Eating the Sun

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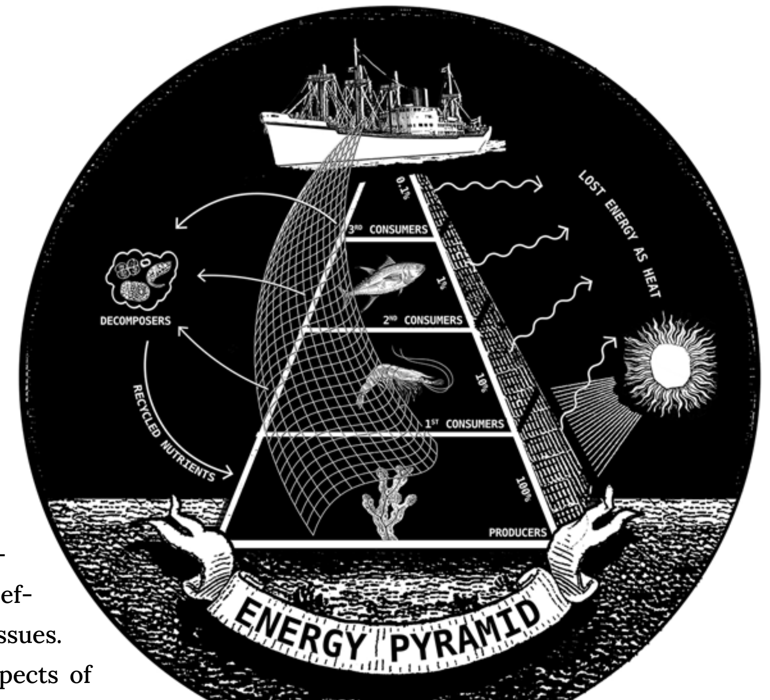
Exploring Human Sustainability as Solar-Based Regenerative Networks

Through an economic lens, this text explores how solar energy circulates through the biosphere as a primary life-supporting value. Photosynthetic organisms convert solar energy into organic matter, generating the carbon compounds that form the basis of life on Earth. Energy from the sun is the basis of the entire food chain and fuels human activities, such as gathering, hunting, fishing, agriculture, cooking, heating, and building. This investigation examines the terrestrial metabolization of solar energy as a means to reconsider the concept of sustainability. It explores how heterodox economic representations could inform governance to achieve lighter ecological footprints and sustainable human coexistence within ecosystems.

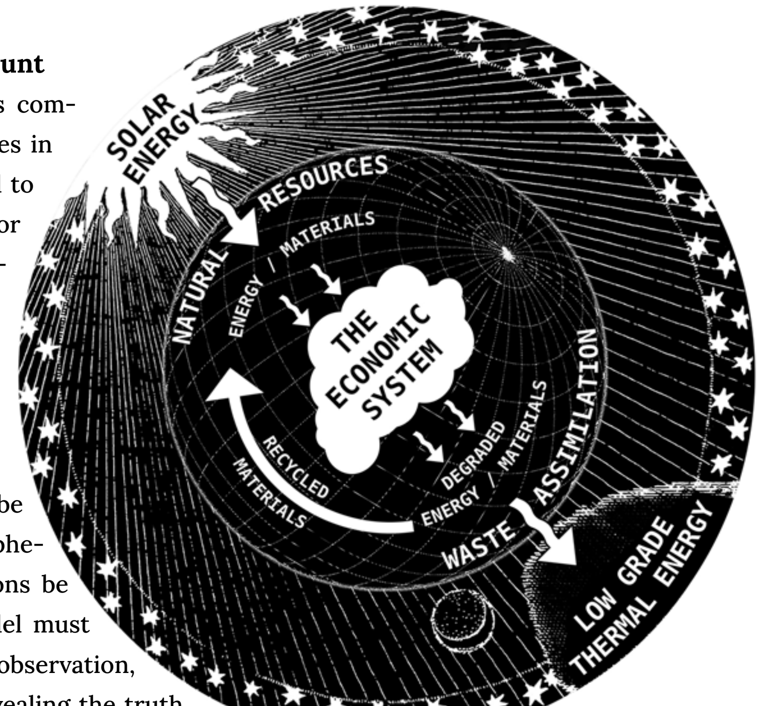
In Search of Sustainability

What does sustainability mean? We propose to examine sustainability as a social goal for humans to coexist on Earth over a long time. Since the sustainability of the material affordances of human needs is a core topic in economics, we will explore how a broader comprehension of economics, value, and accounting can effectively address such ecological issues. We propose to embrace the prospects of human 'sustainability' from the following perspective: Earth's geological materiality is finite, mining is irreversible, and geological matter is poorly recyclable. Consequently, only the network of matter-energy fueled directly and indirectly by the Sun can be understood as truly sustainable.



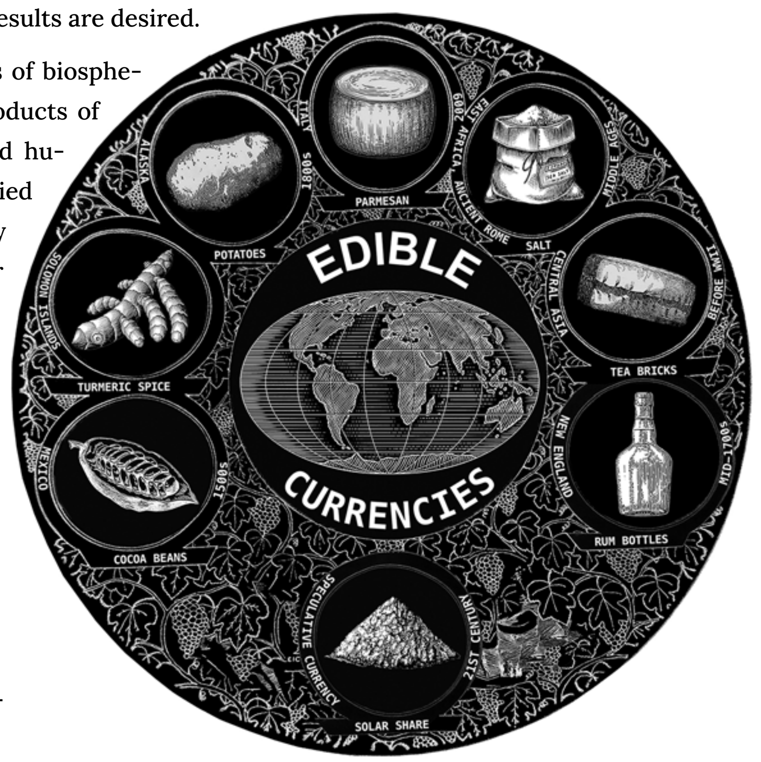
What Isn't Counted Doesn't Count

Accounting as a practice involves complexity reduction, generating biases in the process. It is therefore critical to question what is being measured or quantified. Quantification is the basis of all modern economic rationality, but quantification is incomplete by definition. Understanding that all elements of an environment are in symbiosis and cannot exist independently, it can neither be sufficient to examine any isolated phenomena nor can sufficient relations be enumerated. Any accounting model must be seen more as an instrument of observation, especially control, than as one revealing the truth of a circumstance. Further, quantification is essential to digital cybernetic operations that are designed to conform living beings to desired models of productivity and activity. In this sense, accounting can only be understood as part of a regime of governance. What is measured, and how it is measured, has to do with what results are desired.



Distinguishing Value From Money

"The cost of a thing is the amount of life which is required to be exchanged for it" (H. D. Thoreau). While monetary accounting systems are commonly used to assess sustainability, they are inadequate to the task of balancing human needs within planetary boundaries. Quantifying the value of goods or environmental assets in monetary terms — of a viable ecosystem, for example — is doomed to produce insufficient and varying assumptions due to methodological, regional, and ideological factors. In contrast to monetary accounting, alternatives which employ plant-based units with inherent metabolic value can provide valuable insights into our sustainability challenges. Historical examples such as cocoa beans, hemp, beer, or tea bricks are tangible accretions of biospheric photosynthesis, representing products of ecosystem energy flows, stocks, and human labor. Their "intrinsic value" is tied to the photosynthetic biomass they contain, the labor invested in their cultivation and preservation, and the underlying biodiversity that supports the ecosystems of which they are a part. By emphasizing the interconnectedness of goods and services with their origins in planetary biophysical processes, plant-based units can help model a sustainable global economy.

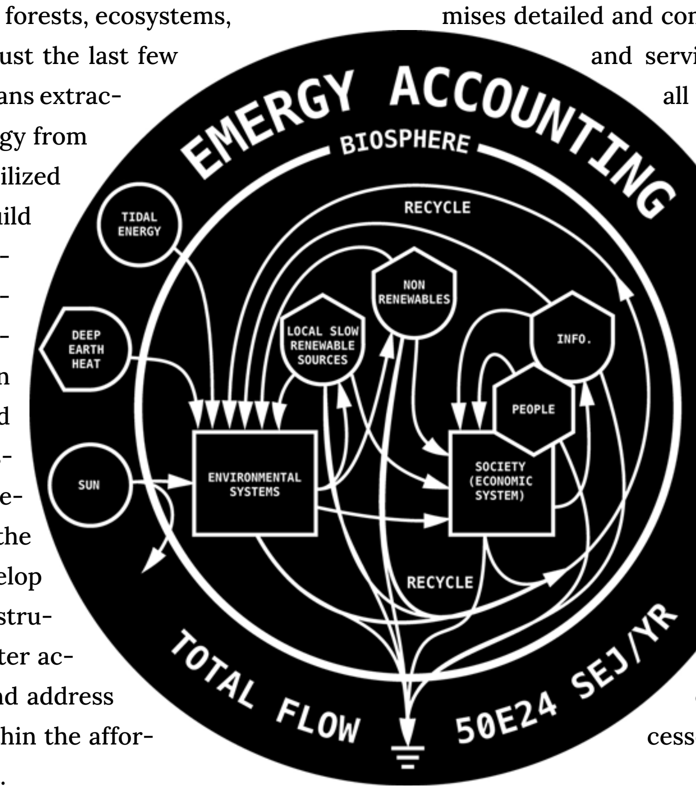


Energy as a Universal Currency

The study of energy flows as a fundamental unit for comprehending economic interactions finds its origins in recognizing the Sun's role as the primary source of energy on Earth. This idea is rooted in various cultural, scientific, and philosophical perspectives as noted by V. Vernadsky: "The biosphere is as much, or even more, the creation of the Sun as it is a manifestation of Earth-processes. Ancient religious traditions that regarded terrestrial creatures, especially human beings, as 'children of the Sun' were much nearer the truth than those which looked upon them as a mere ephemeral creation". Similar visions explored how solar energy flows and stocks fuel terrestrial systems, and how trophic chains drive vital processes to form the basis of our economic and ecological existence. "Earth is a chemical battery where, over evolutionary time, billions of tons of living biomass were stored in forests, ecosystems, and fossil fuels. In just the last few hundred years, humans extracted exploitable energy from these living and fossilized biomass fuels to build the modern economy". By recognizing the matter-energy of solar origin that is circulated within the Earth system, via photosynthesis on land and in the ocean, we can develop new economic instruments that help better account for, model, and address anthropic needs within the affordances of the planet.

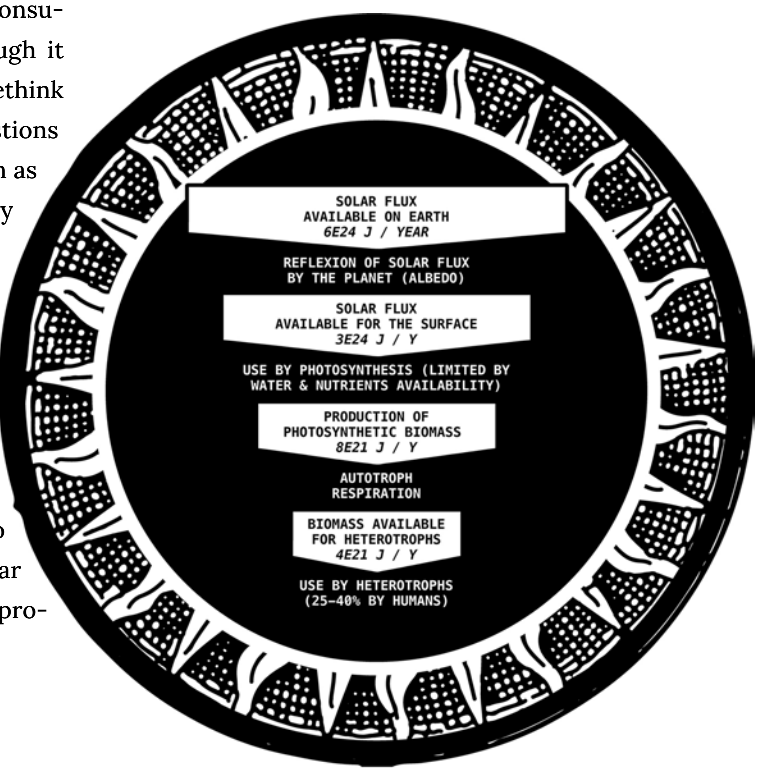
Accounting for Historical Solar Energy

To unfold our investigation into solar value, we propose to look at Emergy (with an M), an accounting method proposed by American ecologist H. T. Odum in the 1970s to analyze energy flows in ecosystems. In the Emergy model, the Earth system, biosphere, and all human activity on the planet from the most rudimentary to the most industrialized are examined as transformations of solar energy flows. Emergy provides a unit: "solar-equivalent joules", which allows us to model an energetic economy of the Earth related to solar income (for instance, 1 joule of plant matter is the product of 40,000 solar-equivalent joules). This systemic approach can be applied to concrete examples, such as the food chain or the economic flow of a country. It models the interconnectedness of ecological and economic cycles, much like a circuit diagram. Emergy promises detailed and comprehensive modeling of goods and services as tree structures, where all anterior solar energy consumed is factored in. Though it helps to radically rethink fundamental questions in economics, such as how to adequately value a commodity. While the Emergy method is not intended for exact quantitative analysis, it provides a unique insight into the magnitudes of solar energy embedded in vital processes across the economy.



Accounting for Historical Solar Energy

We need to recognize the limits of renewable energy, as the mathematician-economist Nicholas Georgescu-Roegen has pointed out: "Future generations will still be able to access their inalienable share of solar energy. However accessible material low entropy is by far the most critical element from the bioeconomic viewpoint, [...] a piece of coal burned by our forefathers is gone forever, just as is part of the silver or iron mined by them". Today, any circulation of energy in industrialized human society requires the use of non-renewable minerals. Even renewable energy infrastructures rely intensively on non-renewable mineral resources, raising critical justice concerns about the intergenerational allocation of finite resources. For the physicist José Haloy, technologies characterized by non-renewables, planned obsolescence, and fossil fuel use are "zombie technologies" that, as waste, continue to affect the biosphere after they are "dead," destined to haunt humanity for ages.



Planetary Photosynthesis as an Indicator of Renewable Flows

Since 2000, ground data and satellite imagery of photosynthetic processes monitored on a planetary scale are increasingly confirming earlier theories of solar value flows. Recent instruments developed for planetary observation provide data that inform our understanding of the links between solar energy, autotrophic biomass — microalgae, algae, plants — and global human needs. This data provides estimates of the quantity of stored energy generated by photosynthesis, which is critical for sustaining human activity on the planet. NASA's annual Net Primary Production (NPP) figures illustrate and estimate the primary work of the Earth's ecosystem, which continually captures solar energy via photosynthesis and physically stores it in living matter, sustaining flows in the rest of the living organisms. NPPs can now be used to test and challenge the hypotheses of the last century linking sustainability and biomass energy. The annual NPP is estimated to be 104.9 petagrams of carbon per year. We propose to provisionally consider this as "solar income", a reference for the primary matter-energy budget renewed via photosynthesis each year in the Earth system. This hypothesis enables us to construct realistic "strong sustainability" scenarios that recognize the maximum biomass energy available to all living beings.

The Limits of Biomass Exploitation

NPP, a measure of renewed autotrophic biomass mentioned above, is estimated based on satellite observations of fluorescence produced during photosynthesis. But how do human activities relate to this process? A significant proportion of photosynthesis production (NPP) is consumed by humankind, either directly for food, fiber, livestock, and wood, or indirectly through land use. The Human Appropriation of Net Primary Production is an indicator (HANPP) that represents vectors of appropriation, extraction (setting nature to work), and transfers of wealth (exploitation) from the biosphere and its biodiversity to human societies; from rural areas to cities; from peripheral regions to megalopolises; from the Global South to the Global North; from oceans to land. HANPP is currently estimated at 25% to 40% of global photosynthetic production (NPP). As an indicator of the decline in biodiversity, a critical HANPP threshold of well below 50% of NPP has been identified as likely to trigger irreversible systemic disruption. How can we use these complementary indicators at both global and ultra-local levels to guide sustainable human projects on this planet? Can these indicators help reorient economic policy away from the narrow imperatives of GDP growth, and "green" profiteering?

The Solar Share, a Portion of the Biosphere's Work

Autotrophs give life to the Earth. Photosynthetic organisms can effectively slow down the speed of light by converting solar energy into persistent carbohydrates. This phenomenon provides the basis for a tangible method of reconsidering human activities as embedded in Earth's ecosystem processes. Starting from an accounting of photosynthetic biomass, human-available metabolized energy income from the sun, it becomes possible to elaborate a basic energy unit, a "solar share" on which comprehensive models of accounting for human material needs within the affordances of the planet can be built. Such a unit can meaningfully and reliably inform sustainable governance of human-ecosystem interactions, emphasizing the pivotal role of photosynthetic organisms and the ecosystems they regenerate. The Solar Share can bridge between our cosmic origins and our common cause of long-term planetary viability.

This investigation prefigures The Solar Share, an artistic research by disnovation.org, a research collective whose core members include Maria Roszkowska (Pl/Fr), Nicolas Maigret (Fr), Baruch Gottlieb (Ca/De) and Jérôme Saint-Clair (Fr).

The Laboratory Planet

Planetary Peasants

planetary turn, biofuturism, peasants revolts, soil chemistry, plantationocene, terricide, monohumanism, agroforestry, dehesa, resource curse, biopolitical wars, terraformation, extermination, climate justice, symbiosis, consociation, mutual aid, feral living, satoyama, multispecies landscapes, agroecology, bioregionalism, zomia, rural public order, œgrowth, negentropy, energy

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Between 1961 and 2016, the number of people on Earth doubled, and the global area of cultivated land per capita was halved[1]. According to United Nations projections, the world's population is set to increase by 2 billion over the next 30 years, from 8 billion today to 9.7 billion in 2050[2]. In these new conditions, how can the Earth remain habitable for all?

Laboratories for habitable futures

In 2007, we created the journal The Laboratory Planet, based on the intuition that from a "factory planet" it was necessary to move on to the analysis of a "laboratory planet" – where "acceptable risk" is the adjustment variable for experiments on a scale of 1. We postulated that 1945 was the symbolic date of this transition, with the atomic bomb as marker and symptom. We were just beginning to hear talk of the "Great Acceleration" and the Anthropocene, but it was already clear that the construction of environmental monitoring, with its apparatus ranging from micro-sensors for terrestrial measurements to satellite observation, stemmed directly from the technologies and methodologies of Cold War nuclear deterrence. Without the deployment of this military-industrial complex, we now know that it would have been impossible to define either the Great Acceleration or the Anthropocene. The continuous monitoring of Earth System indicators is an indirect legacy, as are the institutions themselves, and the technocracy that accompanies them. Our aim is to highlight the "Anthropocene Bomb"[3] that exploded at the turn of the 1950s, and the "alien" character of computers' conquest of the Earth[4].

But as science historian Christophe Bonneuil points out, awareness of the "planetary turn" goes back much farther than the view of the Earth from the Moon, or the founding of the International Union for Conservation of Nature at the end of the Second World War. He reminds us that, while the historian community now concedes the existence of a "consciousness of globality" since at least the 16th century, "regimes of planetarity" remain largely unclear[5]. And as Gayatri Chakravorty Spivak wrote in 1999, "The globe is on our computers. Nobody lives on it"[6].

Since then, the Indian philosopher has been encouraging us to move away from the technicist vision of the "globe", perceived as invading and controlling the planet, towards a "planetary" gaze that would encounter this other that we inhabit, as well as the othernesses with whom we cohabit on Earth.

At a time when living conditions are deteriorating ever further, ecologically as well as socially and humanly, this is the direction we propose to take. In this issue, we imagine a peasant and neo-peasant future, invented by planetary peasants, organized in diverse territories, cultivating biotopes that are more heterogeneous, more democratic, and therefore more habitable than those of imperial cities. This issue opens up to a central section on the recent Soil Assembly initiative, and develops some of the experiences, reflections and surveys collected within this emerging network.

The futurism that guides us here – that of the peasants who have demonstrated their millennia-old ability to shape living landscapes, and that of the neo-peasants who are inventing new forms of agricultural, pedagogical and social arts – is in solidarity with the Earth and its destiny. It does not claim to accelerate the biosphere and living beings, as we accelerate the evolution of the technosphere with capital. Rather, it seeks to thicken the living, to densify beings, to increase their consistency.

This issue of La Planète Laboratoire is not leaving behind the dying Earth for the Moon or the stars, it is looking toward our soils, our hedgerows, our forests, our mountains, our deserts, our rivers, our seas and the teeming world that inhabits them.

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(1) It decreased from around 0.45 hectares per inhabitant in 1961 to 0.21 hectares per inhabitant in 2016 (FAO, Land use in agriculture by the numbers, 07 May 2020).

(2) https://www.un.org/fr/global-issues/population

(3) Ewen Chardronnet, "La Bombe Anthropocène", AOC, 28 March 2024.

(4) See previous issues of *The Laboratory Planet*.

(5) Christophe Bonneuil, "Der Historiker und der Planet. Planetaritätsregimes an der Schnittsstelle von Welt-Ökologien, ökologischen Reflexivitäten und Geo-Mächten", in Frank Adloff et Sighard Neckel (dir.). *Gesellschaftstheorie im Anthropozän*, Frankfurt, Campus, 2020, pp. 55-92.

(6) Gayatri Chakravorty Spivak, *Imperatives to Re-Imagine the Planet* (Vienna: Passagen Verlag, 1999), 44. Cited in Jennifer Gabrys, "Becoming Planetary", *e-flux Architecture*, 2018.