

Annual Review of Environment and Resources Research On Degrowth

Giorgos Kallis,^{1,2} Vasilis Kostakis,^{3,4} Steffen Lange,⁵
Barbara Muraca,⁶ Susan Paulson,⁷
and Matthias Schmelzer^{8,9}

¹ICTA, Autonomous University of Barcelona, 08193 Barcelona, Spain;
email: giorgoskallis@gmail.com

²ICREA, 08010 Barcelona, Spain

³Ragnar Nurkse School of Innovation and Governance, Tallinn University of Technology,
19086 Tallinn, Estonia; email: kostakis.b@gmail.com

⁴Berkman Klein Center for Internet & Society, Harvard University, Cambridge,
Massachusetts 02138, USA

⁵Institute for Ecological Economy Research, 10785 Berlin, Germany;
email: steffen.lange@ioew.de

⁶College of Liberal Arts, Oregon State University, Corvallis, Oregon 97331, USA;
email: barbara.muraca@oregonstate.edu

⁷Center for Latin American Studies, University of Florida, Gainesville, Florida 32611, USA;
email: spaulson@latam.ufl.edu

⁸Konzeptwerk Neue Ökonomie, 04229 Leipzig, Germany; email: m.schmelzer@knoe.org

⁹DFG Research Group "Postgrowth Societies," University of Jena, PF 07737 Jena, Germany

Annu. Rev. Environ. Resour. 2018. 43:291–316

First published as a Review in Advance on
May 31, 2018

The *Annual Review of Environment and Resources* is
online at enviro.annualreviews.org

<https://doi.org/10.1146/annurev-enviro-102017-025941>

Copyright © 2018 by Annual Reviews.
All rights reserved

Keywords

economic growth, green growth, sustainability, political ecology,
ecological economics, democracy

Abstract

Scholars and activists mobilize increasingly the term degrowth when producing knowledge critical of the ideology and costs of growth-based development. Degrowth signals a radical political and economic reorganization leading to reduced resource and energy use. The degrowth hypothesis posits that such a trajectory of social transformation is necessary, desirable, and possible; the conditions of its realization require additional study. Research on degrowth has reinvigorated the limits to growth debate with critical examination of the historical, cultural, social, and political forces that have made economic growth a dominant objective. Here we review studies of economic stability in the absence of growth and of societies that have managed well without growth. We reflect on forms of technology and democracy compatible with degrowth and discuss plausible openings for a degrowth transition. This dynamic and productive research agenda asks inconvenient questions that sustainability sciences can no longer afford to ignore.

**ANNUAL
REVIEWS CONNECT**

www.annualreviews.org

- Download figures
- Navigate cited references
- Keyword search
- Explore related articles
- Share via email or social media

Contents

1. INTRODUCTION	292
2. HISTORY: ORIGINS OF THE GROWTH PARADIGM.....	294
3. ECOLOGICAL ECONOMICS: THE LIMITS OF GREEN GROWTH.....	296
4. MANAGING WITHOUT GROWTH: THE ECONOMICS OF DEGROWTH.....	298
5. ANTHROPOLOGY AND SOCIAL SCIENCES: STUDIES OF SOCIETIES LIVING WITHOUT GROWTH.....	301
6. TECHNOLOGY STUDIES AND DEGROWTH.....	303
7. POLITICAL SCIENCE: DEMOCRACY AND DEGROWTH.....	306
8. CONCLUSION: A DEGROWTH TRANSITION?	308

1. INTRODUCTION

Degrowth is a new term that signifies radical political and economic reorganization leading to drastically reduced resource and energy throughput. Related scholarship critiques the ideology behind the dogma of economic growth; contributes to documentation of negative material, social, and ecological effects of growth; and assesses alternatives to growth-based development (1). Put simply, the degrowth hypothesis is that it is possible to organize a transition and live well under a different political-economic system that has a radically smaller resource throughput.

In the early 2000s activists in Lyon, France, mobilized the slogan *Décroissance* (Degrowth) in direct actions and publications against cars, consumerism, and advertising (2). The term was drawn from the title of a translated collection of essays by physicist-economist Nicholas Georgescu-Roegen who, in the 1970s and 1980s, developed a thermodynamic theory of economic processes, concluding that in the long run economic activity will inevitably “decrease” to a level supportable by solar flows (3). The impulse toward degrowth was also inspired by thinkers including Serge Latouche, an economist and critic of the Westernization of Africa, who popularized *Décroissance* through a series of books in the 1990s and 2000s that criticize economic reasoning and the ideology of economic development (in English, see 4).

Degrowth became a missile slogan for activists in France, Italy, and Spain, followed by other parts of Europe and beyond (2). A community of scholar-activists studying and practicing degrowth formed around a series of biannual international conferences starting in 2008. Most of the 4,000 participants in the 2014 Leipzig conference converged on their critique of green growth, and that ecological and social sustainability require a radical reorganization of society, although opinions varied on how this might—or should—play out (5).

This new (and young) generation of scholars mobilizes concepts and tools across disciplinary boundaries and goes beyond critique to study conditions for the emergence and proliferation of viable alternatives. Degrowth conferences follow participatory formats with sessions and assemblies that facilitate conversation among scientists, activists, and political stakeholders (6). Emerging paradigms of activist and post-normal science draw awareness to values and political stakes that influence scientific inquiry and promote involvement of lay communities in the struggle for the production and verification of knowledge (7). Scholars theorizing degrowth learn with, articulate, and apply critical perspectives already embodied by social movements, notably those engaged in environmental justice struggles. The flow of ideas is multidirectional; after reading scholarly work, activists launched the term degrowth, and their applications have traveled back to consideration by scientists and scholars (8).

Degrowth: a process of political and social transformation that reduces a society’s throughput while improving the quality of life

Throughput: the energy and resource flows in and out of an economy

Economic growth: an integrated cultural, political, ecological, and economic process manifested as an increase in the total market value of all goods and services (GDP)

Green growth: economic growth accompanied by a reduction of a society’s throughput

Degrowth is a normative concept with analytical and practical applications. In this regard, degrowth research is not any different from growth or development economics, which also start from a normative premise—that growth and development are desirable—then investigate and promote conditions for their realization.

Fournier (9) reviews older francophone literature on *Décroissance*, and Weiss & Cattaneo (10) review over 100 recent peer-reviewed articles with the word “degrowth” in their titles. Our article covers a wider range of research relevant for the degrowth hypothesis (**Figure 1**). Section 2 reviews work by historians on the origins and rise to dominance of the idea of growth. Section 3 reviews recent work, mostly by ecological economists and sustainability scientists, on the unsustainability of green growth. These two literatures show the ideological and political construction of growth and its ecological and social limits—these are foundational elements of the degrowth agenda, which asks how we can manage without growth in the case that growth is not desirable or sustainable

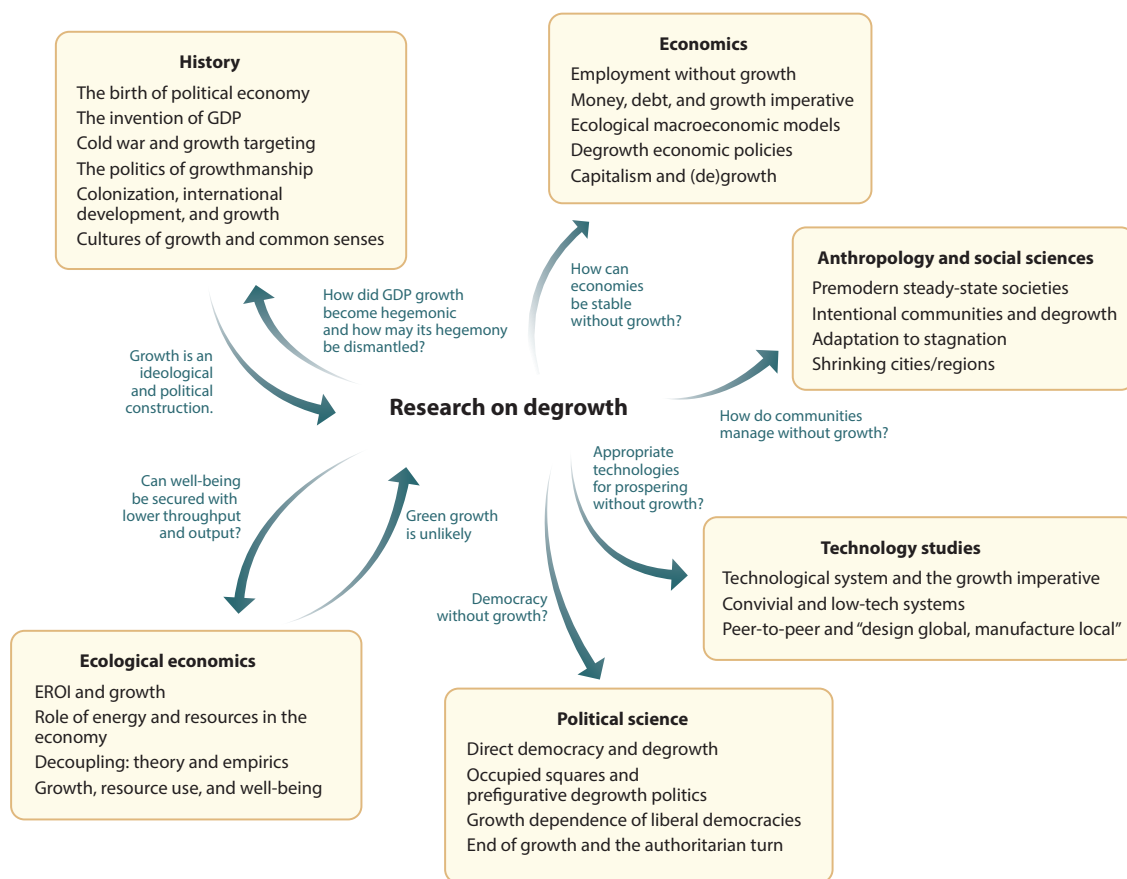


Figure 1

Research on degrowth. Here we show the different themes of degrowth research and the disciplines they come from (political science, economics, ecological economics, history, anthropology, and technology studies). Research on the history of ideas and on ecological economics provides the two foundational degrowth ideas: that growth is an ideological construction and that growth is ecologically unsustainable. Making economies and societies stable without growth, then, raises new questions that are addressed by research communities in these and other disciplines.

(Figure 1). This creates a range of questions addressed by the historical and ecological-economic literature (see arrows in Figure 1), but also by other literatures. Section 4 focuses on the economic literature and what it offers in seeking to understand how economies may be stable without growth. Section 5 draws insights from ethnographies of social systems that have managed well without growth. Section 6 looks at technology and degrowth. Section 7 considers political philosophy and work on links between democracy and degrowth. Section 8 concludes by looking toward conditions for a degrowth transition.

2. HISTORY: ORIGINS OF THE GROWTH PARADIGM

The growth paradigm refers to the entrenched cognitive framework in which economic growth is constructed and conceived as necessary, good, and imperative (11, 12). When and why did this paradigm come about, and how did it become hegemonic?

Here we review historical-anthropological studies on the economy within a broader research field on invented (national) traditions. These studies show that the apparent natural status of the national economy as a distinct institution is of relatively recent origin, with consequences including the separation and mystification of the economy as a domain of professional experts, unknowable to common people. Better understanding of historical invention of the economy informs efforts to reverse this process by reclaiming economic activities as a public domain that can be understood—and changed.

One can distinguish two separate periods in the genesis of “the economy” as concept and institution (13). Scholars such as Margaret Schabas and Michel Foucault analyze how the birth of political economy in eighteenth- and nineteenth-century France and Britain formed the economic sphere as a separate sphere of social life and as the domain of a specific kind of social action (14, 15). The economic sphere was construed as a relatively autonomous, self-equilibrating sphere governed by different laws than nature (14), and also distinct from the state. The state supposedly intervened from the outside into that economic sphere (15, 16). In the second period of change, during the 1930s and 1940s, what we now identify as “the economy” was established as a self-contained structure or totality of relations of production, distribution, and consumption of goods and services within a given geographical space (17–19). Economic growth as a policy goal appeared in the 1950s (see collection of essays in 20), together with the development of accounting techniques and statistical tools designed to represent and measure it. Processes of state-sponsored economic statistics, particularly national income accounting, worked to mark the national economy as a well-defined object (13, 18).

Research on the power of economic statistics and the public trust in numbers shows how GDP statistics were devised and gained dominance in the making of nation states, in socio-economic and military conflicts, geopolitics, and global uneven development. Studies vary from popular critiques of the “Gross Domestic Problem” (21–23), to analyses of specific aspects of the internationalization of GDP accounting (see 24; 25, chapter 1), to stories of the making and contribution of GDP (26, 27). The statistical convention of GDP crystallized the formerly fuzzy sphere of the economic into a technical object with well-defined content and boundaries. GDP has been characterized as a global abstraction that naturalized the nation state and became, such as the anthem and the flag, a symbol of national sovereignty (24). It rose to prominence between the 1930s and 1950s, linked to Keynesian efforts to counter the Great Depression and to plan expenditures for the Second World War and postwar reconstruction (25).

Boundaries construct exclusions. The limitations of GDP as a measure of wellbeing, or even of economic output, are widely known. GDP calculations increase not only with the flow of goods and services valued as “good,” but also with expenditures for social “bads,” such as prisons,

disasters, epidemics, and oil spills. GDP does not count valuable unpaid work for subsistence or caretaking, nor ecosystem services, and ignores enjoyment of the commons, unless they are enclosed and commodified with monetary admission. What is less known is that the early founders of GDP were aware of these limitations, extremely cautious regarding universal applications, and wary of the statistic's ability to measure welfare, and to be used for comparisons over space and time. The institutionalization of national accounts involved fundamental controversies about how to define economic output, such as whether public expenditures should be counted as output (they were counted), whether or not to include unpaid housework and subsistence labor (they were excluded), and whether it makes sense to weigh different expenditures by their prices alone. It was not scientific consensus, but rather the political usefulness of market-oriented data for countercyclical policies, war planning, and the distribution of development aid that turned GDP into a universal yardstick (25–27).

But even after the introduction of GDP, Keynesian-led economic discussions focused on levels of output, employment or prices, and whether these could be sustained, not on rates of change. When and how did the shift to growth happen? Unprecedented political focus on growth emerged in the early 1950s (first in the United States and somewhat later in Europe and Japan), giving rise to growthmanship, a form of politics focused primarily on the pursuit of economic growth as an all-embracing and overarching priority. Heinz W. Arndt's (28) *The Rise and Fall of Economic Growth* is a classic history of the work on growth by British and US economists. Other historians and political scientists trace the evolution and politics of the growth paradigm in the United States, Britain, Japan, and other countries (11, 29, 30). Beyond national peculiarities, there are noticeable similarities between growth discourses in OECD (Organisation for Economic Co-operation and Development) nations in the postwar decades.

GDP numbers were increasingly politicized as growth became a pivotal policy goal of governments in the context of Cold War competition, the pursuit of modern development, and pacification of class struggles. In the West, growth was instrumental to diffuse demands of the workers' movement, and in the East, to excuse the lack of democracy and the failure of more revolutionary ambitions (11, 12, 25). In parallel processes, growth targeting became a driver of five-year socialist plans and of social-democracy programs. Overambitious growth targets of the Soviet Union scared the West, and helped US and European progressives to overcome resistance by liberals to economic plans and targets that gave a stronger role to government (25).

We know little, however, of the genesis of the growth paradigm in the Eastern bloc, or how it became entrenched despite the abolition of certain capitalist institutions. Such knowledge would help us to better understand how growth became a bipartisan narrative that now transcends ideological divisions. Scholarship on institutional and political-economic processes that established the growth hegemony can also be strengthened by complementary research on how the paradigm infiltrated everyday practices and became popular commonsense.

The depth of that internalization became clear in the wake of environmental and social critiques and movements that challenged the growth paradigm in the late 1960s and early 1970s. These newly emerging problems were integrated into the paradigm without displacing core principles, as evidenced in subsequent sustainable, green, and inclusive growth strategies (25). Repeated efforts to replace or amend GDP have proved futile, given that the peculiar circumstances supporting the internationalization of national accounting in the mid-twentieth century cannot be reproduced. Today GDP is not just an economic statistic, but a means to organize society on the assumption that only markets create wealth (21). Questioning GDP and searching for alternative indicators is not just a technical question, but a political and cultural project that requires significant reorganization of economic institutions, such as markets and ownership structures, as well as diverse sociocultural institutions that organize social security, social stratification, and prestige (21, 23, 25).

Growthmanship:

a form of politics focused on the pursuit of economic growth

Growth paradigm:

a worldview institutionalized in social systems proclaiming that economic growth is necessary, good, and imperative

Absolute decoupling:
an absolute decline in
throughput, alongside
GDP growth

Relative decoupling:
growth in the rate of
throughput slower
than GDP growth

Purposeful economic growth had precursors in colonial doctrines of improvement and development, and was used to stabilize the international economic order after each world war (31). During the second half of the twentieth century, it was entrenched through processes of internationalization of standards and rules, rising power of the profession of economics, and international competition in the context of the Cold War and decolonization (12, 25).

The rise of the growth paradigm was integral to the invention of development and the “making of the Third World” (19, 32). Post-development scholars have shown how, starting with President Truman’s 1949 inaugural address, large parts of the world (largely colonies or former colonies), were defined as underdeveloped, subject to development aid by those countries identified as developed. Backed by the first set of national income estimates (24), this division justified a range of interventionist policies.

Post-development studies articulated through the work of Serge Latouche and others are important predecessors and sources for degrowth, examining the ideology of growth-based development as a Western myth that naturalizes sociohistorical processes as unidirectional, continuous, cumulative, and irreversible, thereby justifying the expansion of capitalist markets and economic growth throughout the world (1, 33). In Latouche’s spirit, degrowth is not only about downscaling energy and resource use, but also about an overall project of exiting economism (9), that is, decolonizing the social imaginary and liberating public debate from prevalent discourses couched in economic terms, privileging growth (4).

3. ECOLOGICAL ECONOMICS: THE LIMITS OF GREEN GROWTH

Although driven by political, institutional, and discursive processes, growth is also biophysical. The economic process converts energy, resources, and matter to goods, services, and waste (34). In theory, it seems possible to decouple material throughput from economic output by improving the resource efficiency of production. Ecological economists, however, argue that in practice absolute decoupling is unlikely, even though relative decoupling is common (34). Efficiency should not be confused with scale (35): The more efficiently we use resources, the lower they cost, and the more of them we end up using (36). This is, in essence, growth. Just as increases in labor productivity lead to growth and new jobs, not to less employment, increases in resource productivity increase output and resource use (37). Capitalist economies grow by using more resources and more people, more intensively. Accelerating this is unlikely to spare resources.

Growth can become “cleaner” or “greener” by substituting, for example, fossil fuels with solar power, or scarce, environmentally intensive metals with more abundant and less intensive metals. But new substitutes have resource requirements, and life-cycle impacts that cross space and time. Energy is a vital source of useful work (38); growth has been possible because fossil fuels did things human labor alone could not do. Ending the use of fossil fuels is likely to reduce labor productivity and limit output (34). Solar and wind power are constrained only by their rate of flow, but unlike fossil fuels, they are diffuse—more like rain than a lake (3). To collect and concentrate a diffuse flow of energy, more energy is necessary and more land is required. The EROIs (energy returns on energy investment) of renewable energies are between 10:1 and 20:1, compared to more than 50:1 for earlier deposits of oil and coal (39). An economy powered by a diffuse energy flow is then likely to be an economy of lower net energy and lower output than one powered by concentrated stocks (3). Land use for solar or wind also competes with the use of land for food production, and rare materials are necessary for infrastructures and batteries that store their intermittent flows, with significant environmental effects.

Historical data corroborate ecological economic theory (40). Ayres & Warr (38) find that the use of net energy after conversion losses explains a big portion of the United States’ total factor

productivity and economic growth. At the global level, GDP and material use have increased approximately 1:1. Carbon emissions have increased somewhat slower than GDP, but still have increased (34). This is unlikely to be a coincidence. Exceptions may exist, but cross-panel data analysis shows that overall, 1% growth of a national economy is associated with 0.6% to 0.8% increase in its carbon emissions (41) and 0.8% growth in its resource use (42).

Global resource use follows currently the “collapse by 2050” scenario foreseen in the “Limits to Growth” 1971 report (43–45). Domestic material use in some developed OECD economies has reached a plateau, but this is because of globalization and trade. If we take into account imported goods, then the material requirements of products and services consumed in OECD countries have grown hand in hand with GDP, with no decoupling (46). For water use, the effects of growth overwhelm any realistic savings from technologies and efficiency (47); water footprints have increased even in regions such as California where water withdrawals were stabilized (40).

Carbon emissions in some EU (European Union) countries have been declining, even after trade is taken into account, suggesting some substitution of fossil fuels by cleaner energies. [Although recession also played a role (34).] These declines are nowhere near the 8–10%, year-after-year reductions in carbon emissions required for developed nations under scenarios compatible with a 50% chance of limiting warming to 2°C (48). Further reductions will be harder to sustain once one-off substitutions of oil or coal with natural gas are exhausted (34).

Resource use or carbon emissions are a product of the scale of the economy (GDP) times its resource or carbon intensity (kg/GDP or kgCO₂/GDP). With 1.5% annual increase in global income per capita, carbon intensity has to decline 4.4% each year for staying within 2°C; with 0% growth, carbon intensity has to fall 2.9% each year (49). In the period 1970–2013, the average annual reduction rate for carbon intensity was less than 1.5%—and this gets harder to sustain as the share of carbon-intensive economies in global output increases (49). As Jackson (50) showed in his seminal work, it is practically impossible to envisage viable climate mitigation scenarios that involve growth. This calls for research on managing, or prospering, without growth (50, 51).

Some scenarios deem possible meeting climate targets while sustaining growth, but these generally assume after 2050 some sort of “negative emissions technology,” geo-engineering or otherwise. According to a recent *Nature* editorial, these technologies remain currently “magical thinking” (52). Clean energy investments can stimulate the economy in the short run, but in the long run growth may be limited by their low EROIs. Studies suggest that economic growth requires a minimum EROI of close to 11:1 (53). Less EROI means less labor productivity, and hence less growth. Indeed, “Limits to Growth” scenarios do not predict growth ending when resources are exhausted but, rather, when the quality of resources declines to such an extent that further extraction diverts more and more investment away from productive industry (44).

Degrowth is defined by ecological economists as an equitable downscaling of throughput, with a concomitant securing of wellbeing. If there is a fundamental coupling of economic activity and resource use, as ecological economics suggests there is, then serious environmental or climate policies will slow down the economy. Vice versa, a slower economy will use fewer resources and emit less carbon (40). This is not the same as saying that the degrowth goal is to reduce GDP (54); slowing down the economy is not an end but a likely outcome in a transition toward equitable wellbeing and environmental sustainability.

Advancing a position of “a-growth,” van den Bergh (54) proposes ignoring GDP and implementing a global carbon price, indifferent to what its effect on growth turns out to be. Ignoring GDP is a normative position—but in the end, the economy will either grow or not, and if it does not, then there should be plans for managing without growth. Given how entrenched GDP growth is in existing institutional and political structures, a-growth approaches must be advanced as part of broader systemic change (55).

Is it possible to secure a decent standard of living for all while throughput and output degrow? Substantive evidence indicates that prosperity does not depend on high levels of production and consumption. Kubiszewski et al. (56) find that the Genuine Progress Indicator, an indicator that includes environmental and social costs alongside output, peaked in 1978, despite subsequent global growth. A similar indicator, the Index of Sustainable Economic Welfare, has stayed at the same levels in the United States since 1950, despite a threefold growth of GDP (57).

Wealthier countries on average have higher levels of life expectancy and education than poorer ones, but above a certain level of GDP, income does not make a difference in wellbeing—equality does. Satisfactory levels of wellbeing are achieved by countries such as Vietnam or Costa Rica at a fraction (one-third or less) of the output, energy, or resource use of countries such as the United States. Even the lower levels of resource use of mid-income countries, however, would not be sustainable if they were to be generalized to the planet as a whole. No country currently satisfies social wellbeing standards while staying within its share of planetary boundaries, suggesting that radical changes in provisioning systems are necessary (58).

Wealthier people within a country are on average happier than others, but in the long run, overall happiness does not increase as a country's income rises (59). Nuances of this income-happiness paradox depend on the sample of countries included and how one defines and asks about happiness. Within societies, individuals with higher incomes evaluate their lives as better than others, but do not enjoy better emotional wellbeing (60). Income determines social rank, and rank affects individuals' assessments of their lives. Growth does not change relative rank or relative access to positional goods (those signifying position) but it does inflate expectations and prices of material goods, increasing frustration (61). Relative comparisons matter for personal wellbeing in low-income and high-income countries; for both, the more equally income is distributed, the happier people are (62). Pro-environmental behaviors and sharing are also strongly associated with personal wellbeing (63). This suggests that an economic contraction may not impact wellbeing negatively if accompanied by redistribution, sharing, and value shifts (34).

There is no political constituency currently demanding degrowth, but a survey of 1,008 people in Spain finds that one-third prefers ignoring or stopping growth altogether (64). Even so, the majority, including those in this one-third, want growth rates in the order of 3% or higher (64). This may not be as paradoxical as it first seems: One may be aware that continued growth is impossible or catastrophic but also sense that capitalist societies need growth to avoid collapse. The stability of current economies does depend on growth—growth is necessary to avoid unemployment, reduce debt, and fund public services. Recent economic research, however, shows that this is not necessarily so—under certain conditions, economies may function well without growth. We now turn to this research.

4. MANAGING WITHOUT GROWTH: THE ECONOMICS OF DEGROWTH

Although literature explicitly addressing degrowth economics is young (65), economists have long raised similar questions. Classical economists considered the concept of a stationary state, where economic growth eventually and unintentionally ends, be it due to limits to the division of labor (Smith) or a confined supply of land (Ricardo). Whereas Smith and Ricardo painted a dark picture of the stationary state in contexts with high levels of economic inequality, Mill argued that distributional policies could lead to a high degree of social welfare (66).

Economists may share politicians' obsession with growth, but there is nothing in neoclassical models to suggest that zero or negative growth is incompatible with full employment or economic

stability. In recent years, several authors have investigated no-growth economies in the context of established macroeconomic theories. From a neoclassical supply-side perspective, Irmen (67) shows that market economies do not always generate growth, nor do they need growth to function. Lange (68) tests several models and shows that the major condition for stable degrowth is a decline in the supply of production factors—labor and/or natural resources—and a reduction of working hours (51). Heikkinen (69) and Bilancini & D'Alessandro (70) develop neoclassical models in which decreases in labor supply lead to stable degrowth with increasing social welfare, as consumption losses are overcompensated by more free time, allowing enjoyment of nonmaterial relational goods.

In Keynesian models, the primary condition for an end of growth is constant aggregate demand. Fontana & Sawyer (71) emphasize the role of investments: If firms invest less, wage income stabilizes and growth is low. Exploring conditions for a stable steady-state, Lange (68) examines the economic circle the other way around: The central condition for zero growth is nonincreasing demand by households and government, which leads to low levels of investment by firms. In this model, nongrowing economies have zero net investments and savings and a constant sum of consumption and government spending.

Lack of growth does not mean lack of change. Zero change in net investments may entail increased investments in one sector (e.g., renewable energies), compensated by disinvestment in another (e.g., coal). Fontana & Sawyer (71) show that with government deficit, private savings can still be positive. High levels of employment can be achieved in nongrowing economies by reducing average working hours, shifting employment toward labor intensive sectors, and/or redirecting technological change to increase resource rather than labor productivity (68).

Ecological economists have been explicitly concerned with the question of steady-state economies (35). In Daly's (35) concept, market mechanisms bring about an efficient and stable steady-state economy, if (a) a relatively equal distribution of income and wealth is guaranteed, (b) energy and resource throughput is capped, and (c) population growth is limited. Jackson (50) analyzes a contemporary system in which supply continuously expands due to market competition and firms' profit orientation, and consumption follows due to conspicuous consumption and materialist values. Jackson (50) paints an alternative picture of a "Cinderella economy" (p. 133) characterized by equality, reduced work, and ecological limits (p. 194). Paech (72) develops a more concrete vision of a postgrowth economy, where (a) the distance between producers and consumers is shortened with a strong regionalization of economic structures; (b) working hours are reduced and strategies to reduce consumption by repairing, sharing, and downscaling allow for higher wellbeing; (c) firms focus on preserving and repairing products rather than producing new ones; and (d) numerous policies support consumers and firms to follow these paths.

Integrated ecological-economic models are increasingly important sources of policy proposals. Victor (51) developed an econometric system-dynamics model to simulate low or negative growth paths that may be initiated by a set of economic policies including carbon taxes, reductions in average working hours, and a combination of progressive taxation and social spending. Scenarios of low or negative growth led to positive results measured by social and ecological indicators. Among others, Gran (73) extends Victor's model by including ecological footprints and comes to very similar results for the German economy.

On the basis of such studies and multiple other contributions, several authors have compiled policy packages for a transition toward degrowth economies including green taxes, caps, and the elimination of dirty subsidies. These policies limit the environmental throughput and redirect technological change to increase resource efficiency rather than labor productivity (65, 68, 72). Minimum and maximum income and wealth levels, as well as a more progressive taxation, are

intended to avoid inequality (35, 65). Divestments from dirty sectors and investments in green sectors bring about necessary sectoral changes (55, 72). To counterbalance the growth impetus observed in shareholder-based companies (74), economic legislation (e.g., legislation regarding commercials and product designs) can favor firms that are socially and ecologically responsible, including cooperatives or not-for-profit corporations and organizations (72, 75).

Reductions of working hours are included in all major degrowth scenarios (51, 76). They are meant to prevent unemployment in nongrowing economies and free up time for reproductive, subsistence, social, and recreational activities (72). However, Sorman & Giampietro (77) claim that if EROI declines, human labor will have to increase, not decrease. Scarcer and more expensive energy, be it due to depletion or climate change mitigation, will likely reduce labor productivity and demand more work to sustain the same amount of product. The amount of product, however, will not be the same in a degrowth trajectory; reductions in working hours become feasible if consumption and production are also reduced, if sharing is increased, or if conspicuous and luxury expenditures decline (78). In an energy-scarce future, it is also possible that work in the paid sector declines, whereas unpaid care or subsistence work increases. Research in Catalonia shows that the unpaid sector is much less energy-intensive than the paid (79).

A fundamental question here is whether capitalist economies could really function without growth. Binswanger (74) claims that the existing economic system and, particularly, its monetary system, create “a growth imperative.” In a model with discrete time parameters, endogenous money supply, and positive interest rates, he finds that there is an imperative for growth to pay back interests. However, others argue that this would not be the case if bank profits were socialized or distributed to savers (80). If one economic actor, for example banks, in a monetary system accumulates assets continuously, then another actor necessarily accumulates debts continuously, leading to economic instability (68, 80). Zero growth in such a setup of endogenous money and positive interest rates, however, can be achieved as long as all interest is spent (80, 81).

Competition and the drive to accumulate also create a growth imperative. Magdoff & Bellamy-Foster (82) theorize that zero growth would be possible if all wages and all revenues of firms (above replacement for capital depreciation) were consumed. Without saving and accumulating, growth would come to an end. However, they deem this scenario incompatible with capitalism, given that owners of capital are propelled to accumulate wealth (rather than spending all money on consumption) and firms must reinvest to stay competitive.

Capitalist economies do undergo prolonged periods of zero or negative growth, but these have generally been undesired and unstable periods. Without growth, profits and accumulation by capital holders come at the expense of other groups in society—intensifying economic inequalities and social tensions (83). Recession and depression are possible within capitalism; degrowth is probably not. Whereas in theory, growth may not be necessary or inevitable within capitalism, in practice, the system generates growth via dynamics of competition, private ownership, and the availability of cheap energy supply. Economic growth is also perceived as a political necessity to pacify social conflict and ensure reproduction of the system.

Lange (68) argues that a combination of collective firm ownership, prevention of economies of scale, and limits on the exploitation of fossil fuels would prevent actors from accumulating interest and reduce pressures to do so. Such reforms, however, chart a transitional pathway beyond capitalism as we know it, and raise questions of whether the resulting institutions and economic system could still be described as capitalistic (68). Blauwhof (83) claims that this is precisely why apparently innocuous reforms, such as carbon caps and taxes, a basic income, or reduced working hours, are so fiercely resisted by capitalist interests with power and are unlikely to be implemented, short of a social revolution and systemic change.

5. ANTHROPOLOGY AND SOCIAL SCIENCES: STUDIES OF SOCIETIES LIVING WITHOUT GROWTH

Studies of life-worlds not driven by expansion can broaden the horizon of environmental and economic sciences, which have tended to circumscribe desire and possibility within the already jeopardized form of industrial fossil fuel socio-economies. We can learn from noncapitalist societies that have lived long without growth; from countries and cities that adapt constructively to halted growth; and from groups within high-growth societies who live with little or no money, either by choice or by necessity (84).

Global economic growth is a nineteenth- and twentieth-century phenomenon, driven by historically unique sociocultural systems and values that developed in tandem with capitalism and colonialism (Section 2). During the preceding 200,000 years, many human populations thrived without growth. Long-enduring societies, such as Classical Greece, developed institutions, moral codes, and myths that tempered impulses for expansion (85), and expended surpluses in ceremonies and collective pursuits that reaffirmed social order as opposed to investing them to expand production (86). Scattered efforts to enlarge territories, markets, or resource use have led to processes and outcomes that historians characterize as the rise, fall, or collapse of civilizations.

History curricula pay scant attention to ways in which populations have survived and adapted over millennia with relatively steady-state economies. Throughout human existence, diverse hunter-fisher-gatherers have maintained extremely low ecological footprints, rigorously measured in contemporary groups, such as the Andaman Islanders (87). Archaeological and genomic data show that hunter-gatherer communities living in the Kalahari for 70,000 years are the longest-enduring society on Earth. During 25 years of research among a group known as the Ju/'hoansi, Suzman (88) has documented affluence measured in time, social relations, and cultural richness, rather than material possessions; he argues that the Kalahari people have made a good living by working only enough to sustain their communities in harmony with their desert environment.

Ethnographers draw attention to sociocultural features of human populations who flourish without pursuing growth. In the forests of the Democratic Republic of Congo, Lewis (89) observed that Mbendjele Yaka people value resources for their abundance, rather than scarcity, and practice management strategies aimed at sustaining that abundance, together with moral obligations for nonreciprocal sharing among community members via distribution of forest resources such as meat and honey. Studying groups on three different continents, Bird-David et al. (90) find varying manifestations of a “cosmology of sharing” in which relations among community members and with the natural world are constituted as interdependent partnerships. In a comparative analysis of data from a range of human groups, Woodburn (91) found that the most egalitarian societies favor immediate consumption rather than surplus accumulation, and they sustain social institutions that undermine uneven buildup of power, wealth, or authority.

More common today are socio-economies in which practices and meanings oriented toward expanding profit have been incorporated into older systems oriented toward reproduction of families and communities. Fraser et al. (92) compare Amazonian livelihood systems in which smallholders engage in extractivist activities for cash, variously balanced with agroforestry for subsistence, and mutuality coexists in complementarity and tension with exchange values and market mechanisms. Guttman-Bond (93) reviews engineering and agricultural technologies adapted to sustain populations over thousands of years with stable resource use: raised fields in Bolivia and Mexico, water-harvesting in the Negev desert, terraces in Yemen, and intercropping around the world. These ancient technologies based on local materials are being reinstated within some contemporary market economies, not for purposes of economic growth, but for survival and resilience in marginal environments. Altieri & Toledo (94) celebrate the role of such long-enduring technologies in a threefold agroecological revolution (technical, social, and epistemological) that is

restoring local self-reliance, regenerating agrobiodiversity, and producing healthy foods with low inputs, while empowering peasant organizations across Latin America.

Revaluation and recuperation of non-Western traditions that can inform alternatives to growth-based development range from Maya-infused Zapatista projects in Mexico, to South African ideas of Ubuntu, to Buddhist-inspired economies of happiness in Bhutan (95). Bogadóttir & Olsen (96) argue that controversial whale hunts in the Faroe Islands express principles that may nourish degrowth pathways; in communal harvests of sizes that have remained consistent over centuries, meat and blubber are shared among community members for nourishment, and neither money nor profits are generated. As with hunter-gatherers in the Congo studied by Lewis (89), these islanders find that principles of their longstanding steady-state economies (commons, ritualized sharing, immediate expenditure, respect of limits) clash with capitalist logics of scarcity and conservation, represented not only by expanding market forces, but also by international NGOs (nongovernmental organizations) who attack traditional practices with impacts that are minimal compared to those of the economic growth.

In India, Kothari (97) finds promise in grassroots local projects that exercise “radical ecological democracy” and that do not necessarily seek to scale up. Alternative forms of engaging larger-scale bioregional processes are evident in cases such as the Arvari River Parliament, formed by 72 riverine villages in western India, which meets regularly to make ecological, economic, and social decisions. In Latin America, the idea of “*buen vivir*,” nourished by deep cultural traditions that prioritize ecological balance and community wellbeing, has emerged as an alternative to developmentalism (1). Amid debates and conflicts around desired socio-ecological worlds, Bolivia and Ecuador have attempted to institutionalize aspects of this indigenous cosmology via national policies and programs.

How do growth-driven societies adapt to economic recession, resource depletion, or population loss? Involuntary declines are not degrowth in themselves, and countries in recession or depression are not degrowth experiments, unless communities make a virtue out of necessity, building low-impact livelihoods that enhance wellbeing and equality. Although there are plenty of studies of the social and economic effects of recessions, there are fewer studies of how societies adapt to them.

Some of them focus on Cuba’s special period. Without explicitly embracing degrowth, Cuban society responded to crises in the 1990s by experimenting with strategies and shifts envisioned by degrowth thinkers. Unwelcome reductions in imports of food, agrochemicals, and industrial equipment were met with shifts from high-input toward semiorganic agriculture and from energy-intensive toward labor-intensive methods, resulting in reduced ecological and carbon footprints (98). Borowy (99) documents surprising improvements during Cuba’s special period in public health indicators including maternal and infant mortality; obesity; mortality from diabetes, tumors, and strokes; and death from external causes. The rise of urban agriculture fed people well with fewer fossil and financial resources, provided labor-intensive employment, enhanced urban environments, stimulated community building, and brought about lifestyle changes with tangible health benefits (99).

Rises in Cuban life expectancy during this period contrast sharply with the concurrent mortality crisis—extreme among men—in post-Soviet Russia. Although US data indicate reduction of health-related fatalities after recessions (100), austerity cuts in health expenditures have the opposite effect (101). Cuba-specific advantages in achieving this transition included relative socioeconomic equality, strong public policies, such as support of public health, absence of landlord and agribusiness interests, and limits to private accumulation. Analysts, however, agree that degrowth processes would have also benefitted from more open democracy.

Other studies focus on shrinking cities. The city of Leipzig shrank continuously since 1966, and more quickly since 1989, until a recent upturn. As other cities struggled to reignite growth,

Leipzig's authorities decided early on to adaptively manage contraction. They envisioned a dynamic, sustainable city that would preserve trademark architectural heritage, replace dilapidated housing with green spaces, and support microscale centers. Florentin's (102) research finds value in Leipzig's example, even though its realization has been constrained by limited financial and legal resources.

Schindler's (103) similar study of Detroit documents the breakdown of the city's "growth coalition" as authorities accepted the end of growth and embraced plans to invest in landscape infrastructure to improve residents' quality of life. Schindler's description of communities' efforts to reorganize amid collapse emphasizes the importance of the city's decision to declare bankruptcy, putting the interests of its citizens before those of banks and debtors. This was not the case in Greece, which suffered the greatest economic depression recorded among Western countries (104). Although sharing projects and new commons addressing immediate needs for food, health, and socialization proliferated in the city of Athens, their scale was insufficient to compensate for the decline in state provisioning, given the extreme austerity for repaying debts. Processes of gentrification and renewed investment and growth in contexts such as Leipzig and Detroit also raise concerns that, within contemporary capitalist systems, recession, devaluation, and debt relief may open up new profitable outlets paving the way for relaunching growth.

Innovations are motivated not only by crisis but also by new visions. In households and communities around the world, people are voluntarily acting to reduce the harmful impacts of their lifestyles on vulnerable human and ecological systems. Many intend to support green growth. Others, who strive toward living without growth, are examined in two edited collections: *Ecocultures: Blueprints for Sustainable Communities* (see the chapter by Boehm et al. in 105) and *Environmental Anthropology Engaging Ecotopia: Bioregionalism, Permaculture, and Ecovillages* (106).

Cattaneo & Gavalda (107) examine two degrowth-minded eco-communes in the outskirts of Barcelona and find that resource use and paid working time of participants have declined substantially. They argue that economic and material degrowth was not the objective, but rather a felicitous outcome of broader ambitions to colive autonomously and democratically, reviving and sharing common spaces. Around the world, place-based responses to climate change and peak oil have sprung up in the form of so-called transition towns. Following a two-year study on processes of relocation and consensus-building in select transition towns, Barr & Pollard (108) analyze the coalescence of traditional narratives of environmental activism with more personal changes in behavior and attitudes.

Research on past and present alternatives illuminates attributes of low-throughput and steady-state socio-economies, undermining the conviction that there is no alternative to growth. These insights from peripheral niches in the world system can be developed via further research on strategies and possibilities to influence the organizing principles and social metabolisms of larger and more complex economies.

6. TECHNOLOGY STUDIES AND DEGROWTH

Until recently, degrowth literature had little to say about technology other than a critique of technological fixes (see Section 3). However, thoughts on technology by twentieth-century philosophers Jacques Ellul and Ivan Illich have long influenced the conversation, and a recent collection of essays reporting on research presented at the Leipzig degrowth conference offers new and complex ways to think about degrowth and technology (109).

Ellul (110) argued that in modern societies a technological system has emerged with its own logic of reproduction, autonomized from social control. At the core is a scientific-industrial complex, which invents what can be invented and develops what can be developed without external

considerations for the social purposes that new knowledge serves. Unlike most contemporary degrowth thinkers, Ellul went as far as claiming that profit-seeking, growth, and capitalism are epiphenomena of the technological system, not its driving forces.

If technology has such dominating power, then the pursuit of sustainability requires release from it. Heikkurinen (111) argues that all technology is geared to transform the nonhuman into human-made objects, therefore an ecologically sensible social project should restrain technological practice. Others emphasize instead an appropriation and habilitation of technology to destabilize the hegemonic order of the growth-oriented technological regime and enable new modes of economic (re)production (112).

Illich (113) and Ellul agree that economic growth results from the inversion of tools from means into ends but differ in their responses. Illich advocated technologies that users can control, dismantle, repair, or reconstitute, conceptualized as spaces and tools for conviviality. Think of a bicycle compared to a nuclear power plant. Similarly, Ernst Friedrich Schumacher (114) argued for alternative trajectories of technology appropriation that encompass small-scale, decentralized, environmentally sound, and locally autonomous applications.

Using a “matrix of convivial technology” based on five dimensions (relatedness, accessibility, adaptability, bio-interaction, and appropriateness), Vetter (115) ethnographically evaluates the practices of several degrowth-related groups who produce, develop, or adapt different technologies. Grunwald (116) applies a technology assessment to evaluate green technologies that are often promoted in the name of growth, and considers the position of those who expect to overcome ecological crises merely by technological progress morally hazardous, because they ignore the ambivalences of technology and its unavoidable, unintended side effects.

Lizarralde & Tyl (117) develop a practical, convivial approach for directly engaging designers, engineers, and other stakeholders in the development of new products and services. They introduce guidelines for integrating conviviality criteria into the design process with attention to relationships between the life-cycle stages of a product or service and the five main threats to conviviality identified by Illich (113). Criteria and constraints outlined in these recommendations prioritize users’ autonomy and creativity, local production, and the use of simple techniques. The aim of this design for conviviality approach is to enable designers and engineers to embrace complex design processes in the transition toward a degrowth society and to cocreate such a society with stakeholders (117).

Several case studies look at concrete tools. Alexander & Yacoumis (118) argue that low-tech technologies (such as solar shower bags, washing lines, bicycles, and alternative heating and cooling methods) are compatible with an energy descent scenario, and their use produces cultural conditions for the emergence of degrowth practice and ethos. The Malmo-based “Bike Kitchen” is a repair studio where people borrow tools and use the space for repairing or building their own bikes, one example of a rich tapestry of emerging community-driven spaces that aim to make technology and know-how available to everyone (119). Carlsson & Manning (120) examine projects in California that meet needs in transportation (bicycling subculture), food (urban gardening/agriculture), and communication (open-source communities). The authors conceptualize participants in these spaces as a new class of “nowtopians,” people consciously exiting a capitalist system in which they are categorized as excess labor, and coconstructing utopias now through systems of reciprocity and gift-exchange.

Nowtopian urban initiatives, such as the Bike Kitchen, and community-driven spaces that experiment with digital technologies, such as makerspaces and hackerspaces (121, 122), offer alternatives to growth-oriented and technology-led visions of the “Smart City” (122). However, features of high or low technologies alone do not open alternative pathways—that depends on the wider political and cultural contexts in which they are embedded (121, 122). Today, the dominant

trajectory of technological development is still geared around growth. Pollex & Lenschow (123) examine the EU's strategic Horizon 2020 program of R&D and find that the growth paradigm is dominant, marginally updated with green growth, and beyond GDP notions.

A very different innovation trajectory is demonstrated by the grassroots-driven KSLM (Kerala Science Literature Movement), which started in Southern India in 1962 as a small group of social activists interested in science, and grew to become a people's science movement, with an NGO as a pillar (124). KSLM has been popularizing scientific thinking by translating key scientific literature from English to the local language (Malayalam), and by helping to implement forms of production and innovation that challenge the dominant progrowth and market-led paradigm (124). In 1987, the Integrated Rural Technology Center was established in response to the conviction that the diffusion of scientific literature alone was not enough to emancipate rural populations; they should be able to use knowledge to transform their social contexts. Via this center, people in Kerala have been developing or modifying technologies developed elsewhere to suit local and rural needs and desires (124).

Another trajectory is manifest in DGML ("design global, manufacture local") processes through which design is developed, shared, and improved through global digital commons, in which shared resources are managed by a community according to rules set by the community (121). Manufacturing takes place locally, often through shared infrastructures, and the convergence of digital commons with local manufacturing technologies in products ranging from three-dimensional printers and laser cutters to low-tech tools and crafts is giving rise to new forms of value creation. Successful low-cost DGML projects include wind turbines, farming machines, and prosthetic robotic hands.

Three interlocked practices observed in these projects make them compatible with a degrowth trajectory: They provide incentives for design-embedded sustainability; they open possibilities for on-demand production; and they are based on practices of sharing in common digital and physical productive infrastructures (125). DGML technologies have the potential to be low-cost, feasible for small-scale operations, and adjustable to local needs (125, 126). DGML technologies promote technological sovereignty, helping people—from farmers and artists to computer engineers and designers—to become more autonomous by controlling the manufacturing of their means of production.

What opportunities do these diverse socio-technical trajectories offer? Increasing access to information and communication technologies enables the global scaling up of small group dynamics. Commoning processes through which participants relate to each other by sharing digital resources and by coshaping technologies has been referred to as peer-to-peer (P2P) and operates differently from peer-to-peer for market-based exchange, as in the Bitcoin network (127). Bauwens et al. (127) claim that a P2P trajectory may lead a transition out of capitalism, as hierarchical corporate models become less suited for new digital technologies, compared to open, commons-based forms of production, as evidenced in digital commons such as Wikipedia. As new forms of creating, assessing, and distributing value are established, an alternative noncapitalist system of production may emerge within the capitalist system in a transition that will inevitably involve social and political struggle (127).

Even though certain DGML projects abide by principles linked to degrowth, it cannot be taken for granted that expanding these modes of production will lead to degrowth. And although the P2P model can perhaps come to dominate the digital/knowledge sphere, it is not clear how it may influence physical processes of resource extraction, transport, and infrastructure development, still dominated by a growth logic.

Pueyo (128) analyzes a different scenario in which the tendency of automation/artificial intelligence coupled with rising energy costs leads to machines substituting and automating the high-paid

"Design global, manufacture local" (DGML): processes through which designs are developed as a global digital commons while products are manufactured locally

jobs of the managerial and capitalist classes. In such a scenario, advancement of capitalism may lead not only to the abolition of meaningful wage labor, but also the abolition of professional and executive labor. Pueyo imagines a possible alliance between managers and workers but once again, such an alliance will not come to be automatically, but through political organization and struggle, whose prospects we turn to now.

7. POLITICAL SCIENCE: DEMOCRACY AND DEGROWTH

Are there existing political-economic dynamics that would favor degrowth-oriented scenarios? Given the historical coemergence of liberal democracy with capitalism and growth, what would degrowth imply for democracy? According to Dörre et al. (129), modern, industrialized societies rely on continual expansion, acceleration, and growth for their dynamic stabilization and structural reproduction. This compulsion has not only driven growth in material flows and GDP, but also in the occupation of spheres of life—including human desires and creativity—that were previously not subordinated to market valorization and the capitalistic logic of accumulation.

Liberal welfare democracies have tempered capitalistic social relations by maintaining a distinction between the economic and the political order (130), subtracting spheres of life from the capitalistic logic and adding a form of social citizenship to civil and political rights (131). But given their dependence on economic growth for the pacification of class conflict, welfare democracies have also legitimized capitalism (11, 132). Growth has been instrumental for securing employment, tax revenue, and investments in large-scale infrastructures. In addition, it has kept alive the promise of social mobility and increasing wellbeing (133). During a relatively short historic period, the alliance between liberal welfare democracies and the capitalistic growth logic guaranteed some social redistribution of economic surplus and a promise of improved wellbeing (134), while supporting a hegemonic project that built consensus between elites and subaltern classes as well as different political fronts.

The dynamic stabilization based on Fordist-era growth, however, turned out to be structurally dysfunctional. Growth-based democracies have been facing fundamental crises due to their immanent acceleration logic and to social and ecological limits that reduce the margin of profitability and spell the end of “easy” economic growth (135). After the crises of the 1970s, neoliberal restructuring mobilized economic growth with a radically different normative order (136) rooted in globalization, deregulation of financial flows, and new modes of governing. Subjects were no longer formed as social citizens, but as individual entrepreneurs of themselves. This new growth path operates not only by occupying new territories both geographically and via the further commodification of former public sectors (education, public services), but also by mobilizing and appropriating the innovative energy and desires of workers in the culture industry and new digital and creative economies (137).

According to Brown (136), the neoliberal program has dismantled the separation between the economic and the political by extending economic and entrepreneurial logics of competition to all dimensions of social and public life, including the state. A novel variant of *homo economicus*, no longer the nineteenth-century merchant or man of trade, but a new entrepreneurial man, replaces *homo politicus* altogether, while the sphere in which discourses about the good life and social justice took place disappears. Thus, neoliberal rationality neutralizes normative foundations of liberal democracy, leading to a path of *dedemocratization* (136), where subjects are driven to act as personal enterprises, responsible for their own investments and failures (131).

An ongoing crisis of growth, heightened by the global financial crisis of 2008, further jeopardizes the stability and legitimacy of liberal democracies. According to Streeck (138, p. 22), “lower growth rates were acceptable for the new powers as long as they were compensated by higher

profit rates and an increasingly inegalitarian distribution. Democracy ceased to be functional for economic growth and in fact became a threat to the performance of the new growth model.” This points to postgrowth scenarios compatible with authoritarian regimes and neo-feudal capitalistic formations. These are characterized by increased inequality without redistribution and without social mobility, and by a shift from accumulation of (productive) capital to accumulation of wealth, with investment in luxury goods and personal services (139). Social pacification in this scenario is no longer conveyed by the promise of partaking in the national wealth, but by forms of repression and regulation exercised under a constant narrative of state of exception, or through ideological disciplining of the masses whose responsibility is individualized, spiritual values compensating for material destitution, and voluntary philanthropy replacing redistribution (133).

In response to economic crisis, dedemocratization, and authoritarian postgrowth scenarios, degrowth thinkers imagine a radical social-ecological transformation (140) that forges new forms of democracy guided by (global) social and environmental justice, solidarity, and autonomy (6). This stream of degrowth excludes a mere return to the growth-dependent model of welfarist liberal democracies (6), addressing not only the environmental and structural consequences of neoliberal growth (Section 3), but also the pervasive logic of economism (Section 2) (141).

In the heterogeneous literature on democracy and degrowth, some scholars advocate the reconstitution of a stronger deliberative democracy, in which—in a Habermasian mode—the separation of the economic and the political logic is reinstated (142) and the (capitalistic) economy is subordinated to ethical principles and politically negotiated conditions. Others claim that to challenge neoliberal rationality and restore democracy on a different footing, we need a more radical transformation of social institutions and alternative principles of societal organization, some of which are already prefiguratively embodied by new social movements (133, 143). An essential element is economic democracy (144), not only in the sense of more participation in decision making within enterprises, but also in terms of radical restructuring of economic processes through collective deliberation about their scope, functions, and structure.

Referencing especially Gorz (145), degrowth thinkers and activists articulate a strong critique of techno-managerial modes of governance implemented under neoliberalism (141), against which self-management at different scales of societal organization strengthens collective autonomy. According to Ashish Kothari (97), this comes close to India’s tradition of *swaraj*, which can be loosely translated as “self-rule” and includes collective autonomy and mutual responsibility, put in practice by the network of self-organized communities for a radical ecological democracy presented in Section 5.

Concepts of real and direct democracy, albeit intended in different ways and open to scholarly and societal debate, are central to alternative projects articulated by degrowth thinkers and activists. New social movements, such as the Spanish Indignados, often compared to the US Occupy movement, and various social experiments following the dissolution of both formal movements, explicitly incorporate degrowth critiques and advocate real democracy against the pseudodemocratic face of (neo)liberal representative democracies (143). Although pragmatist factions of the movement promote real democracy via wider participation in institutional processes and the extension of democratic decision making to all spheres of life, an autonomist faction challenges the very structure of representation and calls for direct democracy not only with respect to the political dimension, but also extended to economic, ecological, and social spheres and relations (143).

Models of direct democracy in degrowth discourse are inspired by Cornelius Castoriadis (141, 146). Democracy for him means that society becomes autonomous by recognizing and taking responsibility for its self-instituting character against the imposition of imaginaries based on nonquestionable truths coming from gods or immutable pseudoscientific laws, such as the invisible hand of the market, the selfish gene, or an economy’s need to grow. For Castoriadis,

democracy and capitalism are fundamentally incompatible, given that capitalism rests on heteronomous justifications, and their parallel evolution is coincidental.

The idea of society as self-instituting reinforces degrowth-based critiques against the naturalizing narrative of neoliberal rationality. It liberates spaces for the imagination of radical alternatives. However, it remains unclear why and how diverse autonomous societies led by a direct democratic process of decision making would embrace the degrowth project in its substantial form (140, 147). Under current conditions, a transition to direct democracy in tandem with a decelerating economy is a highly unlikely scenario. Other than environmental justice groups that oppose specific developmentalist projects that damage their livelihoods, Indignados/ Occupy movements, and other social experiments that prefiguratively embody alternatives, there are few signs of movement toward a political-constitutional change of that order. In the absence of social forces that can catalyze radical change, the scenario of stagnation and an authoritarian drift seems more likely. This underscores the importance of strengthening social movements and political tendencies aiming to revitalize democracy and politicize economics.

8. CONCLUSION: A DEGROWTH TRANSITION?

Abandoning economic growth seems politically impossible. As a result, many scientists prefer to study policy and technological fixes that promise to make growth sustainable rather than think about managing without growth. This review summarized evidence from ecological economics suggesting that proposed green growth paths are unlikely to be sustainable and highlighted literatures that suggest that although degrowth may seem politically impossible, under certain conditions it could become real and have desirable effects.

In future degrowth societies envisioned in the literature examined here, the economic is no longer at the center of everything; democracy is direct; surplus is expended for reproduction or fun; income and wealth are distributed according to egalitarian principles; vital resources, infrastructures, and spaces are shared and held in common; technology is convivial and serves social purposes; resource throughput is minimized; and working hours are reduced by cutting consumption, production, and wasteful expenditures (1, 9, 34).

Degrowth proposals are to a certain extent utopian—there is no “topos” (place) where they fully exist. But are there viable transition pathways toward this vision? Thinking of open and plural utopias helps to free the imagination to conceive worlds that motivate changes in our actions today, producing something different tomorrow, although not necessarily the utopia initially imagined (148). Although some degrowth proposals (76) can be criticized as wishful thinking, sound points for studying and starting transitions are found in real existing societies living without growth (see Section 5) and radical social experiments that embody and anticipate degrowth utopias. What Muraca (133) calls concrete utopias illuminate potential openings for paths forward that are already emerging.

The fate of such openings will play out amid coevolutionary processes involving institutional organization, technology, environmental conditions, values, and knowledge (149). Although current worlds seem trapped in continuity, history is rife with surprise, fueled by the incessant creativity of humans and their ability to come up with new ways of seeing the world and new forms of living and producing their societies and their environments (150).

From this perspective, recent debates on the possibility of voluntary paths to degrowth versus the more probable event of forced reductions provoked by an involuntary crash (10, 77) is misleading (78). Change is always voluntary and is always enacted through unchosen conditions (such as the availability of fossil fuels or the thermodynamics of production processes). History is shaped by collective action or inaction. As economic growth falters and as the toll of its limits and costs

becomes unbearable, a transition in the direction of something akin to degrowth could emerge from dynamics among unforeseeable reactions, experiments, adaptations, and political struggles. Such a transition does not have to be in the name of degrowth. As with the eco-communes of Barcelona that Cattaneo & Gavalda (107) studied, the reduction of resource use can be the outcome of broader processes of social transformation driven by an ambition to co-live autonomously and democratically (1).

In contexts where life under growth is already disastrous for many people, and threatens to become even more so with climate change and the overshooting of planetary boundaries, literature reviewed here studies, envisages, and advocates changes in institutions, policies, values, understandings, and everyday modes of living. Without the voluntary work to conceive and embody alternative ideas, explanations, practices, and institutions today, an involuntary end to growth may well lead to a state of continual economic depression in which islands of wealth are sustained in seas of deprivation, without pretense of democracy and social justice.

Degrowth is an action, or activist, research program. The scholarship presented here constructs intentionally novel forms of knowledge, sensibilities, and values, and circulates new narratives aimed to support positive transitions. It raises vital questions for future research concerning forces and factors that render growth so hegemonic, the scalability of alternatives, the efficacy of proposed institutional changes, conditions for stability without growth, social dynamics of transition, and compatible philosophies of humanity and nature.

One may agree or disagree with the diagnosis and prognosis of degrowth, but it cannot be denied that this exciting research agenda asks vital—and sometimes inconvenient—questions that can no longer be ignored.

SUMMARY POINTS

1. Economic growth is a recent social and political objective—GDP was first measured in the 1930s and growth entrenched as an overriding goal in the 1950s.
2. There is no empirical evidence of absolute decoupling of throughput from economic growth; sufficient decoupling to stay within environmental limits is logically possible, but physically unlikely.
3. Economic growth has long worked as the key dynamic stabilization mechanism for modern, capitalistic societies. The end of economic growth without social transformation would lead to destabilization.
4. Economies can be stabilized without growth if basic monetary, fiscal, labor, and welfare institutions are transformed (working hours are reduced, new investment in clean sectors is offset by disinvestment in dirty sectors, debt interest is spent or socialized, redistribution of wealth is secured, and growth in relational goods compensates for decline in material goods).
5. Capitalism as we know it is incompatible with degrowth.
6. Perpetual growth is ecologically limited and, in all likelihood, disastrous.
7. Planned degrowth is politically unlikely, given established interests and power relations.
8. An authoritarian and more unequal variant of capitalism is likely to emerge after a period of stagnation, unless social forces organize politically to produce more democratic alternatives.

9. Human history offers myriad examples of noncapitalist societies, and of community economies not based on capitalist relations, that have lived well without growth.
10. Appropriate and “design global, manufacture local” technologies can provide localized solutions to human needs, while degrowing throughput.

FUTURE ISSUES

1. How and why did growth become hegemonic in the Eastern bloc in the twentieth century?
2. How does the idea of growth reproduce its commonsensical hegemony through everyday practices and performances?
3. Why does resource use keep increasing in service-based economies?
4. Why is there so little absolute decoupling?
5. How and under what conditions may work sharing, basic income, green taxes, or reinvestment plans allow economies to manage without growth?
6. How do existing collectives and community economies undo the imaginary of growth through their everyday practices, and how and under what conditions may their experiences be scaled up?
7. Why and how did past civilizations and societies manage without growth?
8. How do digitalization, automation, and artificial intelligence open or limit possibilities for a degrowth transition? What are their implications in terms of throughput?
9. Is growthmanship coming to an end, and why? Or is it morphing to a new, authoritarian variant?

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

ACKNOWLEDGMENTS

G.K. acknowledges support from the “María de Maeztu” Unit of Excellence (MDM-2015-0552) grant from the Spanish Ministry of Economy and Competitiveness; he acknowledges that he is a member of Research & Degrowth, an academic association dedicated to research, training, awareness raising, and events organization around degrowth. V.K. acknowledges financial support from IUT (19-13) and B52 grants of the Estonian Ministry of Education and Research.

LITERATURE CITED

1. D’Alisa G, Demaria F, Kallis G, eds. 2014. *Degrowth: A Vocabulary for a New Era*. New York: Routledge
2. Demaria F, Schneider F, Sekulova F, Martinez-Alier J. 2013. What is Degrowth? From an activist slogan to a social movement. *Environ. Values* 22(2):191–215
3. Georgescu-Roegen N. 2011. *From Bioeconomics to Degrowth: Georgescu-Roegen’s “New Economics” in Eight Essays*. London: Routledge

4. Latouche S. 2009. *Farewell to Growth*. Cambridge, UK: Polity
5. Eversberg D, Schmelzer M. 2018. The degrowth spectrum: convergence and divergence within a diverse and conflictual alliance. *Environ. Values* 27(3):245–67
6. Cattaneo C, D’Alisa G, Kallis G, Zografos C. 2012. Degrowth futures and democracy. *Futures* 44(6):515–23
7. D’Alisa G, Kallis G. 2014. Post-normal science. See Ref. 1, pp. 185–88
8. Martinez-Alier J, Healy H, Temper L, Walter M, Rodriguez-Labajos B, et al. 2011. Between science and activism: learning and teaching ecological economics with environmental justice organisations. *Local Environ.* 16(1):17–36
9. Fournier V. 2008. Escaping from the economy: the politics of degrowth. *Int. J. Sociol. Soc. Policy* 28(11/12):528–45
10. Weiss M, Cattaneo C. 2017. Degrowth—taking stock and reviewing an emerging academic paradigm. *Ecol. Econ.* 137:220–30
11. Dale G. 2012. The growth paradigm: a critique. *International Socialism*, March 27, Issue 134. <http://isj.org.uk/the-growth-paradigm-a-critique/>
12. Purdey SJ. 2010. *Economic Growth, the Environment and International Relations: The Growth Paradigm*. London: Routledge
13. Hirschman DA. 2016. *Inventing the economy or: how we learned to stop worrying and love the GDP*. PhD Thesis, Univ. Mich., Ann Arbor
14. Schabas M. 2009. *The Natural Origins of Economics*. Chicago: Univ. Chicago Press
15. Foucault M. 1994. *The Order of Things: An Archaeology of Human Sciences*. New York: Vintage
16. Polanyi K. 2001. *The Great Transformation: The Political and Economic Origins of Our Time*. Boston: Beacon Press
17. Mitchell T. 2013. *Carbon Democracy: Political Power in the Age of Oil*. London: Verso
18. Tooze A. 1998. Imagining national economies: national and international economics statistics 1900–1950. In *Imagining Nations*, ed. G Cubitt, pp. 218–28. Manchester: Manchester Univ. Press
19. Escobar A. 1995. *Encountering Development: The Making and Unmaking of the Third World*. Princeton, NJ: Princeton Univ. Press
20. Borowy I, Schmelzer M, eds. 2017. *History of the Future of Economic Growth: Historical Roots of Current Debates on Sustainable Degrowth*. London: Routledge
21. Fioramonti L. 2013. *Gross Domestic Problem: The Politics Behind the World’s Most Powerful Number*. London: Zed Books
22. Philipsen D. 2015. *The Little Big Number: How GDP Came to Rule the World and What to Do About It*. Princeton, NJ: Princeton Univ. Press
23. Waring M. 1999. *Counting for Nothing: What Men Value and What Women Are Worth*. Toronto, Ont., Can.: Univ. Toronto Press
24. Speich-Chassé D. 2015. *Die Erfindung des Bruttosozialprodukts. Globale Ungleichheit in der Wissensgeschichte der Ökonomie*, Vol. 38. Göttingen, Ger.: Vandenhoeck & Ruprecht
25. Schmelzer M. 2016. *The Hegemony of Growth: The OECD and the Making of the Economic Growth Paradigm*. Cambridge, UK: Cambridge Univ. Press
26. Coyle D. 2015. *GDP: A Brief But Affectionate History*. Princeton, NJ: Princeton Univ. Press
27. Lepenies P. 2016. *The Power of a Single Number: A Political History of GDP*. New York: Columbia Univ. Press
28. Arndt HW. 1978. *The Rise and Fall of Economic Growth: A Study in Contemporary Thought*. Melbourne, Austr.: Longman Cheshire
29. Collins RM. 2002. *More: The Politics of Economic Growth in Postwar America*. Oxford: Oxford Univ. Press
30. O’Byrne S. 2009. *The Growth Idea*. Honolulu: Univ. Hawai’i Press
31. Allan BB. 2018. *Scientific Cosmology and International Orders: The Balance of Power, Improvement, and the Rise of Economic Growth*. Cambridge, UK Malden, MA: Cambridge Univ. Press
32. Rist G. 2008. *The History of Development: From Western Origins to Global Faith*. London: Zed Books
33. Muraca B, Schmelzer M. 2017. Sustainable degrowth: historical roots of the search for alternatives to growth in three regions. In *History of the Future of Economic Growth: Historical Roots of Current Debates on Sustainable Degrowth*, ed. I Borowy, M Schmelzer, pp. 174–98. London: Routledge

34. Kallis G. 2018. *Degrowth*. Newcastle upon Tyne, UK: Agenda Publ.
35. Daly HE. 1977. *Steady-State Economics*. San Francisco: W. H. Freeman Company
36. Alcott B. 2014. Jevons' paradox. See Ref. 1, pp. 121–24
37. Magee CL, Devezas TC. 2017. A simple extension of dematerialization theory: incorporation of technical progress and the rebound effect. *Technol. Forecast. Soc. Change*. 117:196–205
38. Ayres R, Warr B. 2010. *The Economic Growth Engine: How Energy and Work Drive Material Prosperity*. Cheltenham, UK: Edward Elgar Publ.
39. Murphy DJ, Hall CAS. 2011. Energy return on investment, peak oil, and the end of economic growth. *Ann. N. Y. Acad. Sci.* 1219:52–72
40. Kallis G. 2017. Radical dematerialization and degrowth. *Phil. Trans. R. Soc. A* 375. <https://doi.org/10.1098/rsta.2016.0383>
41. Burke P, Shahiduzzaman M, Stern D. 2015. Carbon dioxide emissions in the short run: the rate and sources of economic growth matter. *Glob. Environ. Change* 33:109–21
42. Steinberger JK, Krausmann F, Getzner M, Schandl H, West J. 2013. Development and dematerialization: an international study. *PLOS ONE* 8(10):e70385
43. Meadows DH, Meadows DL, Randers J, Behrens WW III. 1974. *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe Books
44. Jackson T, Webster R. 2016. *Limits Revisited. A Review of the Limits to Growth Debate*. London: All Party Parliamentary Group on Limits to Growth
45. Turner G. 2008. A comparison of *The Limits to Growth* with 30 years of reality. *Glob. Environ. Change*. 18:397–411
46. Wiedmann TO, Schandl H, Lenzen M, Moran D, Suh S, et al. 2015. The material footprint of nations. *PNAS* 112(20):6271–76
47. Distefano T, Kelly S. 2017. Are we in deep water? Water scarcity and its limits to economic growth. *Ecol. Econ.* 142:130–47
48. Anderson K, Bows-Larkin A. 2013. Avoiding dangerous climate change demands de-growth strategies from wealthier nations. kevinanderson.info. <https://kevinanderson.info/blog/avoiding-dangerous-climate-change-demands-de-growth-strategies-from-wealthier-nations/>
49. Antal M, Van Den Bergh JCJM. 2016. Green growth and climate change: conceptual and empirical considerations. *Clim. Policy* 16(2):165–77
50. Jackson T. 2011. *Prosperity Without Growth*. London: Routledge
51. Victor PA. 2008. *Managing Without Growth: Slower by Design, Not Disaster*. Cheltenham, UK: Edward Elgar Publ.
52. Editorial. 2018. Why current negative-emissions strategies remain “magical thinking.” *Nature* 554(7693):404
53. Fizaine F, Court V. 2016. Energy expenditure, economic growth, and the minimum EROI of society. *Energy Policy* 95:172–86
54. van den Bergh JCJM. 2017. A third option for climate policy within potential limits to growth. *Nat. Clim. Change* 7(2):107–12
55. Kallis G. 2011. In defence of degrowth. *Ecol. Econ.* 70(5):873–80
56. Kubiszewski I, Costanza R, Franco C, Lawn P, Talberth J, et al. 2013. Beyond GDP: measuring and achieving global genuine progress. *Ecol. Econ.* 93(C):57–68
57. Beça P, Santos R. 2010. Measuring sustainable welfare: a new approach to the ISEW. *Ecol. Econ.* 69(4):810–19
58. O'Neill DW, Fanning AL, Lamb WF, Steinberger JK. 2018. A good life for all within planetary boundaries. *Nat. Sustain.* 1(2):88–95
59. Easterlin R, Angelescu McVey L, Switek M, Sawangfa O, Smith Zweig J. 2010. The happiness-income paradox revisited. *PNAS* 107(52):22463–68
60. Kahneman D, Deaton A. 2010. High income improves evaluation of life but not emotional well-being. *PNAS* 107(38):16489–93
61. Hirsch F. 1978. *Social Limits to Growth*. London: Routledge

62. Reyes-García V, Babigumira R, Pyhälä A, Wunder S, Zorondo-Rodríguez F, Angelsen A. 2016. Subjective wellbeing and income: empirical patterns in the rural developing world. *J. Happiness Stud.* 17(2):773–91
63. Kasser T. 2017. Living both well and sustainably: a review of the literature, with some reflections on future research, interventions and policy. *Philos. Transact. A* 375. <https://doi.org/10.1098/rsta.2016.0369>
64. Drews S, van den Bergh JCJM. 2016. Public views on economic growth, the environment and prosperity: results of a questionnaire survey. *Glob. Environ. Change* 39(July):1–14
65. Kallis G, Kerschner C, Martínez-Alier J. 2012. The economics of degrowth. *Econ. Degrowth* 84(Suppl. C):172–80
66. Luks F. 2013. *Die Zukunft des Wachstums: Theoriegeschichte, Nachhaltigkeit und die Perspektiven einer neuen Wirtschaft*. Marburg, Ger.: Metropolis
67. Irmen A. 2011. *Ist Wirtschaftswachstum systemimmanent?* Discuss. Pap. 509, Alfred Weber Inst., Dep. Econ., Univ. Heidelberg. <https://www.econstor.eu/bitstream/10419/127323/1/dp509.pdf>
68. Lange S. 2018. *Macroeconomics Without Growth. Sustainable Economies in Neoclassical, Keynesian and Marxian Theories*, Vol. 18. Marburg, Ger.: Metropolis
69. Heikkinen T. 2015. (De)growth and welfare in an equilibrium model with heterogeneous consumers. *Ecol. Econ.* 116(C):330–40
70. Bilancini E, D'Alessandro S. 2012. Long-run welfare under externalities in consumption, leisure, and production: a case for happy degrowth versus unhappy growth. *Ecol. Econ.* 84(Suppl. C):194–205
71. Fontana G, Sawyer M. 2015. The macroeconomics and financial system requirements for a sustainable future. In *Finance and the Macroeconomics of Environmental Policies*, pp. 74–110. London: Palgrave Macmillan
72. Paech N. 2012. *Befreiung vom Überfluss: Auf dem Weg in die Postwachstumsökonomie*. München: Oekom Verlag
73. Gran C. 2017. *Perspektiven einer Wirtschaft ohne Wachstum: Adaption des kanadischen Modells LowGrow an die deutsche Volkswirtschaft*. Marburg, Ger.: Metropolis
74. Binswanger HC. 2013. *The Growth Spiral*. Berlin, Ger.: Springer
75. Gebauer J, Lange S, Posse D. 2017. Wirtschaftspolitik für Postwachstum auf Unternehmensebene. Drei Ansätze zur Gestaltung. In *Postwachstumspolitik: Wege zur wachstumsunabhängigen Gesellschaft*, ed. F Adler, U Schachtsschneider, pp. 239–52. München: Oekom Verlag
76. Videira N, Schneider F, Sekulova F, Kallis G. 2014. Improving understanding on degrowth pathways: an exploratory study using collaborative causal models. *Futures* 55:58–77
77. Sorman AH, Giampietro M. 2013. The energetic metabolism of societies and the degrowth paradigm: analyzing biophysical constraints and realities. *J. Clean. Prod.* 38:80–93
78. Kallis G. 2013. Societal metabolism, working hours and degrowth: a comment on Sorman and Giampietro. *J. Clean. Prod.* 38:94–98
79. D'Alisa G, Cattaneo C. 2013. Household work and energy consumption: a degrowth perspective. Catalonia's case study. *Degrowth Theory Pract.* 38(Suppl. C):71–79
80. Richters O, Siemoneit A. 2017. Consistency and stability analysis of models of a monetary growth imperative. *Ecol. Econ.* 136(C):114–25
81. Jackson T, Victor PA. 2015. Does credit create a “growth imperative”? A quasi-stationary economy with interest-bearing debt. *Ecol. Econ.* 120(C):32–48
82. Magdoff F, Bellamy-Foster J. 2010. What every environmentalist needs to know about capitalism. *Monthly Rev.* 61(10):1–30
83. Blauwhof FB. 2012. Overcoming accumulation: Is a capitalist steady-state economy possible? *Ecol. Econ.* 84(Suppl. C):254–61
84. Paulson S. 2017. Degrowth: culture, power and change. *J. Polit. Econ.* 24:425–48
85. Skidelsky R, Skidelsky E. 2012. *How Much is Enough?: Money and the Good Life*. New York: Other Press
86. Romano O. 2014. Depense. See Ref. 1, p. 67
87. Singh SJ, Haas W. 2012. Aid, metabolism and social conflicts in the Nicobar Islands. In *Ecological Economics from the Ground Up*, ed. H. Healy, J. Martínez-Alier, L. Temper, M. Walter, J-F Gerber, pp. 35–54. London: Routledge

88. Suzman J. 2017. *Affluence Without Abundance: The Disappearing World of the Bushmen*. New York: Bloomsbury
89. Lewis J. 2017. Managing abundance, not chasing scarcity: the big challenge for the twenty-first century. *Rad. Anthr.* 2:11–19
90. Bird-David N, Abramson A, Altman J, Bicchieri MG, Burch ES, et al. 1992. Beyond “The Original Affluent Society”: A Culturalist Reformulation [and Comments and Reply]. *Curr. Anthropol.* 33(1):25–47
91. Woodburn J. 1982. Egalitarian societies. *Man* 17:431–51
92. Fraser JA, Cardoso T, Steward A, Parry L. 2017. Amazonian peasant livelihood differentiation as mutuality-market dialectics. *J. Peasant Stud.* <https://doi.org/10.1080/03066150.2017.1296833>
93. Guttman-Bond E. 2010. Sustainability out of the past: how archaeology can save the planet. *World Archaeol.* 42:355–66
94. Altieri MA, Toledo VM. 2011. The agroecological revolution in Latin America: rescuing nature, ensuring food sovereignty and empowering peasants. *J. Peasant Stud.* 38(3):587–612
95. Verma R. 2017. Gross National Happiness: meaning, measure and degrowth in a living development alternative. *J. Political Ecol.* 24:476–90
96. Bogadóttir R, Olsen SE. 2017. Making degrowth locally meaningful: the case of the Faroese *grindadráp*. *J. Polit. Ecol.* 24:425–34
97. Kothari A. 2014. Radical ecological democracy: a path forward for India and beyond. *Development* 57(1):36–45
98. Boillat S, Gerber J-F, Funes-Monzote FR. 2012. What economic democracy for degrowth? Some comments on the contribution of socialist models and Cuban agroecology. *Spec. Issue Polit. Democr. Degrowth* 44(6):600–7
99. Borowy I. 2013. Degrowth and public health in Cuba: lessons from the past? *Degrowth Theory Pract.* 38(Suppl. C):17–26
100. Ruhm C. 2000. Are recessions good for your health? *Q. J. Econ.* 115(2):617–50
101. Karanikolos M, Mladovsky P, Cylus J, Thomson S, Basu S, et al. 2013. Financial crisis, austerity, and health in Europe. *Lancet* 381(9874):1323–31
102. Florentin D. 2010. The “perforated city:” Leipzig’s model of urban shrinkage management. *Berkeley Plan. J.* 23(1):83–101
103. Schindler S. 2016. Detroit after bankruptcy: a case of degrowth machine politics. *Urban Stud.* 53(4):818–36
104. Varvarousis A, Kallis G. 2017. Commoning against the crisis. In *Another Economy is Possible: Culture and Economy in a Time of Crisis*, ed. M Castells, pp. 107–12. Cambridge, UK: Polity
105. Boehm S, Bharucha ZP, Pretty JN. 2015. Ecocultures: towards sustainable ways of living. In *Ecocultures: Blueprints for Sustainable Communities*, ed. S Boehm, ZP Bharucha, JN Pretty, pp. 3–26, Abingdon, UK: Routledge,
106. Lockyer J, Veteto JR. 2013. *Environmental Anthropology Engaging Ecotopia: Bioregionalism, Permaculture, and Ecovillages*. New York: Berghahn Books
107. Cattaneo C, Gavalda M. 2010. The experience of rurban squats in Collserola, Barcelona: What kind of degrowth? *J. Clean. Prod.* 18:581–89
108. Barr S, Pollard J. 2017. Geographies of transition: narrating environmental activism in an age of climate change and “Peak Oil.” *Environ. Plan. A* 49(1):47–64
109. Kerschner C, Nierling L, Wächter P, Ehlers M-H. 2015. Special Issue on Degrowth and Technology. *J. Clean. Prod.* In press. https://www.researchgate.net/publication/282540106_Special_volume_Technology_and_Degrowth
110. Ellul J. 1964. *The Technological Society*. New York: Vintage Books
111. Heikkurinen P. 2016. Degrowth by means of technology? A treatise for an ethos of releasement. *J. Clean. Prod.* In press
112. Likavcan L, Scholz-Wäckerle M. 2016. Technology appropriation in a de-growing economy. *J. Clean. Prod.* In press
113. Illich I. 1973. *Tools for Conviviality*. New York: Harper & Row
114. Schumacher EF. 1993. *Small is Beautiful: A Study of Economics as if People Mattered*. London: Vintage Books

115. Vetter A. 2017. The matrix of convivial technology—assessing technologies for degrowth. *J. Clean. Prod.* In press
116. Grunwald A. 2016. Diverging pathways to overcoming the environmental crisis: a critique of eco-modernism from a technology assessment perspective. *J. Clean. Prod.* In press
117. Lizarralde I, Tyl B. 2017. A framework for the integration of the conviviality concept in the design process. *J. Clean. Prod.* In press
118. Alexander S, Yacoumis P. 2016. Degrowth, energy descent, and “low-tech” living: potential pathways for increased resilience in times of crisis. *J. Clean. Prod.* In press
119. Bradley K. 2016. Bike kitchens—spaces for convivial tools. *J. Clean. Prod.* In press
120. Carlsson C, Manning F. 2010. Nowtopia: Strategic exodus? *Antipode* 42:924–53
121. Kostakis V, Niaros V, Dafermos G, Bauwens M. 2015. Design global, manufacture local: exploring the contours of an emerging productive model. *Futures* 73:126–35
122. March H. 2016. Smart City and other ICT-led techno-imaginaries: any room for dialogue with degrowth? *J. Clean. Prod.* In press
123. Pollex J, Lenschow A. 2016. Surrendering to growth? The European Union’s goals for research and technology in the Horizon 2020 framework. *J. Clean. Prod.* In press
124. Pansera M, Owen R. 2016. Innovation for de-growth: A case study of counter-hegemonic practices from Kerala, India. *J. Clean. Prod.* In press
125. Kostakis V, Liarokapis M, Latoufis K, Bauwens M. 2016. The convergence of digital commons with local manufacturing from a degrowth perspective: two illustrative cases. *J. Clean. Prod.* In press
126. Cornelius Zoellick J, Bisht A. 2017. It’s not (all) about efficiency: powering and organizing technology from a degrowth perspective. *J. Clean. Prod.* In press
127. Bauwens M, Kostakis V, Pazaitis A. 2018. *Peer-to-Peer: The Commons Manifesto*. London: Westminster Univ. Press
128. Pueyo S. 2016. Growth, degrowth, and the challenge of artificial superintelligence. *J. Clean. Prod.* In press
129. Dörre K, Lessenich S, Rosa H. 2015. *Sociology, Capitalism, Critique*. London: Verso
130. Brown W. 2005. *Edgework: Critical Essays On Knowledge and Politics*. Princeton, NJ: Princeton Univ. Press
131. Dardot P, Laval C. 2014. *The New Way of the World: On Neoliberal Society*. London: Verso
132. Habermas J. 1985. *The Theory of Communicative Action*, Vol. 2: *Lifeworld and System: A Critique of Functional Reason*. Boston: Beacon Press
133. Muraca B. 2017. Against the insanity of growth: degrowth as concrete utopia. In *Socialism in Process*, ed. J Heinzekehr, P Clayton, pp. 147–69. Anoka, MN: Process Century Press
134. Barth T, Reitz T. 2016. Strukturprobleme der Krisenbewältigung: Weshalb Wachstumskritik vom Kapitalismus nicht schweigen sollte. In *Wachstum—Krise und Kritik: die Grenzen der kapitalistisch-industriellen Lebensweise*, ed. AK Postwachstum, pp. 39–62. Frankfurt, Ger.: Campus-Verlag
135. Petridis P, Muraca B, Kallis G. 2015. Degrowth: between a scientific concept and a slogan for a social movement. In *Handbook of Ecological Economics*, ed. J Martínez-Alier, R Muradian, pp. 176–200. Cheltenham, UK: Edward Elgar Publ.
136. Brown W. 2015. *Undoing the Demos: Neoliberalism’s Stealth Revolution*. New York: MIT Press
137. Lazzarato M. 2009. Neoliberalism in action: inequality, insecurity and the reconstitution of the social. *Theory Cult. Soc.* 26(6):109–133
138. Streeck W. 2016. *How Will Capitalism End?: Essays on a Failing System*. London: Verso
139. Zinn K-G. 2016. Vom Industriekapitalismus zum Neofeudalismus? Überlegungen zu einer Zukunft auslaufenden Wirtschaftswachstums. In *Wachstum—Krise und Kritik: die Grenzen der kapitalistisch-industriellen Lebensweise*, ed. AK Postwachstum, pp. 63–90. Frankfurt, Ger.: Campus-Verlag
140. Asara V, Otero I, Demaria F, Corbera E. 2015. Socially sustainable degrowth as a social-ecological transformation: repoliticizing sustainability. *Sustain. Sci.* 10(3):375–84
141. Muraca B. 2013. Decroissance: a project for a radical transformation of society. *Environ. Values* 22(2):147–69
142. Ott K. 2012. Variants of de-growth and deliberative democracy: a Habermasian proposal. *Spec. Issue Polit. Democr. Degrowth* 44(6):571–81

143. Asara V. 2016. The Indignados as a socio-environmental movement: framing the crisis and democracy. *Environ. Policy Gov.* 26(6):527–42
144. Johanisova N, Wolf S. 2012. Economic democracy: A path for the future? *Spec. Issue Polit. Democr. Degrowth* 44(6):562–70
145. Gorz A. 1980. *Ecology as Politics*. Montr., QC., Can.: Black Rose Books
146. Castoriadis C. 1998. *The Imaginary Institution of Society*. New York: MIT Press
147. Bohmann U, Muraca B. 2016. Demokratische Transformation als Transformation der Demokratie. In *Wachstum—Krise und Kritik: die Grenzen der kapitalistisch-industriellen Lebensweise*, ed. AK Postwachstum, pp. 289–311. Frankfurt, Ger.: Campus-Verlag
148. Kallis G, March H. 2015. Imaginaries of hope: the utopianism of degrowth. *Ann. Assoc. Am. Geogr.* 105(2):360–68
149. Norgaard RB. 1994. *Development Betrayed: The End of Progress and a Coevolutionary Revisioning of the Future*. London: Routledge
150. Kallis G. 2017. Economics without growth. In *Another Economy is Possible: Culture and Economy in a Time of Crisis*, ed. M Castells, pp. 34–54. Cambridge, UK: Polity