlement of the New World, which for one hundred and fifty years was a story of sustainable growth (the recessions hardly make a dent in the economy's upward curve) shows that there were not just many winners in this game, but many losers—the soils, the buffaloes, the minority populations in North America (and in other parts of the world) who have to live with the stench and the refuse of progress. The dismantled infrastructure in New Orleans also serves as an example: it reminds us that decisions (ultimately also decisions about life and death) are the preserve of a select few instances that have the power to define risks. Looking to the past reminds us of hopes that have remained unfulfilled, of avoidable disasters, and of the unintended consequences of human actions. It teaches us—and here the Hohokam Indians are our example—that the fall of cultures is a slow and inexorable process, but that the end can also be swift and dramatic, that expansive recipes for success always have their limits, and that expanding systems can only endure in the end if there is space for resilience in the event of a catastrophe. Many lessons from environmental history are so abstract that they seem almost banal. But why is it that we even ignore or forget *unmistakeable* warnings from the past? Scientists have brought to our attention the big crises caused by nature's dynamism and human

manipulations. But scientific research lacks the connection with history, to humans as decision-makers and agents: it misses the coincidences and cycles, the cultural perceptions, and the political and social forces that have shaped natural processes for millennia, and particularly strongly in recent centuries.[73]

Close contact with nature was important in the past and it will be even more important in the future. The deforestation in Venice, the destruction of topsoil in the era of the Dust Bowl disaster, the disappearance of cod in the Pacific, the songless and soundless death of birds in Carson's Silent Spring—we will see similar developments and shifts in the future too, and we will not be able to prevent them all. But if we humans want to endure on this globe, we will need to transmit to the generations to come the insight that our sources of food and our own survival are entwined with a nature that is becoming ever more disconnected from human perception under the pressure of population growth and urbanization. The quotation often attributed to Albert Einstein, "if the bee disappears from the surface of the earth, man would have no more than four years to live," may not actually be true, and it probably was not Einstein who said it either,[74] but it epitomizes the connection between human survival and the nature that we are losing sight of. Without bees there would be no more honey; but more importantly, without the pollination of flowers there would be no more fruit. If we agree that it is important to note these subtle changes in the natural world into the future, then we need different, ecologically aware infrastructure and urban planning, which does not banish nature to discrete reserves (such as national parks), but protects ecology within human settlements. Humans and plants and animals,

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resources and food, none should be discrete from one another, but linked, intertwined. "Urban gardening" or environmentally friendly (and bird-friendly) urban planning and construction projects have, in this context, not only a pragmatic function, but are also charged with re-sensitizing us to our natural world.[75]

The sobering experiences with world environmental summits on the one hand, and our encounter with Carlowitz on the other, remind us that large-scale historical shifts almost always expand out of small spaces and local transformations. In the beginning was the Earth. The Earth does not need humans to survive, but humans need the Earth. Anyone who thinks that the global is more powerful than the local is merely obfuscating the fact that global change is only possible in the wake of perceptions, insights, and initiatives that have changed on the ground. Ultimately we need to recognize that our race can only survive on Earth in the longer term when we stop operating as parasites that harm our host (our Earth), and become commensal organisms, feeding off the Earth's resources without damaging the overall balance.[76]

Carlowitz's desire for sustainable forest growth was not born of economic calculations but of his own intuitive understanding of his surroundings. He could not have conceived of economic value without intrinsic value: the forest of the *Sylvicultura* is not the "clean forest" of later centuries, and not a wood depot for charcoal stacks, but a biodiverse entity that incorporated the farmers' orchards.[77] Carlowitz, who knew all of the soils, leaves, and mosses of the territory he presided over in his capacity as overseer of the mines, describes the forests as "the crown of the hills," "the glory of the fields," as "the nation's treasure," and "a sensory pleasure combined with usefulness."[78] If we can prize our nature as deeply as Hans Carl von Carlowitz did, and combine our "sensory pleasure" with the "love of fostering the greater good," then we may not need to feel so anxious about the future of our Earth.[79]

Annotations

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76 As part of his research at the University of Zurich, Marcus Hall has employed the pair of metaphors "parasite" and "host" to refer to the relationship between humans and the Earth. He points to new conclusions from the field of parasitology that show that hosts to parasites live longer in some circumstances than

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77 Cf. Joachim Radkau, Dossier for the nomination of "Sylvicultura oeconomica" by Hans Carl von Carlowitz as a UNESCO World Heritage document. Unpublished letter by Prof. Dr. Joachim Radkau (Bielefeld) to the Dean of the TU Mining Academy Freiberg, 17 Juni 2013. Hans von Carlowitz, Sylvicultura, 71: "Man soll das Holtz / Laub und Mooß in denen Wäldern nicht sammlen / weil dadurch ihre Fruchtbarkeit verhindert wird."

78 Hans von Carlowitz, Sylvicultura, 357.

79 Franz Josef Rademacher, Die Ressourcen der Erde setzen uns Grenzen – vom sächsischen Bergmann Hans Carl von Carlowitz 1713 bis zum neuen Report an den Club of Rome 2052, in: Füsslein, Die Erfindung der Nachhaltigkeit, 136.

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About the author and the publisher

Christof Mauch is director of the Rachel Carson Center for Environment and Society in Munich, the world's largest center for advanced study in the field of environmental humanities. From 1999–2007, he was director of the German Historical Institute in Washington, D.C. He was also Visiting Professor in India, Canada, Austria, and the United States. From 2011–2013, Christof Mauch was the president of the European Society for Environmental History. In 2013 he was named Honorary Professor of the Renmin University in Beijing.

The German Council for Sustainable Development was first assigned to advising the Federal Government on all items of the National Sustainability Strategy in 2001. Its tasks comprise developing contributions to implement the National Sustainability Strategy, specifying concrete areas for action and projects, as well as making sustainability an important public issue. The Council was given a new mandate in June 2013 by Chancellor Angela Merkel and currently consists of 16 persons from different areas of public life.
Information about members and activities of the council is available at: www.nachhaltigkeitsrat.de/en

How could alpine farmers in the Swiss village of Törbel survive over centuries in adverse conditions? Why did the Hohokam culture suddenly collapse after more than 1000 years? Looking back in history, did truly sustainable societies ever exist? Why is remembering Carl von Carlowitz today still worthwhile? Was the discovery of America, which gave us the sense and philosophy of a world without limits, perhaps not a blessing after all?
In his search for the history of sustainability, Christof Mauch discusses these and many more questions. This reveals that looking back at the historical relationship between humans and their environment can serve as a guide for the central political debates of the present.

"The Growth of Trees: A Historical Perspective on Sustainability" is the third volume in the lecture series of the German Council for Sustainable Development. In this series, exceptional scientists from different fields present their thoughts on and concepts for sustainable development. The series' patron is Carl von Carlowitz, who lived between 1645 and 1714 in Saxony, an area of ruthlessly exhaustive forest exploitation. Carlowitz recommended the "sustainable use" of wood with the aim of putting an end to resource destruction—and has been regarded as the father of the term "sustainability" ever since.