

Reconstructing the Future

Bauhaus Earth,
Hans Joachim Schellnhuber,
Rocío Armillas Tiseyra (Eds.)

Reconstructing the Future

Cities as
Carbon Sinks

BIRKHÄUSER
BASEL

BAUHAUS ● EARTH

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foreword

Giovanna Melandri

In June 2022, the whole community working at the **MAXXI** museum felt a great burst of hope and excitement. It was the museum's 10th anniversary, coinciding with a number of enthusiastic and progressive initiatives. The team from Bauhaus Earth was in Rome for its cohosted conference with the Pontifical Academy of Sciences, *Reconstructing the Future for People and Planet*. The event brought together an incredible short list of world-size influential speakers, from Francis Kéré to Ursula von der Leyen, including a long list of front-runners in design, planning, the arts, activism, philosophy, and science.

President von der Leyen was in Rome not only to participate in Bauhaus Earth's conference but also to celebrate the first festival of her own project, the New European Bauhaus (NEB), choosing **MAXXI** as the Italian pivotal venue for a network of synchronous events across Europe. The unusual circumstance of operating such important public events in the immediate aftermath of the COVID-19 vaccine rollout in Europe wasn't a real obstacle for the organizing team, who took inspiration from the constraints of the time to work even harder and make the events program

accessible for a broader audience via streaming and digital media.

Our spirits were sky-high at **MAXXI**, and everybody worked nonstop to prepare for events linked to our anniversary and to the other initiatives. We were happy not only for the opportunity to cross paths with the NEB but also to form a lasting friendship with Bauhaus Earth. The decennial was a good time to look back at our own 10 years' record of exhibitions and projects, and to be proud. And when we reviewed them—from time to time focused on topics such as recycling, energy, science (*Gravity: Imaging the Universe after Einstein*), digital culture (*Low Form: Imaginaries and Visions in the Age of Artificial Intelligence*), food—we felt reassured that we had chosen the right direction for our curatorial agency, and because of that we also felt we were a “natural ally” for the other protagonists of that exciting Roman (early) summer. However, the series of events was not only an opportunity to look back and feel proud of the identity we had built for our museum over a decade of projects and actions. It appeared even more as the right time to discuss and launch our projects for the second

decade of **MAXXI**'s life. These projects have to do with the museum's diverse fields of operation: exhibitions and public programs, direct agency in the social and physical space, wider cultural policies. As a backdrop to all this, but certainly not a secondary issue, we felt we were (and are) implicitly participating in a wider, global, and still-open discussion about the mission and identity of contemporary museums in general and museums focusing on the arts in particular.

Concerning our exhibition program, our aim is to keep building on the idea that an art exhibition, and more especially an architecture exhibition, is not only a device for promoting a specific contemporary artist or for displaying a fragment of architectural history. The exhibition, as we felt over these last 10 years of production, is thought of as part of the ongoing construction of an alternative and progressive culture in the fields of art and architecture—a culture that involves alternative design strategies, such as recycling and reuse of spaces and materials, research focus on new and more sustainable building materials, socially aware planning, and integration between arts and science.

On the one hand, we're convinced that we can learn a lot from our past and share this knowledge with the world, considering how the process of building architecture and cities in Italy has always relied on the acknowledgment, reuse, and integration of existing structures. On the other hand, we're conscious of the power an institution like ours wields from its easy access to ideas and proposals from all over the world and from the possibility of sharing and diffusing them to an even larger community of artists, designers, thinkers, and producers. A perfect example of this cognitive-communicative process is the dialogue **MAXXI** established in this specific frame with **NEB** and **Bauhaus Earth**. From **Bauhaus Earth**, we learn about the potential of new building materials; from **NEB**, we are reminded how no ethics can be asserted if it does not imply a new aesthetics. The agency of a museum like ours sits right in the middle of this crossroads of ideas, issues, risks, constraints, and new discoveries.

Speaking of the presence of the museum in the physical space of the city of Rome and in the conceptual space of global civilization, **MAXXI** has taken in the last

years a big step toward direct agency. The aim is to materialize in architectural terms the evolution of the museum from a space of preservation and ecstatic contemplation to a space made of research and direct action that looks to the future. To pursue this task, the museum decided to go from **MAXXI** to “Grande **MAXXI**” by planning a specific addition where some of the innovative fields of operation will find their home: platforms for the dialogue between technology, science, and art, between the museum and the actual space of the city, between the artists and designers and communities interacting with their proposals. The new building will be neither a simple extension of Zaha Hadid’s project, both a masterpiece and a clear product of its time, nor another, competing piece of performative architecture, choosing form and astonishment as its main objective. Chosen via an international competition and designed by a large team led by Ian architecture from Paris and landscape architect Bas Smets from Brussels, the new layout of the museum will be achieved by a large guided intrusion by nature and by an “intelligent box” completing a newly conceived campus for the arts and science of the future. Expanding in the dialogue with the existing structure, the new building will host additional and “displayable” storage space, labs, experimental educational programs, and workshop spaces for innovative coactions involving artists,

designers, tech experts, and city planners.

The exciting days of June 2022 were also devoted to the celebration of another aspect of the life of the **MAXXI**: the new network a museum needs to build around itself. This network has to be the expanded platform for at least two types of action. First, and very new, is the utopia—hopefully a concrete one—of an unprecedented collaboration between bottom-up actions coming from the communities and young activists and the intellectual and political leadership in Europe. Second—close but different—is the idea of the museum as an institution devoted to the creation of an alliance with politics and science on a new basis. This is not the old conflict about local versus global or popular versus elitist, but a common effort based on new assumptions, concerning the future of the planet, the future of communities inhabiting the planet, and the basics of a new dialogue between the political streams, the digital culture, the creative minds, and institutions committed to a negotiation between memory and the future, like us.

To conclude, if most of the network that was spectacularly displayed in the days of June 2022 takes root—Hans Joachim Schellnhuber and Ursula von der Leyen’s intuition about the NEB and Bauhaus Earth—everything will come back in a virtuous circle in a field defined by the

same values: arts, science, and social
engagement as the drivers of a society
committed to choosing its own future.

Giovanna Melandri
Rome, February 2023



preface

Hans Joachim Schellnhuber & Rocío Armillas Tiseyra

This book emerges from the Reconstructing the Future for People and Planet conference, held at Casina Pio IV, Vatican City, June 9–10, 2022. As a member of the Pontifical Academy of Sciences (PAS), Hans Joachim Schellnhuber put forward the idea for the conference in 2021. He selected the challenge that currently defines his life's work: to initiate an unprecedented *Bauwende*,¹ to help phase out greenhouse gas emissions in the building sector by 2050, and to contribute to the restoration of the global climate by 2200.

In just three months, we managed to bring together 54 eminent scientists, builders, funders, designers, architects, urban planners, and activists, digitally and in person at the PAS headquarters. We were fortunate that the conference coincided with the first festival of the New European Bauhaus (NEB), a major actor in the rekindled Bauhaus movement. The New European Bauhaus itself

surfaced from exchanges between Schellnhuber and President von der Leyen. Indeed, the conference and the festival shared a number of participants, including Francis Kéré, Sheela Patel, Shigeru Ban, and Francesca Bria.

Initially, there was no plan to cover the PAS event with a carefully composed book. However, we realized two things during the planning and execution of the conference: (1) COVID-19 restrictions at the Vatican reduced the number of participants present and able to engage at Casina Pio IV; (2) the questions, agreements, and conflicts, in particular those dealing with inadequacy of current language surrounding the construction of our built environment, should be opened to the critical view of a broader audience. The latter led to our decision to secure an open access license for this publication. We thank **MOD21 (ERBUD Group)** for the generous sponsorship of this license.



from left to right:
Ursula von der Leyen,
Sheela Patel, Edgar
Pieterse, Hans Joachim
Schellnhuber

Not all those who spoke at the conference in 2022 are represented in this book. It is no easy task, nor even a fair one, to ask authors to render their spoken words into written form. Hearing and reading build different memories. So we ask you, the reader, as best you are able, to hear the words on the following pages, rather than to read them. For it has been a challenge to authors and editors alike to truly convene, in writing, memories made of spoken words.

The 21st century must be the century of *re-entanglement*, where quintessential functions (housing, work, culture, recreation, et cetera) are reintegrated within urban spaces, where socioeconomic and ecological systems form a mutually supportive network of networks (PAS 2022), and where past, present, and future are perceived as interwoven currents in an ocean of time. Our contemporary global system does not serve the future we need to restore our planet. The extraction of resources across geogra-

phies is also an extraction over time. Our pursuit of economic growth is our theft from future generations (Monbiot 2021).

Eloquently, Sandrine Dixson-Declève will point to the need to completely uproot our current economic models and measurements. This is a sentiment shared by Marc Palahí, who, echoing Robert F. Kennedy, will note that GDP measures everything except that which is worth measuring at all. Specifically, Klaus Mindrup will give us a glimpse into the absurdities entrenched in contemporary German legislations and institutions, which stall the transition to a system that truly respects our planet. Here, Ursula von der Leyen overlaps, as she speaks to the importance of revolutionizing what is often thought to be the monoliths of the status quo. She highlights the importance of the vibrations in the room²—what Ana María Durán Calisto will come to describe as *sumak kawsay* or *el buen vivir*³—as the missing element in the policies, legislations, and institutions of





the European Commission designed to implement the European Green Deal. This is how she came to embrace the metaphor of the Staatliche Bauhaus zu Weimar as inspiration for the framework of the New European Bauhaus.

Contributors will detail pathways toward low-impact/no-impact extractive methods for the future construction of our built environment. Elspeth MacRae tells us resistance is already out there, and options for a circular bioeconomy are widespread regardless of their endorsement, or not, by the contemporary extractivist global system. Indeed, Shigeru Ban will share his disappointment with the architectural discipline that led him to explore low-tech construction to shelter those faced with calamity. A sentiment echoed by Xu Tiantian, as she draws our attention to the importance of working with vernacular forms, processes, and materials, with people on the ground, to give meaning and opportunity to the environment we co-inhabit. A vision she sums up in “the rural is global.”

In turn, Andreja Kutnar will highlight the importance of an interdisciplinary

approach for sustainability and the sensible use of resources. In the vein of cities and technology, Francesca Bria will question the hegemony of either Big Tech or Big State, in favor of Big Democracy as a framework for digital rights. In addition, Carlo Ratti will frame his work within the purpose of Utopia or Oblivion, and details a project on citywide energy storage islands. It will be Wael Al Awar who will disrupt any trending nostalgia for traditional architectures as self-evident pathways to a sustainable future, arguing that local, modern innovation of unlikely place-based materials represents a viable, desirable future. Finally, it will be Sheela Patel who will throw a wrench into our assumptions and question the sole-actor mindset of the architectural discipline in the production of space. She will draw our attention to the fact that the majority of the built environment in the Global South is not in fact developed by developers, designed by architects, or financed by states or firms, but rather by the people themselves, who inhabit it.⁴ Which indeed calls for multiple, diverse, and simultaneous actions, rather than a single pathway for all.



from left to right:
Andreja Kutnar, Wael
Al Awar, Shigeru Ban

Just as our contemporary system thieives from future generations, so too does it have history. A poignant component in Edgar Pieterse's contribution is when he tells us that conference colleagues spoke "quite a bit of systems thinking, quite a lot of design thinking, a lot of focus on technology, but there is no critical thought about historical path-dependent constraints that shape the power of place-making."⁵ In particular, he will question the sinister relationship between ODA⁶ and trade relations between the Global North and South, and its impact on, and acceleration of, the climate crisis. This is an argument that will resonate with the process of epistemicide, described by Ana María Durán Calisto as the hegemony of faraway cities (colonial and imperial

legacy) preaching a modernity that eradicates all other knowledge systems. Here again Sheela Patel will drive the point home, when she criticizes the exclusion and the excitement of beautiful visuals, which only remind us that there is no clarity in our frameworks on the production of space or on what constitutes inclusion. Just as architects claim to feel accountable to the planet, so too must they feel accountable to one-third of the population that has been excluded for multiple generations.

As one contributor to the book put it, during the editing process, *this is an eclectic project*. Indeed, we hope so, because we believe that the change we need will be defined by the bridges we build between actors and actions.

1 German term referring to the necessary paradigm shift in how we build, operate, and demolish the built environment.

2 See page 40.

3 See page 85.

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4 See page 193.

5 See page 126.

6 Overseas Development Assistance

Final Statement of the Workshop, June 9–10. www.pas.va/en/events/2022/reconstructing_the_future/final_statement.html.







1

bioeconomy:
toward
sustainable
living and
biosensitive
cities

Joachim von Braun

Bioeconomy to Strategically Transform the Anthropocene

Humankind faces large and growing ecological, social, and economic challenges, which are interlinked in complex ways. The climate crisis has its root cause in the excessive use of fossil fuels and in huge global land use change, both of which have detrimental effects for biodiversity. Energy and land use change relate fundamentally to two sectors, the food sector and the construction sector. Together, these sectors cause almost 70 percent of greenhouse gas emissions (IPCC 2019; IEA 2019). Both sectors need to be guided toward fundamental transformations.

A challenge is that transforming these sectors must have a focus on equity because large parts of the world population depend on these two sectors and have their livelihoods connected to them. More than 500 million small farms form part of the world food systems, many of these farm families live in inadequate housing, and many are among the approximately 830 million undernourished people worldwide (Diao et al., 2023). Employment in the construction sector is estimated to be 8.6 percent of total employment globally (ILO 2021). About 1.1 billion people live in urban slum settlements, and today more than 56 percent of the world's population (4.4 billion inhabitants) live in cities. By mid-century about two-thirds are projected to live in cities (UN DESA 2019).

With the coming urban population boom, a continued massive expansion of construction and food production is expected. In the Anthropocene—the age in which humankind has become an important factor influencing the biosphere, the geosphere, and the atmosphere of the earth—a combination and integration of far-reaching initiatives for more social and technological innovation is necessary. The strategic answer to Anthropocene challenges is an evolution toward a more bio-based economy—a bioeconomy.

The need to reintegrate human economic activity into nature's cycles is widely recognized by now. The challenge of decoupling economic growth from the excessive use of finite resources needs to be tackled. At the same time, shaping the future of work in the digitized, networked world offers opportunities in decentralized setups of urban

and rural habitat. Consequently, the very concepts of urban and rural, of cities and villages, may become obsolete in the 21st century.

Evolving Concept of Bioeconomy

Bioeconomy is on the one hand very ancient and traditional (bread baking, beer brewing, food conservation, charcoal production, wood and other plant products, or house and infrastructure constructions) and on the other hand new and innovative (novel biomaterials, biopharmaceuticals, biotechnologically produced ingredients for food, feed, and cosmetics). The innovative bioeconomy is based on scientific and technological progress. It is a central strategic component that can serve the three dimensions of ecological, social, and economic sustainability. Bioeconomy is defined as the “knowledge-based production and use of biological resources, processes and principles to provide products and services in all economic sectors within a sustainable economic system” (IACGB 2020, 14).

Transformation into a post-fossil age would hardly be possible with a closed-loop circular economy alone. A circular-flow economy, with its focus on material flows and recycling routes, is not per se sustainable. It must always ask itself which resource costs and external effects “circulation” (including recycling) actually produces. The bioeconomy goes well beyond the circular-flow economy by focusing on social, ecological, and economic sustainability (El-Chichakli et al. 2016). The bioeconomy takes its model from the cycles of nature and the special abilities of organisms and entire ecosystems. They can reproduce, repair, and adapt to environmental changes. Georgescu-Roegen (1970)—a pioneer of an ecologically oriented economic theory—applied the laws of thermodynamics to economic questions and derived far-reaching consequences for the economic use of nonrenewable resources. Even with recycling—i.e., in recycling management—it is only possible to recover raw materials that have already been used by using energy and materials, and only partially.

In recent years, rapid progress has been made in many areas of the biosciences and life sciences, in particular genomics, which now makes innovations for sustainability possible through digitization and information technology. The life sciences cover research fields

as diverse as biology, biochemistry, bioinformatics, biomedicine, biophysics, biotechnology and genetic engineering, nutrition sciences, agricultural sciences, food technology, medicine, medical technology, pharmacy and pharmacology, environmental management, and environmental technology. New knowledge in these areas is of great relevance for bioeconomy and a sustainable society.

In the bioeconomy, the use of biomass comes partly at the expense of forests and may compete with food production on scarce land. These concerns must be taken seriously, because a bioeconomy is not sustainable per se, but must be designed to be sustainable. Ecological sustainability can only be seen in actual improvements in the resource efficiency of the national economy, whereby external effects as well as the so-called rebound effects of changed use and consumption behavior are taken into account. This requires clear concepts for measuring the bioeconomy (Wesseler and von Braun 2017). Bioeconomics must adapt to biomass with limited availability, and must not be misunderstood as a biomass strategy.

Opportunities, Trade-offs, and Synergies in Bioeconomy: Food System in the Bioeconomy

We owe life on earth to a unique cycle in which solar energy is stored in various plants through photosynthesis. Plants are often mentioned in the technical literature as biomass when it comes to their universal function as a renewable and energy-rich carbon carrier. When biomass decomposes, CO₂ and water are produced, which are required for photosynthesis. Around 60 billion tons of biomass (measured in dry matter) is produced annually on land areas such as forests, meadows, steppes, and fields, and a quarter of this growing biomass is already used by humans (Haberl et al. 2007). Most of the plants are used for food, especially animal feed. But fuels and building materials, as well as raw materials for chemicals and industry, also play an important role. In climate mitigation policy, the binding of CO₂ from the atmosphere in forests, agroforests, wetlands, grasslands, and humus soils is of great and increasing importance.

In the area of sustainable food consumption, incentives and product modifications can reduce food waste. Numerous bioeconomic

start-ups are working on sustainable alternatives to animal protein. High-protein meat, milk, and egg substitute products are already on the market, and start-ups are in the experimental stage of bringing the synthetic (biotechnical) production of meat from the laboratory to production. In agriculture, rapid success can be achieved in curbing water consumption and overcoming soil degradation. Technological solutions include improved breeding of high-yielding, resistant, and frugal plants. This will be of great importance in view of climate change. Precision agriculture manages to generate new knowledge with the help of automatic data collection and to provide farmers worldwide with information for optimal management. Field robotics is emerging to protect the soil, contain diseases, and dispense with pesticides and herbicides. The catchphrase “urban farming” encompasses various projects for the production of food in large cities, which are to supply the population with fresh vegetables, fruit, and fish.

Biosensitive Cities and Construction

In order to achieve a net-zero carbon building stock by 2050, we need to cut direct building emissions by 50 percent and indirect building emissions by 60 percent by 2030 (IEA 2019). As such, innovative biosensitive solutions are needed in order to reshape the ways we live and consume, reconstruct cities in sustainable ways, and design urban and rural living contexts that function sustainably. This entails new ways to design cities, and new methods of construction with new materials, and all that while providing quality of life for inhabitants. This puts bioeconomy at the center of sustainable reconstruction strategies. By integrating biological principles in urban and rural planning and life, the development of the bioeconomy can contribute to higher levels of quality of life (Global Bioeconomy Summit 2020).

Biobased cities are inspired by nature’s design and circulation principles and aim for a high quality of life and a healthy lifestyle for all. In addition to renewable and environmentally friendly building materials, which can even be used in modern high-rise buildings, these concepts deal with closing the material cycles in the city. This concerns the recycling of materials, the extraction of bioenergy from

organic waste and wastewater, and the biotechnological recovery of scarce raw materials from wastewater (e.g., phosphorus) and residual materials (e.g., precious metals). The architecture makes use of local conditions and biological knowledge for natural shading, cooling, or heating of buildings and entire districts. Greenery is used strategically for shading, for air purification, to provide a recreation and movement area for the urban population, for the protection of biodiversity, and as a water reservoir and regulator.

The use of biobased and residual materials is a relevant aspect of future architecture and building projects. It should help to minimize the use of energy-intensive and nonrenewable building materials and should also be used for cost-efficient retrofits of existing buildings. In light of their material properties and their improved environmental balance, natural resources can serve as materials for buildings, as general construction materials, or for construction and interior construction. Since humans first began building houses, we have used biological resources such as wood and straw as building materials. In recent years, sustainability and energy efficiency have become increasingly important topics in the construction sector. Innovative and high-tech building materials have been developed from renewable resources. One example is wood fiber insulation materials, but cellulose from defibrated old paper, hemp, flax, meadow grass, straw, and sheep's wool can also serve as raw material for insulation. Urban bioeconomy is not only about construction, but also about urban production. "Green" industrial production and urban farming are becoming relevant. Organic aquaponics and hydroponic greenhouses provide fresh vegetables.

The Way Forward

There is an accelerating global trend into bioeconomy; about 50 countries have newly adopted bioeconomy-related policy strategies in the past decade (Dietz et al. 2018). This trend toward bioeconomy is driven by the need to address resource constraints related to climate, water, energy, and land, by recent advances in microbiology, and by shifts in consumer preferences. New opportunities are arising in bioeconomy for industries, construction, and agriculture, but strategies also need to address conflicting goals with science and policy

to ensure innovations for food security and resource protection. Policy for urban and construction transformation should focus on navigating toward sustainable bioeconomy, and fully involving the population. This includes creating strong incentives for innovation to promote sustainability, and encouraging respect and appreciation of nature as the unique inspiration and livelihood of humanity. Accelerated life science and social sciences are fundamental for mobilizing bioeconomy at scale to overcome the Anthropocene's pitfalls (von Braun 2022).

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