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Review

Green Growth or Degrowth? Possible Outcomes for Climate and Society

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Abstract As global temperatures continue to rise, those in favor of rapid climate mitigation face critical questions regarding maintaining current levels of economic growth. On a global scale, there remains a clear positive correlation between economic growth and carbon emissions, leading many climate scientists to call for a move away from a growth-focused economy. In this article, we draw from recent research to compare possible outcomes in terms of social well-being and climate mitigation for green growth and degrowth pathways. Green growth aims to maintain economic growth while reducing carbon emissions. Degrowth calls for a purposeful contraction of economic growth in wealthy countries. Drawing from recent studies, we compile evidence to compare these pathways and assess how each of these key strategies is evaluated and framed in the literature. We find that research indicates clear differences between these pathways in terms of mitigation potential and risks to human welfare, and we call for future research on specific topics related to a degrowth transition. Additionally, we identify issues of feasibility as primary concerns within both paradigms.

Keywords degrowth; green growth; climate change; society; well-being; environmental degradation; sufficiency; economic growth; sustainability

1. Introduction

The debate on whether continuous economic growth is compatible with environmental sustainability is intensifying, yet has been around for decades. In 1972, writer and scholar, André Gorz, was already exploring whether or not ecological balance is "conditional upon non-growth—or even degrowth (*décroissance* in French)—of material production" [1–4]. More recently, the relationship between our current economic model and the advancement of climate change has taken precedence in such debates. While some argue that continued economic growth can coexist with efforts to reduce carbon emissions through technological advancements and increased efficiency, others posit that such growth inherently leads to environmental degradation and is incompatible with long-term sustainability goals. Given the growing threats posed by global climate change, climate scientists are calling for a systemic transformation, stating that we need to make overarching changes in all facets of our lives—values, goals, institutions, and economies [5–7]. The Intergovernmental Panel on Climate Change (IPCC) explains that fundamentally altering our social and economic systems is essential to effectively address the climate crisis, suggesting the necessity for "rapid, far-reaching, and unprecedented changes in all aspects of society" to meet climate targets [8]. More recently, in the *IPCC Sixth Assessment Report* [9], the authors call for a transition to a low-carbon and high-well-being system, specifically moving "beyond the single dimensional metric of GDP (Gross Domestic Product)". Due to empirical relationships between economic growth (measured as GDP) and greenhouse gas emissions, the report's authors state that "degrowth pathways may be crucial" for climate mitigation efforts.

Degrowth has been developed, researched, and discussed over time with the purpose of illuminating a viable pathway toward a more sustainable society. While misunderstandings of degrowth suggest it would result in negative social impacts similar to those of an economic recession, degrowth is a planned reduction of energy and resource use with simultaneous social protections put in place [10,11]. In contrast, a recession is an unplanned event that can exacerbate inequality and diminish environmental and social welfare [11,12]. Degrowth policies, on the other hand, are designed to enhance well-being and address environmental impacts through a deliberate economic contraction focused on reducing *over*production and *over*consumption in wealthy countries, while supporting equitable growth to meet needs in poorer countries [13]. The policies aim to enable societies to live within ecological limits, address inequality, enhance

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well-being, and tackle urgent environmental threats such as climate change and biodiversity loss [14,15].

Despite increasing discussion about degrowth, as indicated by its mention in the latest IPCC report, most economists and political leaders are proponents of green growth. Green growth can be described as the idea that we can continue to foster "economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies" [16,17]. Proponents of green growth argue that economic growth and environmental sustainability can be compatible if economies shift towards more efficient and cleaner technologies, renewable energy sources, and sustainable practices [18–20]. Green growth theories suggest that climate change is primarily caused by inefficient use of resources, outdated technologies, and unsustainable consumption and production patterns [21,22]. Through strategies like investing in clean technology, innovation, green markets, and resource efficiency, green growth aims to achieve economic growth and environmental sustainability simultaneously [23–25]. Clean technology and innovation investments manifest as developments in solar, wind, and hydroelectric power, as well as advancing electric and hydrogen fuel cell vehicles or creating new materials and processes such as biodegradable plastics, energy-efficient building materials, and smart grid technologies for better energy management [26–29]. The widespread implementation of green markets has involved the adoption of carbon credits, promotion of sustainable agriculture products, and encouragement for the consumption of eco-friendly goods through certifications like Fair Trade and organic labels [30–32].

Green growth overall is dependent on the theory that it is possible to maintain economic growth while mitigating climate change and addressing environmental degradation more broadly. The primary goal of green growth is thus to decouple economic growth from environmental impacts, often specifically focusing on carbon emissions and climate change as we do here. Decoupling can be categorized in two ways: 1) absolute decoupling, or the reduction of overall emissions, and 2) relative decoupling, or the reduction of emissions per unit of production [33]. Evidence suggests that in order to effectively mitigate climate change, decoupling must be absolute, permanent, and global in scale [34]. Recent research has investigated the evidence for and feasibility of such decoupling. For example, Haberl et al. [35] systematically reviewed 835 peer-reviewed articles for evidence of decoupling and found that absolute decoupling is not occurring at the rate or scale necessary to prevent dangerous levels of warming. However, citing Hickel & Hallegatte [36], Semieniuk [37] explains that "despite this intensive empirical research, there is no consensus on what is and isn't feasible". Given that addressing climate change under a green growth pathway depends primarily on the ability to achieve rapid absolute decoupling at a global scale, the feasibility of such decoupling has largely formed the basis of the debate between green growth and degrowth proponents.

Green growth and degrowth are two contrasting approaches to achieving environmental sustainability, each with distinct perspectives and strategies. One of the core differences between these perspectives is that green growth aims to achieve sustainable growth through innovation and efficiency, while degrowth advocates for reducing excessive economic growth in wealthy countries to achieve ecological sustainability [20,38–40]. Among other differences, green growth operationalizes GDP and economic performance as indicators of success and human progress, supplemented by sustainability metrics. In contrast, degrowth rejects GDP as a social indicator and focuses on measures of well-being, ecological sustainability, and social equity [41–44]. Overall, green growth seeks to align economic growth with environmental sustainability through technological and efficiency improvements, while degrowth calls for a deliberate reduction in global economic activity where there is excess production and consumption to prioritize ecological health, equity, and human well-being. As the evidence linking economic growth to climate instability continues to mount, it becomes increasingly important to further explore the potential of degrowth and green growth to effectively address climate change.

In addition to addressing climate change, scientists are also calling for a system that prioritizes human well-being and social equity [5,9]. In this article, we focus specifically on how degrowth and green growth might serve both to mitigate climate change and improve social well-being. While existing research has compared green growth and degrowth, studies have typically taken distinct methodological or theoretical approaches, focusing on empirical feasibility, ethical and philosophical justifications, or economic system dynamics rather than synthesizing their broader benefits and drawbacks. Some studies have examined how these paradigms align with sustainability goals [39], while others have highlighted their analytical and structural differences [45] or

explored their normative foundations [46]. Additional studies have assessed macroeconomic trade-offs within ecological transitions [47] and considered the potential for hybrid approaches that balance economic and ecological priorities [48]. Building on these contributions, our study takes an integrative approach by synthesizing insights from both climate and social dimensions.

Our analysis reveals feasibility as a primary point of contention in the debate between green growth and degrowth, with differing assumptions, uncertainties, and perspectives shaping how each paradigm is evaluated. Rather than making absolute determinations about the feasibility of green growth or degrowth, we examine how the literature evaluates their feasibility in relation to societal well-being and climate outcomes, identifying key assumptions, uncertainties, and trade-offs that shape these discussions. Additionally, we situate our analysis within emerging discourses, responding to authoritative calls from climate scientists, including IPCC authors, who advocate for a transition to a well-being economy. By identifying and analyzing key arguments, we highlight how these paradigms are framed, the evidence used to support them, and their potential implications for climate and societal objectives. We thereby provide a timely, policy-relevant synthesis that reflects evolving sustainability debates and identifies important areas for future research.

2. Method and Approach

This research was completed by conducting an integrated literature review to compare and contrast the implications of green growth versus degrowth, particularly in relation to climate change mitigation and societal well-being. Climate was chosen because of the clear global need for effective strategies to mitigate climate change impacts, while society was chosen in hopes of exploring how different growth trajectories affect factors of human well-being such as social stability, quality of life, and equity. An integrated literature review is a non-systematic, "rigorous research method used for examining, criticizing, and synthesizing literature on a specific topic to advance science/knowledge," and it is known as one of the "only approach(es) that allows for the combination of diverse methodologies (for example, experimental and non-experimental research)" [49–51]. Literature was selected based on an exploration of both fundamental and recent research published in the disciplines of degrowth, green growth, environmental sociology, and climate policy. Peer-reviewed articles, institutional reports, and relevant grey literature were included, explicitly focusing on publications with significant contributions to the theoretical and empirical understanding of green growth and degrowth. We prioritized the examination of rigorous analyses and studies with clear relevance to ongoing academic debates in these fields. This approach ensures that our research strictly draws on high-quality, credible sources, and is relevant to current debates and knowledge gaps within the disciplines, ultimately allowing for comprehensive evaluation of green growth and degrowth as pathways to a sustainable future.

We provide an overview of available qualitative and quantitative findings to examine how the literature evaluates the feasibility of green growth and degrowth in relation to social well-being and climate change mitigation. We focus on these indicators due to the interconnected challenge of addressing the climate crisis while recognizing that policies targeting one goal may have unintended consequences for broader societal outcomes. Rather than making absolute determinations, we synthesize existing research to explore the key assumptions, uncertainties, and debates surrounding these paradigms. By comparing how studies assess outcomes under the current growth-based economy, green growth, and degrowth, we contribute to a more nuanced discussion of their viability and implications. Additionally, through our structured comparative descriptions, we identify apparent knowledge gaps for future researchers who are interested in contributing to this growing conversation.

While most countries around the globe adhere to a growth-based economy, some have recently taken steps to transition towards a green growth paradigm [52]. Degrowth, in contrast, remains purely theoretical and has not been implemented in practice. Vandeventer & Schmid [53] point out that while a growing number of creative researchers have attempted empirical assessments through a degrowth lens, the translation of degrowth into empirical research is not a straightforward process. While specific policies in alignment with degrowth principles have been enacted across various regions, no country has fully implemented a degrowth economy. Bhutan [54], "the first country in the world to pursue happiness as a state policy", arguably has come closest to implementing degrowth in their pursuit of enhancing "gross national happiness" over gross domestic product. However, some have questioned whether this pursuit truly represents an alternative to the growth-based economic system [55]. Ultimately, Bhutan's economy

continues to grow, as demonstrated by the May 2024 World Bank press release titled "Bhutan's Economy Maintains Robust Growth Despite Challenges" [56].

This lack of real-world examples of degrowth introduces complications in performing comparisons between the societal and climate outcomes of implementing green growth vs. degrowth. Variation in the number of available case studies has in turn led to differences in the content and structure of green growth and degrowth research. In their computational literature review of 1449 journal articles on green growth and degrowth, Polewsky et al. [45] find that green growth research is highly policy-oriented, based on empirical methodology, and focused on practical implementation. In contrast, the authors find that degrowth research is largely theory-driven and focused primarily on analyzing complex human-nature relationships. These differences between degrowth and green growth scholarship act as further barriers to direct comparison between the two. Here we address these barriers through the structured evaluation of two broad indicators—outcomes in societal well-being and climate change—in an attempt to mend these bodies of research and allow for a more thorough comparison.

Despite discrepancies between green growth and degrowth scholarship, here we leverage the best available research and information to provide an overview of the growing debate amongst scholars about how degrowth and green growth might differ in their impacts on climate mitigation and social well-being. This debate has become increasingly relevant as IPCC contributors call for a move away from a growth-centered economy to instead prioritize well-being and environmental sustainability [9]—aligning with the goals of degrowth. In the sections that follow, for both green growth and degrowth, we first evaluate how the literature characterizes their impacts on social well-being, followed by a discussion of how their feasibility is examined in research on rapid and effective climate mitigation. By examining the relationship between economic growth and social and environmental sustainability, we aim to synthesize recent evidence and contribute to the broader discourse on green growth and degrowth. This approach is novel in addressing a critical gap where well-being and climate are considered in isolation or insufficiently distinguished, and our focus aligns uniquely with the priorities outlined by the IPCC and climate scientists who urge the need for consideration of degrowth pathways and indicators beyond GDP [9]. Our findings indicate that feasibility remains the central point of debate in discussions of green growth and degrowth, with our analysis evaluating their potential benefits and drawbacks through differing assumptions, uncertainties, and disciplinary perspectives, shaping the broader discourse on sustainable economic pathways.

3. Societal and Climate Outcomes Under Green Growth and Degrowth

3.1. Green Growth

3.1.1. Social Well-being

Green growth is a broad and variably defined concept, often framed alongside terms like "sustainable growth" or "green development", reflecting diverse interpretations within the literature. As mentioned above, green growth is based on the argument that economic growth and ecological stability can be compatible if economies shift towards more efficient and cleaner technologies, renewable energy sources, and sustainable practices [18–20]. However, varying definitions of green growth indicate diverse levels of prioritization for the social pillar of sustainability within green growth frameworks. Amongst definitions proposed by key international actors, some directly mention social impacts, while others focus entirely on economic and environmental or climate-related impacts. An example of a more socially-focused definition, proposed by the Global Green Growth Institute, defines green growth as "the new revolutionary development paradigm that sustains economic growth while at the same time ensuring climatic and environmental sustainability" and which "focuses on addressing the root causes of these challenges while ensuring the creation of the necessary channels for resource distribution and access to basic commodities for the impoverished" [57].

In recent scholarship, green growth proponents have also advocated for policies that integrate both environmental and social initiatives, such as the "Green New Deal" [58,59], while others have incorporated indicators such as "social inclusion" [60] into their green growth analyses. Sardokie et al. [43] argue that social well-being is an explicit or implied priority of green growth. In Sardokie et al.'s [43] definition of green growth, they state that green growth "improves well-being and social justice while reducing environmental risks and ecological footprint" and "should prioritize green innovation, decarbonization, green trade, resource efficiency, and social

inclusion". Anamika [61] similarly describes green growth as "a strategy to eliminate the tradeoffs between economic growth and investment and gains in environmental quality and social inclusiveness".

Alternatively, the World Bank [62] defines green growth as "growth that is efficient in its use of natural resources, clean in that it minimizes pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters", lacking mention of societal considerations. Similarly, the Organisation for Economic Co-operation and Development [63] states that green growth centers around five broad goals: 1) enhancing productivity, 2) boosting investor confidence, 3) opening up new markets, 4) contributing to fiscal consolidation, and 5) reducing risks of negative shocks to growth. The United Nations Environment Programme [64] describes green growth as an economic trajectory in which "growth in employment and income are driven by public and private investment into such economic activities, infrastructure, and assets that allow reduced carbon emissions and pollution, enhanced energy and resource efficiency, and prevention of the loss of biodiversity and ecosystem services". Again, none of these aims consider social well-being beyond perhaps the indirect impacts of economic growth. Additionally, although scholars in favor of green growth often mention social well-being, many seem to indicate that social well-being would be realized naturally through economic gains rather than explicitly incorporating social well-being as a goal or priority. Lederer et al. [65] explain that green growth "emphasizes an efficient, functioning economy as a *precondition* for achieving progress". This framing thus arguably emphasizes economic status as an indicator of well-being over other indicators such as health and happiness.

Overall, many of the leading international organizations influencing future developmental trajectories in favor of green growth do not necessarily prioritize non-financial societal concerns within their frameworks. Central to most definitions, however, is the focus on reducing environmental degradation while simultaneously promoting economic development and expansion. The feasibility of such a pathway thus comes into question; while many academic proponents of green growth may support interventions aimed at improving social well-being, few include social considerations beyond economic indicators within their green growth analyses. This conclusion aligns with findings by Polewsky et al. [45], who propose that while degrowth research "holds a strong sustainability position and integrates the three dimensions of environmental, economic, and social sustainability", green growth in comparison "follows a weak sustainability approach and tends to neglect the social dimension". In addition, Lederer et al. [65] state that green growth has faced criticism for favoring "an apparently neutral adjustment of technological and economic parameters while overlooking social and political factors".

Researchers have also examined the assumption inherent to green growth that economic improvements necessarily correlate to higher well-being. Several studies support the idea that despite the current prioritization of growth, economic development may only be beneficial to a certain extent, beyond which its benefits flatline or even downturn. One study, for example, found that while young people in developing regions such as sub-Saharan Africa and Eastern Europe are reportedly happier than older generations, young people in North America and Western Europe are increasingly less happy relative to their predecessors [66]. The Easterlin paradox, arising from observations made by economist Richard Easterlin that life satisfaction levels in the US stagnated between 1946 and 1970 despite a 65% increase in GDP, proposes "that at a point in time happiness varies directly with income, both among and within nations, but over time the long-term growth rates of happiness and income are not significantly related" [67]. Similar findings across different regions have been upheld in subsequent studies, with longitudinal analyses in Japan and the United Kingdom indicating average well-being has remained unchanged since the 1950s despite significant GDP increases [68]. Heikkinen [69], in their presentation of an equilibrium framework for degrowth modeling analyses, similarly posits that all growing economies can eventually reach a size at which degrowth improves general social welfare. From these findings, there appears to be a disconnect between income increase and life satisfaction over time, lending itself to the proposition that embracing a simpler, less consumptive lifestyle may be freeing and meaningful rather than restrictive and limiting [70,71].

Regardless, some scholars maintain that green growth is the best, most feasible pathway for global social justice and well-being, particularly within the Global South. Okereke [72], for example, states that "on both conceptual and policy grounds, a 'strong version' of the green economy provides a better foundation for seeking international climate justice for Africa than

degrowth", and "that green growth is a more pragmatic and realistic approach to global climate justice because it is more sensitive to the norms, structures, and dynamics of global politics". Even amongst degrowth scholars, there is a common sentiment that degrowth should be pursued only in the wealthy countries of the Global North while green growth will be necessary for the Global South [73]. Lang [74], for example, explains that "common sense suggests that a project as exotic as controlled economic degrowth is at its best applicable only in the geopolitical Global North while for the South, economic growth would be a requirement".

3.1.2. Climate Change Mitigation

Proponents of the green growth perspective frame economic expansion as essential for climate change mitigation, contending that it provides the necessary incentives and conditions for driving innovation at the scale required to address the climate crisis [75]. In recent literature, advocates of green growth argue that economic expansion can and should continue despite physical planetary boundaries, with their reasoning based largely on the theoretical assumption that GDP can be decoupled from environmental impacts, particularly greenhouse gas (GHG) emissions [15,33,76]. Use of the term green growth has increased in recent decades; as Reilly [21] explains, this terminology "turns the negative association with the cost of environmental control into a positive, promising growth and jobs", which is particularly attractive in an era marked by high unemployment, inflation, and recession. Several international environmental and developmental organizations tend to favor green growth for mitigating climate change, such as the United Nations [77,78] and the World Trade Organization [79,80].

Regarding the fundamental characteristics of green growth, Polewsky et al. [45] (citing Spash [81]) frame green growth as "rooted in ecomodernism and neoclassical environmental economics, which consider environmental degradation as a result of market failures and advocate for market-based instruments and technological innovation to decouple economic growth from negative environmental impacts". Similarly, Javed et al. [25] (citing Umar et al. [82] and Su et al. [83]) state that through "leveraging environmentally friendly technologies and innovations in energy generation green growth facilitates efficient energy production and conservation of natural resources, ultimately fostering a higher-quality environment", demonstrating the centrality of efficiency in green growth framing. Ashfaq et al. [84] also advocate for the nexus between green economic growth and renewable energy as a promising frontier, arguing that countries can simultaneously promote climate change mitigation, sustainable development, and economic growth by transitioning to renewable energy. In this regard, Fernandes et al. [18] argue that it is feasible to achieve green growth through sustainable technology transfers and innovations so long as all stakeholders (government, industry, and individuals) cooperate to "actively build a greener and more sustainable society".

The feasibility of addressing climate change through green growth has been challenged in recent literature, however, leading some climate scientists to believe it will be necessary to transform our economy away from growth [5,6,12]. For example, Slameršak et al. [85] critique "high-growth, low-carbon" models, arguing that they rely too heavily on uncertain improvements in global energy efficiency and carbon intensity while underestimating the impact of population growth. Regarding reliance on market mechanisms to address climate change, the morality of such a strategy has also been debated in the literature. Critics of market-based climate interventions such as cap-and-trade programs have argued that trading pollution rights removes the moral stigma surrounding pollution, and "that inequity is built into the system by allowing the rich to buy their way out of pollution reduction regimes" [86].

The "techno-optimism" inherent to green growth has also been criticized in recent scholarship, referring to the "belief that the problems caused by economic growth can be solved by more growth (as measured by GDP), provided we learn how to produce and consume more efficiently through the application of science and technology" [87]. The International Energy Agency (IEA) [88], for example, includes future technologies as a key part of mitigation, assuming that 46% of emissions reductions between 2030 and 2050 will be achieved with technologies that are still in demonstration or prototype stages. Again, feasibility emerges as a central tension here, with degrowth advocates questioning whether such technological advancements can be assumed or relied upon to meet necessary mitigation timelines. Ribeiro & Soromenho-Marques [89] outline five challenges with the techno-optimist approach: 1) it deflects attention from reflection on the model of the neo-classical economy and its ecological implications, 2) it strengthens the ideology of humans as dominant over nature, 3) it legitimizes free economic markets to ensure continued

growth and maintain corporate reputations, 4) it diverts attention away from planet-damaging practices, and 5) it diverts attention away from policymaker responsibility because their action plans depend on scientific and technical development.

Emphasis on energy efficiency and renewable energy within the green growth framework has become an additional source of contention in recent literature. Scholars have referred to the Jevons paradox as a cautionary deterrent to the prioritization of efficiency improvements within green growth frameworks. Sometimes used interchangeably with the rebound effect, the Jevons paradox refers to the phenomenon of increased efficiency leading to increased consumption of a resource [90–93]. Various studies have estimated the impact of this rebound effect as counteracting more than 50% of energy gains [94,95], alluding to the limited potential of energy efficiency gains in mitigating climate change. Segovia-Martin et al. [96] argue that due to this rebound effect, efficiency measures are unsustainable without sufficiency measures which simultaneously reduce excess production and consumption. Mathai et al. [97] similarly contend that "greater efficiency (technical and economic) in the throughput of matter and energy is a necessary but insufficient condition for guiding energy and resource use policies in the present context". The role of renewable energy in green growth frameworks has also been a subject of debate, with several studies indicating that renewable energy projects have largely expanded the total energy supply rather than replaced fossil fuels [98–101]. Riedlingstein et al. [102], for example, found that emissions from fossil fuels increased by 1.1% in 2023 compared to 2022 levels despite significant growth in renewable energy development. From this perspective, focusing too much on renewable energy without simultaneously reducing energy consumption constrains the potential of both energy efficiency and a true transition to renewable energy sources.

Based on historical and current trends, recent scholarship has posed that the inherent relationships between economic growth and GHG emissions may indicate that green growth is unlikely to be effective in avoiding dangerous levels of warming [34,103]. Researchers have used empirical evidence and modeling to illustrate how decoupling may not be feasible to achieve at the rate and scale necessary to prevent the worst effects of climate change [104,105]. Ward et al. [106], for example, conclude from their model that "growth in GDP ultimately cannot plausibly be decoupled from material and energy use". Recent studies have demonstrated that decoupling has not been achieved globally [35,107] and is not likely to be achieved in the near future [106–108]. Moriarty & Honnery [107] argue that future decoupling is especially improbable given the low energy return from renewable energy investment, along with the high likelihood that wind and solar development will face shortages of rare materials. Ritchie & Roser [109] similarly estimate that a low-carbon energy system would only address 73% of the emissions related to energy. Several quantitative studies have found that GDP growth is incompatible not only with emission reductions but with the sustainable use of natural resources overall [110–112].

Other studies have questioned whether green growth is happening. Based on their finding that environmental efficiency continually improved for the G20 countries between 2000 and 2014, Wang et al. [113] propose "economic growth, resource conservation, and pollution reduction can be achieved simultaneously", further stating that a "positive trend of green growth is clearly evident". In contrast, Vogel & Hickel [108] argue that green growth is not happening, based on their findings that "decoupling rates achieved in high-income countries are inadequate for meeting the climate and equity commitments of the Paris Agreement", and that these decoupling efforts therefore "cannot legitimately be considered green". Hubacek et al. [52] found that while 32 countries have achieved absolute decoupling of emissions from GDP based on production, only 23 have demonstrated absolute decoupling in terms of consumption-based emissions, and only 14 countries have reached absolute decoupling when considering both production and consumption-based emissions. The authors conclude that their results illuminate "the limits of 'green growth' and the growth paradigm" [25], given that even countries that have achieved absolute decoupling are still emitting and contributing to climate change.

Although a substantial body of research questions the feasibility of green growth in mitigating climate change, some scholars challenge the conclusion that sufficient decoupling is impossible or unlikely. Ekins [114] argues that the possibility of decoupling is not a question of technological or economic capacity, but rather solely one of political feasibility. The author presents several reasons why they consider current conditions to be favorable for green growth: 1) there are many low-carbon technologies, 2) many of these technologies are nearly competitive with fossil fuel-based energy, 3) the costs of some of these technologies have decreased significantly, and this will likely continue, and 4) there are many opportunities for cost-effective efficiency improvements.

According to Ekins [114], these four qualities "are precisely the characteristics that, if applicable to a range of resource and environmental issues, would be necessary to achieve the progressive decoupling of economic growth from resource use and environmental impacts".

3.2. Degrowth

3.2.1. Social Well-being

Within degrowth literature, scholars have pointed to issues within our current economic structure as evidence for the necessity of an economic transformation. For example, Wilkinson & Pickett [115] maintain that rising economic inequality has significantly undermined social well-being. While it is arguable that average global well-being has improved under a growth-based economic trajectory since the Industrial Revolution, degrowth scholars contend that these improvements have overwhelmingly benefited the Global North at the expense of the Global South [116]. Even within wealthier nations, degrowth scholars emphasize that the majority of wealth accumulation has been concentrated amongst a small minority of the population. Chancel et al. [117] explain that "multimillionaires have captured a disproportionate share of global wealth growth over the past several decades: the top 1% took 38% of all additional wealth accumulated since the mid-1990s, whereas the bottom 50% captured just 2% of it". In 2022, the wealthiest 10% of the population held 76% of global wealth [117]. Additionally, degrowth proponents point out that a significant portion of the global population remains in poverty and has seen only marginal improvements in living conditions, with one study estimating that one in seven adults struggle to access food and/or shelter as of 2020 [118]. Issaoui et al. [119] argue that our neoclassical economic model has ultimately misled us, as "its wealth has in effect brought us back to poverty".

Citing Preston [120] and Rodgers [121], the National Resource Council [122] states that "when inequality is great, the decrease in life expectancy among those of lower socioeconomic status can outweigh the increase in life expectancy among those of higher socioeconomic status, leading to a life expectancy below that likely to be seen in a country with the same average level of the social indicator but less inequality". Existing literature proposes that these inequalities affect not only physical but emotional health, to the extent that mental health professionals have advocated for more equitable policies such as progressive taxation and basic universal income as ways to improve general mental well-being [123]. Several large-scale survey-based studies have also linked income inequality to lower levels of life satisfaction and/or happiness [124–126], with one US study finding that even wealthier individuals theoretically favor more equitable conditions than currently exist [127].

While the current growth-based economic pathway ultimately prioritizes economic growth above other indicators, degrowth pathways instead tend to explicitly prioritize social well-being [128]. A fundamental component of degrowth is that profit and wealth accumulation become "subordinated to alternative state functions - including sustainability, security, and social welfare" [129]. This emphasis on well-being is often presented in the literature as an inherent aspect or defining characteristic of degrowth. Schneider et al. [130], for example, define degrowth as "an equitable downscaling of production and consumption that increases human well-being and enhances ecological conditions at the local and global level, in the short and long term". Degrowth proponents suggest that ensuring job security during a decline in overall economic activity while redirecting labor toward regenerative and beneficial projects lights the way to meet emissions reduction targets and address community, social, and ecological needs [131]. Some degrowth scholars have negated the possibility of social improvements within growth-based economies entirely, arguing that this system tends to lead to inequality [132] and social instability, particularly due to uneven distribution of resources as well as "diminishing social returns with higher resource use" [133].

The literature on degrowth often emphasizes the redistribution of resources and the restructuring of economic processes as key strategies for meeting societal needs [15]. Scholars such as Issaoui et al. [119] argue that redistribution should be a central focus of economic and ecological policies in degrowth frameworks to support a good quality of life. Similarly, Barlow et al. [134] emphasize that degrowth must be inclusive and attuned to the needs of historically marginalized groups to be successful in achieving desired societal and climate outcomes, and Löwy [135] states that the capitalist system, which prioritizes profit over ecological and social considerations, "is incompatible with a just and sustainable future". Degrowth proponents argue against equating GDP growth with reductions in poverty, as the unequal distribution of wealth can lead to cases

where poor people have constrained access to goods and services despite a growing economy [136,137]. According to degrowth reasoning, indefinite economic growth on a finite planet is impossible, thus, prioritizing growth in socio-economic policy will lead to eventual economic decline with extensive social and political consequences [14]. Further, Kish & Quilley [138] argue that biophysical limitations to growth necessitate a profound transformation in human systems, likely leading to the necessity for systemic contraction and degrowth.

With the assumption that economic decline is inevitable [41], planned degrowth through key policy changes is thus presented by its proponents as the best way to avoid such consequences. Policies such as living wage mandates and progressive taxation [85] represent critical strategies for maintaining well-being within a constricted economy. Citing earlier paper [139], Heikkinen [69] states that, "Assuming both resources and working hours are equally distributed, degrowth to a lower level of average consumption improves welfare via increased average leisure". Degrowth scholars also often argue for universal basic income, as guaranteeing a basic income secures a minimum quality of life and—along with vital services like healthcare, food access, education, and housing—offers a strategic pathway to a fair economic transition [140–142]. Other transition strategies include work time reduction, which addresses economic growth, excess production, and consumption, and transitioning to public ownership of services instead of private, profit-driven models, which also impacts carbon reduction [143–146].

The feasibility of degrowth to guarantee better social conditions for all has not gone unexamined in the literature. For example, degrowth has been criticized for not specifying the form or extent of economic limitations or who would dictate them [132]. Smith et al. [147] similarly contribute two major criticisms of degrowth: 1) many key questions about politics and power are left under-examined in degrowth framing, and 2) emergence and uncertainty are inevitable aspects of social change; thus, the limitations of intention must be considered in more depth than degrowth scholars have typically presented. Some have also criticized the statistical validity of the Easterlin paradox due to mixed empirical findings as well as the fact that while GDP can increase indefinitely, subjective well-being is usually measured with bounded scales [148]. This means that countries that already have very high subjective well-being scores are unlikely to show continuous improvement with increasing GDP, as they are already near the maximum boundary. However, declining happiness among youth relative to older generations in developed nations despite continual economic growth, as mentioned above, could be interpreted as a counterargument to this criticism. Büchs & Koch [148] also point out the theory of loss aversion as predicting potential decreases in social well-being if material living standards are to be reduced. The authors propose that if the theory is correct, then "processes which imply a reduction of (consumption) opportunities may have negative impacts on people's subjective wellbeing compared to processes that offer gains, at least in the short to medium term". In this regard, Büchs and Koch point to evidence of diminished well-being during economic recessions as evidence that although economic growth may not correlate to higher social well-being, economic losses likely correlate to lower well-being. However, the authors follow this by expressing the possibility that people may adapt their preferences to favor lower material standards, which is especially probable if prospects for future improvements are considered unlikely. Although the authors refer to studies of well-being during recession in their arguments, they emphasize that "it is important to stress here that recession and degrowth are not equivalent" [148], as we have also discussed above. In light of these concerns, Strunk [149] argues that overcoming growth-fixated capitalism is critical despite the significant economic trade-offs, emphasizing the need for socially just management of challenges tied to reducing reliance on fossil fuels.

As for criticisms toward degrowth related to resources and ecological well-being, most questions have centered on implications for the Global South. Islar et al. [150] propose that degrowth entails "a downsizing of production and consumption in Western extractive economies to free up ecological space for the Global South". Lang [151], however, argues that degrowth in high-income countries would not necessarily "make space" for the eco-social transformation of the Global South without simultaneously challenging the structures underlying the asymmetric and colonial relations of global governance. Additionally, concerns have been raised about whether economic contraction in the Global North would negatively impact the Global South due to economic interdependencies. Gräbner-Radkowitsch & Strunk [152] illuminate a paradox arising from this globalization of national economies which they call the "twin problem of global dependencies", referring to how these dependencies serve both as motivators and obstacles to

degrowth within our current institutional structure. Thus, the feasibility of societal improvements for the Global South under degrowth remains a critical point of analysis.

3.2.2. Climate Change Mitigation

Recent literature indicates that climate change mitigation is a likely benefit of degrowth given demonstrated correlations between GDP, energy consumption, and GHG emissions [35,153,154]. Within degrowth literature, it is argued that economic growth is the main source of the climate crisis, while "the solution is seen in achieving well-being without it" [155]. Much like social well-being, most degrowth proponents consider climate change mitigation to be a core priority and defining characteristic of degrowth, often referring to the current climate crisis as evidence for the necessity and urgency of widespread structural change [156,157]. Others propose that degrowth may be the only viable economic pathway to address climate change; Wiseman & Alexander [158], for example, propose that economic orthodoxy maintains "that economic growth is incompatible with emissions reductions of more than 3% or 4% p.a.", which necessarily entails "that avoiding runaway climate change requires degrowth in the Annex 1 nations".

Slameršak et al. [85] argue that pathways such as degrowth provide a more sustainable alternative to the perpetually increasing extraction and use of resources required under a high-growth pathway. In light of the difficulty—or, some argue, infeasibility—of decoupling economic growth and resource use, degrowth scholars emphasize that reducing production and consumption is the most effective means for lowering levels of resource use [159,160]. Pretty [68], citing The Royal Society [161], argues that consumption can contribute "positively to human development and well-being when it enlarges the capabilities of people without adverse effects on others, when it is fair to future generations, when it respects the carrying capacity of the planet, and when it encourages the emergence of lively, creative and content communities". However, the author further argues that "current consumption patterns fail on these criteria, and are both unsustainable and unfair" [68].

In this regard, some degrowth scholars have emphasized the concept of sufficiency as an essential strategy for addressing climate change. Sufficiency entails aiming for "enoughness" rather than the ever-expanding production and consumption [162] which, they argue, has led to our current climate crisis. The sufficiency strategy thus requires reorienting economic policy away from the "maximum" and instead toward an "optimum" [163]. The concept of "enoughness" suggests both an upper and lower threshold, wherein human needs are met without exceeding ecological limitations. Di Giulio et al. [164] describe the space between these two thresholds as "consumption corridors", which are "defined by minimum standards, allowing every individual to live a good life, and maximum standards, ensuring a limit on every individual's use of natural and social resources in order to guarantee access to a sufficient level of resources (in terms of quantity and quality) for others in the present and in the future". In this sense, degrowth scholars argue that sufficiency would contribute to the preservation of ecological resources and limit warming [165] by reducing production and consumption, thus reducing the environmental impacts of each.

Given the complexity of emission reductions and interactions between the economy, society, and the climate, as well as the radical implications of restructuring our economic priorities, there have been a number of attempts to model degrowth outcomes in recent literature. Though still few attempts at modeling such scenarios have been made, results have typically demonstrated more favorable climate conditions under degrowth than alternative economic pathways, such as green growth. In their comparison of 1.5 °C degrowth scenarios with IPCC archetype scenarios, Keyßer & Lenzen [166], for example, find that "degrowth scenarios minimize many key risks for feasibility and sustainability compared to technology-driven pathways" characteristic of green growth, "such as the reliance on high energy-GDP decoupling, large-scale carbon dioxide removal, and large-scale and high-speed renewable energy transformation". Slameršak et al. [85] analyzed different model scenarios based on assumptions of low and high economic growth, and their findings similarly indicated that scenarios with lower growth rates enable mitigation efforts without relying on uncertain future technologies and unprecedented decoupling rates. Notably, their ambitious low-growth scenario was the only one found to align with pathways to limit global warming to 1.5 °C.

On the other hand, some modeling outcomes seem to indicate that emission reductions may come at the expense of reducing global poverty in specific degrowth scenarios. The feasibility of

addressing climate change through degrowth without causing societal disruptions has thus come into question. Moyer [167], for example, presents evidence for greater emission reductions through degrowth compared to other frameworks in their modeling of various economic pathways. However, Moyer also finds that within their global degrowth scenario model, these emission reductions limit social development and lead to increased poverty. This potential outcome is well understood by degrowth scholars who typically specify that the implementation of degrowth policies should take place only within developed nations [10,116]. However, while limiting degrowth to high-income countries and pairing it with extensive redistribution negates some of the socioeconomic costs, Moyer further explains that emission reductions in this modeling scenario are minimal (about 11% by 2050) because "a large share of future emissions will be from countries in other income groupings this century and degrowth reduces resources invested in renewable energy" [167].

Regardless, neglect toward implications for the Global South has been a common criticism of degrowth research even among degrowth scholars themselves [168]. Recent research has indicated that if the Global North were to shift toward more sufficiency-based economies, this could result in reduced export revenues and exacerbated debt crises in the Global South [72,129]. A unique dilemma presents itself to degrowth scholars here: on one front, they argue that degrowth may be the most effective way to address climate change, which disproportionately affects those who have contributed the least emissions, particularly the Global South. Concurrently, degrowth scholars acknowledge that the Global South might face significant economic burdens from the implementation of degrowth, which could reduce social well-being and diminish the ability of nations to address climate change and environmental degradation within their own borders. Escobar [169] highlights the importance of tailoring degrowth goals to specific economic and social contexts at national and regional levels, particularly when assessing the relationship between degrowth and well-being in the Global South.

3.3. Summary of Findings

Our analysis reveals feasibility as a central point of debate between green growth and degrowth, as each paradigm presents potential benefits and drawbacks for societal and climate outcomes that are shaped by differing assumptions and uncertainties. Green growth, while compatible with existing market structures, may overlook critical indicators of social equity and well-being. This paradigm promotes economic productivity but ultimately relies upon uncertain technological advancements and the assumption that carbon emissions can be decoupled from economic growth globally. In contrast, degrowth prioritizes social equity and sufficiency, offering the potential for greater emissions reductions by adhering to biophysical planetary boundaries. However, degrowth may pose risks to economic stability and material living standards if not carefully managed, with one of its most pressing challenges being the need to address economic implications for the Global South. Table 1 summarizes our findings from Section 3.

Table 1. Societal and Climate Outcomes Under Green Growth and Degrowth. *This table summarizes our key findings, highlighting the potential benefits and drawbacks of green growth and degrowth approaches in achieving societal and climate outcomes.*

Paradigm	Potential Benefits	Potential Drawbacks
Green Growth	**Societal Outcomes**	
	Promotes economic productivity along with growth in employment and income [16–18,63,64].	May overlook issues of social equity and well-being in favor of economic parameters [10,15,45,65].
	Compatible with existing market structures and institutions, which prioritize economic growth [16–18,38].	Assumes a correlation between economic growth and increased human well-being despite potential evidence to the contrary [66–71,115,120–127,132,133].
	Climate Outcomes	
	Increases green investments, technological innovation, and resource and energy efficiency [23–29,75,82,83].	Relies on uncertain technological advancements and energy efficiency without consideration for rebound effects [80,87–89,91–102].
	Reduces carbon emissions through green market intervention strategies, such as cap-and-trade systems [21,30–32].	Decoupling carbon emissions from economic growth may not be possible at the rate and scale necessary to prevent catastrophic climate change [104–108].

Table 1. (*Continued*)

Degrowth	**Societal Outcomes**	
	Improves social equity and well-being through their explicit prioritization [15,41–44,128,129].	Risks short-term economic instability and reduced material living standards [74,147,148].
	Limits excess production and consumption through a focus on sufficiency [162–165].	May neglect economic implications for the Global South [72,129,168,169].
	Climate Outcomes	
	Confines economies to adhere to biophysical planetary boundaries [36,138,140,165].	Current political feasibility is low, as green growth is currently favored by major intergovernmental organizations [62–64,77–80].
	Models indicate greater emission reductions when compared to high-growth scenarios [85,166,167].	May diminish the ability of nations in the Global South to reduce emissions within their own borders [74,169].

4. Discussion

From our results, we conclude that feasibility remains the key variable in the green growth vs. degrowth debate. The feasibility of each strategy to deliver improvements to society and climate change serves as the pivotal concern within our paper and, arguably, the larger academic conversation. As discussed above, each concept inspires its own major question of feasibility. For green growth, can decoupling feasibly be achieved in time? For degrowth, can such a strategy feasibly be implemented? Based on the evidence we present in Sections III and IV, we discuss the feasibility of green growth on our current trajectory, as well as the feasibility of implementing degrowth within a capitalist model.

4.1. Does the Current Pace of Transition Undermine the Feasibility of Green Growth?

Despite advances in renewable energy, the transition away from fossil fuels has been extremely slow due to the well-established interests of powerful energy corporations and the existing infrastructure built around fossil fuels [170]. McKie [171] explains that "climate countermovement organizations operate as a network attempting to protect a fossil fuel-based economic system challenged by the rise of environmentalism". While industry is overwhelmingly responsible for the majority of greenhouse gas emissions [172], it is well established that corporations and business groups are major players in the political realm [173]. Fossil fuel and other high-polluting companies often have deep ties to political entities and actors, leveraging their influence to shape energy policies and legislation in their favor. These companies invest heavily in political campaigns and lobbying activities [174,175] to ensure that policies continue to support fossil fuel production and consumption [176,177]. Vastenaekels [128] uses the "Capital as Power" framework to demonstrate how under current growth-oriented economies, dominant capital groups maintain their power through "sabotage". Citing Bichler & Nitzan [178], the author elaborates on the term as referring to strategic interventions by corporate entities undertaken to maintain their economic positions at the expense of social well-being for the majority [128]. Under a growth-oriented economy, these societal expenses are largely ignored or excused as unavoidable costs in the continual pursuit of increasing GDP.

Though it is difficult to precisely determine the impacts of corporate political influence on climate change governance within our current system, one can look at lobbying efforts as well as rifts between public opinion and government action as potential indicators. Brulle [174] estimates that lobbyists spent over $2 billion on climate-related legislation from 2000–2016 in the US alone. This has troubling implications, as one study found that while approximately 89% of corporate lobbying endeavors are successful, only 40% of lobbying efforts led by citizen groups and nonprofits ultimately reach their objectives [179]. In addition, an estimated two out of every three US citizens believe the government should do more to address climate change [180]. However, government responses to climate change have remained inadequate in terms of steering the nation toward carbon neutrality, and emissions continue to rise [181]. This rift indicates that factors beyond public opinion are being prioritized in climate decision-making processes. Inadequate response to climate change has thus resulted not only from the technical and logistical challenges involved but also in large part from the structure of our growth-based system, which has incentivized industry to continuously stymie climate protection measures for their own economic benefit.

Given that our current trajectory predicts 3 °C of warming by 2100 [182], we must ask not only whether green growth can effectively limit emissions, but whether it can do so in time to prevent catastrophic warming. With current temperatures only 1.1 °C above pre-industrial levels, we have already observed increases in the frequency and severity of deadly wildfires, storms, floods, droughts, heat waves, diseases, and famines. One study found that between 2000 and 2019, over five million deaths annually could be attributed to non-optimal temperature conditions [183]. Sea level rise has also caused major disruptions, with estimations that sea level rise already causes $500 million annually in property damage in the United States alone [184], equating to a loss of wetland area larger than the state of Rhode Island between 1998 and 2009 [185]. These threats are of course further exacerbated in low-lying island nations such as the island of Tebunginako, part of the central Pacific Island nation of Kiribati. While this island supported a thriving village community up until the 1970s, little evidence of its existence remains as rising sea levels have completely reclaimed the area [186], and many other island nations are now seemingly racing against time to avoid a similar fate [187,188].

Current evidence suggests that green growth is not advancing at the pace necessary to achieve climate change mitigation at the targeted levels inspires particular concern. According to the IEA, despite a 50% expansion in renewable energy capacity in 2023, mainly from solar and wind power, the world is on track to increase renewable capacity by only two-and-a-half times by 2030, falling short of the tripling goal set at COP28 [189]. The IEA emphasizes the need for rapidly increasing renewable energy [189], but it does not address the fact that doing so does not necessarily decrease overall energy consumption—a dynamic related to the rebound effect, or Jevons paradox [190]. Even without considering the rebound effect regarding energy efficiency and increased consumption, the IEA acknowledges the need for an accelerated transition to renewables, but there are limitations due to economic and infrastructural challenges [189]. With proponents of renewable energy acknowledging that the pace of transition needs to accelerate to meet internationally agreed-upon targets, this suggests that the current pace within a growth-oriented economy is insufficient to address climate mitigation challenges at the global scale. As discussed above, Hickel & Kallis [103] determined that absolute decoupling from carbon emissions is highly unlikely to prevent warming under 1.5–2 °C at the necessary rate. These trends cast doubt on whether green growth interventions may be able to address the spatio-temporal scales at which climate change is occurring.

It is critical to consider the risks involved in the pursuit of maintaining our current growth-based economy through the green growth pathway, which includes economic, environmental, and technological challenges. Economic challenges primarily involve the costs of investment in green alternatives, while environmental challenges pose issues such as continued resource extraction, carbon emissions involved in the production process, habitat degradation, and increased land use [191]. Both the viability and reliability of green technologies also pose a great deal of uncertainty [192]. Muraca & Neuber [192] found that from an applied ethics perspective, as well as a degrowth-based critique of technology, the only green technology that would be ethically responsible and low-risk to pursue would be afforestation, and only in certain regions. The risks associated with green growth may be surmountable, but the issue of the spatio-temporal rate at which the transition toward green technology is happening makes this pursuit of the green growth pathway especially challenging and high-risk.

The low feasibility of green growth to sufficiently limit warming, though concerning, does not imply that degrowth is necessarily a more feasible pathway. Like a transition to low-carbon energy systems, degrowth faces strong opposition from those vested in a system prioritizing economic growth, likely the majority of powerful financial and political players globally. Gathering enough support for a degrowth pathway would likely take years of education and incremental implementation of degrowth policies. As Savini [193] points out, creative degrowth policies are abundant and several examples have already been implemented across various regions, such as the fossil fuel phase-out targets set in Amsterdam, Glasgow, Barcelona, and Copenhagen. Savini further argues that, "What degrowth research currently lacks, then, is not policy proposals but insights into strategies that can publicly legitimize those policies" [193]. While evidence suggests that green growth is not occurring at the rate and scale necessary to prevent catastrophic climatic impacts, we cannot necessarily assume a degrowth transition would occur in sufficient time either. Given the significant political barriers inherent to garnering widespread support for such a radical economic transformation, it is critical to avoid overestimating the feasibility of a timely transition toward degrowth.

4.2. Can Capitalism Adapt to a Degrowth Framework?

Many people associate capitalism with private property and market-based distribution of goods and services, yet these have been in existence for thousands of years. Others argue that modern capitalism emerged due to the rise of the profit imperative over other social goals [194]. Answering the question "does degrowth mean moving beyond capitalism?" depends on how one defines and understands capitalism and its growth dependency. With the mounting climate crisis, evidence for the inadequacy of our current economic trajectory is plentiful. However, creating beneficial change requires first understanding areas of concern within our current system, thus warranting a discussion here of capitalism and the complex web of drivers and interactions that comprise it.

Capitalism as an economic system is growth-dependent, relying on continuous economic expansion to maintain stability [195,196]. This drive for growth is fueled by competition, innovation, and the pursuit of higher returns on investment (profit) [197]. Since the 1950s, global economies have been predominantly focused on economic growth, marked by persistent efforts to increase GDP as a primary measure of national success [198–200]. While this orientation is often associated with the post-World War II era and its focus on GDP growth as a measure of national progress, this perspective arguably overlooks the deeper historical and ecological roots of capitalism. Moore [201] argues that capitalism's origins are tied to its ability to appropriate "Cheap Natures", embedding the relentless accumulation of capital into the foundation of socio-ecological systems since long before the Industrial Revolution. In this sense, capitalism emerged not merely as an economic system but as a "world-ecology", fundamentally reshaping relationships between power, capital, and nature. Through centuries of socio-ecological exploitation and transformation, capitalism has evolved to its current capacity. Under current structures, businesses strive to increase their market share, enhance productivity, and introduce new products or services, all of which contribute to economic expansion [202,203]. Capitalism's reliance on continuous growth is deeply embedded in its structural features and institutional practices—the profit motive, competition, financial systems, and labor markets all drive the need for perpetual expansion [204–206]. For example, investors seek returns on their investments, typically in the form of dividends or increased stock prices. Businesses must demonstrate growth to attract and retain investment, leading to a focus on continuous expansion.

We also see attachment to growth present in the culture of consumption as advertising and marketing companies relentlessly encourage individuals to purchase more goods and services [207–209]. This consumer culture drives increasing levels of demand and supports economic growth, and businesses are driven to maximize their profits by increasing production, improving efficiency, and expanding markets. Societal and institutional cornerstones like government policies, corporate strategies, cultural norms, and educational institutions are all equally entrenched in this profit-driven system, further reinforcing this growth orientation [210–212]. In summary, the drive for profit has molded social conduct around the primary goal of continuous economic expansion; understanding this dependence is crucial for analyzing the sustainability of capitalist economies and exploring alternative economic pathways that prioritize environmental and social well-being.

One way to understand the relationship between capitalism and growth is through the treadmill of production theoretical framework. The treadmill of production can be explained as the cyclical and self-reinforcing nature of capitalist economic growth, driven by the continuous need to increase production and consumption to sustain rising profits for producers [213–215]. Foster [216] eloquently discusses the connection between our current growth-driven economy and the treadmill of production as being composed of six elements: 1) increasing accumulation of wealth amongst a small section of the population, 2) movement of workers from self-employment toward wage jobs which depend on continuous expansion, 3) competitive struggle among businesses compels the allocation of accumulated wealth to new, revolutionary technologies that expand production, 4) wants are manufactured to be insatiable, 5) government becomes increasingly responsible for national economic development and some level of social security, and 6) the primary means of communication and education are part of the treadmill of production and serve to reinforce it.

The treadmill of production theory lends itself to the argument that "there is a fundamental contradiction between a profit-oriented economic system and long-term environmental sustainability" [217]. Given the unsustainable nature of growth-dependent capitalism, degrowth scholars propose that we must begin searching for alternative pathways. These pathways must allow

us to function within the Earth's ecological boundaries to ensure stability, resilience, and overall well-being, instead of focusing predominantly on increasing GDP [218–220]. The historical orientation of global economies towards economic growth has been driven by a combination of reconstruction efforts, consumerism, globalization, technological advancements, and development policies [221–223]. While this growth has led to significant improvements in living standards, degrowth scholars emphasize that it has also yielded significant environmental challenges and economic inequality, prompting a reevaluation of growth-centric economic strategies in favor of more sustainable and equitable approaches [206,224].

Broadly, many principles of degrowth inherently contradict capitalist norms. Barlow et al. [134] emphasize how degrowth challenges the foundations of capitalist economies, such as reliance on perpetual growth, consumerism, and the commodification of nature. As Savini [193] argues, the anti-capitalism of degrowth "derives from its rejection of accumulation and acceleration as logics of social organization—the very logics through which capital exists". Other scholars have described degrowth as "a pathway to post-capitalism" [225] and as "part of a contemporary renewal of anti-capitalist critique and postcapitalist politics, practice, and thought" [226]. Some degrowth scholars have argued that it is unnecessary to explore whether degrowth is inherently anti-capitalist, expressing that our time would be better spent "solving the problems" rather than "worrying about what we call this" [227].

5. Conclusion and Future Research Directions

Current climate scientists, including IPCC contributors, agree that given the state of the world and our current climate crisis, it will be necessary to make major transformative changes across all sectors of society [8]. As described in the prior section, our society is currently structured in a manner where social institutions and economic practices are geared towards promoting growth, and economies are considered to be functioning properly when GDP is continuously expanding along with increasing profits [228]. This stands in contrast to authoritative calls by climate scientists in the *IPCC Sixth Assessment Report* [9] to move beyond the use of GDP as the sole indicator of progress. Focus on GDP within our current economies has ultimately led to a global growth-based economic market. Matyushok et al. [229] explain that although the wealth of nations is currently greater than at any time in history, uncertainty in the global economy and financial markets has been exacerbated by international conflicts; the authors further proclaim that "the turbulence and instability of the world order is also at its highest" [229]. This raises the question of whether our current growth-based economic trajectory can deliver on its promise to continuously enhance economic prosperity, or if instead the benefits of such a system are limited temporally.

Debate over whether and how to move forward from our current economic structure is a source of significant academic contention and a critical area for future research. Opinions diverge on whether the current growth-driven economic strategy can be modified to effectively address social and environmental needs, and on whether the prioritization of growth itself has been a driving force of social issues and climate change in the first place. Existing evidence suggests that we are unlikely to avoid catastrophic levels of warming within a growth-based model. The significant body of research centered around the links between economic growth and climate change [34,35,98–108,230] in many ways does demonstrate an inherent incompatibility between endless economic growth and climate stability on both theoretical and empirical levels. Given that our economy is highly energy-intensive, still relying mostly on fossil fuels such as coal, oil, and natural gas, the demand for continuous growth drives increased energy consumption, further exacerbating carbon greenhouse gas emissions [231,232]. This explains new calls from climate scientists, including IPCC contributors, who now assert that our global economic system must shift away from GDP-rooted expansion as its main goal, given that economic growth is a fundamental driver of environmental degradation and climate change [225,233,234].

The degrowth pathway also offers its own risks—primarily in relation to economic instability—if scaling-back methods are not properly tailored to avoid consequences such as increased unemployment, decreased income, and lower standards of living [235]. These risks are largely dependent on how degrowth strategies are implemented, with research suggesting that international cooperation can allow for scaling back the economy without impacting human well-being or leading to unfavorable societal outcomes [235]. Thus, to adequately address risks posed by degrowth, careful policy planning, international agreements, and political will are needed. Degrowth focuses on reducing consumption and production in wealthy countries, but it could

also impact developing nations that rely on global markets for exports, necessitating alternative degrowth pathways for policies in the Global South [236]. To minimize this risk, there must be mechanisms to ensure that both wealth and resources are more equitably distributed globally, which involves complex international cooperation and policy alignment across nations [166]. This complexity necessitates significant further research into the implications of both growth and degrowth strategies for addressing climate change and social issues, as we discuss next.

Based on our analysis, future research directions for determining potential outcomes and feasibility for adopting degrowth should include: 1) examining how degrowth strategies could be applied/adapted to the Global South, 2) practical approaches to policy implementation, 3) sector-specific analyses, and 4) additional cross-cultural analyses of degrowth potential conducted at a multitude of scales. While green growth has been shown to be inadequate in reducing poverty and achieving sustainable development goals in these regions [236], degrowth strategies could benefit from additional research as to how they might ameliorate the current challenges that developing countries face. Further research and experimentation on practical approaches to degrowth policy implementation could include context-specific implementation possibilities for degrowth policies, as well as research on policymaker support for degrowth initiatives [237]. Additional sector-specific analyses will provide a greater understanding of how different industries can implement degrowth pathways, as well as what challenges these transitions may pose for sectors such as energy, transportation, agriculture, and manufacturing [45]. Degrowth scholarship would similarly benefit from cross-cultural and multi-scalar comparative studies as well as more case studies where possible. This may entail performing studies between countries/regions that have adopted degrowth strategies and comparing them to those that have not.

As more attention is given to degrowth as a pathway to address climate change, the debates and discussions highlighted in this article are likely to intensify. Continually assessing and comparing green growth and degrowth based on new and evolving evidence will be crucial for shaping scientific and political perspectives, as well as determining our social, economic, and environmental trajectories. However, the ideological barriers that prevent a degrowth transition remain, making growth seem natural and the only path forward, simply a way to "green" the current economic pathway [238]. The pursuit of both green growth and degrowth presents unique challenges; while obstacles to green growth are based largely on overcoming technological and ecological limitations, the pursuit of degrowth presents primarily political and psychological challenges. Ultimately, long-term global welfare depends largely on our collective ability and will to reassess the meaning of sustainability and well-being within the context of our current climate crisis. Regardless of the path we choose, the imperative remains for commitment to rapid, transformative actions that guarantee sustainable conditions for future generations.

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Conflicts of Interest

The authors have no conflict of interest to declare.

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