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How the Concept of "Regenerative Good Growth" Could Help Increase Public and Policy Engagement and Speed Transitions to Net Zero and Nature Recovery

Jules Pretty [1,2,*], Dennis Garrity [3,4], Hemant Kumar Badola [5], Mike Barrett [6], Cornelia Butler Flora [7], Catherine Cameron [2,8], Natasha Grist [9], Leanne Hepburn [1], Heather Hilburn [2,10], Amy Isham [11], Erik Jacobi [12], Rattan Lal [13], Simon Lyster [2,14], Andri Snaer Magnason [15], Jacquie McGlade [2,16,17], Jan Middendorf [18], E. J. Milner-Gulland [19], David Orr [20], Lloyd Peck [21], Chris Reij [3,22], Johan Rockström [23], Yarema Ronesh [2,24], Osamu Saito [25], Jo Smith [26], Pete Smith [27], Peter Thorne [28], Atsushi Watabe [25], Steve Waters [29] and Geoff Wells [30]

1 School of Life Sciences, University of Essex, Wivenhoe Park, Colchester CO4 3SQ, UK; l.hepburn@essex.ac.uk
2 Essex Climate Action Commission, Essex County Council, Chelmsford CM1 1QH, UK; catherine@agulhas.co.uk (C.C.); heather.hilburn@ucl.ac.uk (H.H.); simonlyster1@gmail.com (S.L.); jacquie.mcglade@ucl.ac.uk (J.M.); yarema@biodiversity.capital (Y.R.)
3 Global Evergreening Alliance, 12/24 Lakeside Dr, Burwood East, VIC 3151, Australia; d.garrity@cifor-icraf.org (D.G.); c.reij@outlook.com (C.R.)
4 World Agroforestry Centre (CIFOR-ICRAF), Los Baños, Laguna 4031, Philippines
5 Independent Biodiversity Expert, Aditya Doonshire Apartments, Sailok Phase 2, Dehradun 248001, Uttarakhand, India; hkbadola@gmail.com
6 WWF-UK, The Living Planet Centre, Brewery Road, Woking GU21 4LL, UK; mbarrett@wwf.org.uk
7 Department of Sociology and Criminal Justice, Iowa State University, Ames, IA 50011, USA; cflora@iastate.edu
8 Agulhas Applied Knowledge (B Corp), 10E Branch Place, London N1 5PH, UK
9 Norwich Institute for Sustainable Development, University of East Anglia, Norwich NR4 7TJ, UK; n.grist@uea.ac.uk
10 Thames Estuary Partnership, University College London, 26 Bedford Way, London WC1H 0AP, UK
11 School of Psychology, Swansea University, Swansea SA2 8PQ, UK; a.m.isham@swansea.ac.uk
12 Essex Business School, University of Essex, Colchester CO4 3SQ, UK; ejacobi@essex.ac.uk
13 CFAES/SENR Rattan Lal Center for Carbon Management and Sequestration, The Ohio State University, Columbus, OH 43210, USA; lal.1@osu.edu
14 Essex Local Nature Partnership, Essex County Council, Chelmsford CM1 1QH, UK
15 Independent Researcher, Reykjavík, Iceland; andrimagnason@gmail.com
16 Institute for Global Prosperity, University College London, 149 Tottenham Ct Rd, London W1T 7NE, UK
17 Strathmore Business School Institute for Public Policy, Strathmore University, Karen Ole Sangale Rd, Madaraka Estate, Nairobi 00200, Kenya
18 Climate-Resilient Sustainable Intensification Innovation Lab, Kansas State University, Manhattan, KS 66506, USA; jmiddend@ksu.edu
19 Interdisciplinary Centre for Conservation Science, University of Oxford, Oxfordshire OX1 3UL, UK; ej.milner-gulland@biology.ox.ac.uk
20 Oberlin College, Oberlin, OH 44074, USA; dorr@oberlin.edu
21 British Antarctic Survey, Natural Environment Research Council, Cambridge CB3 0ET, UK; lspe@bas.ac.uk
22 World Resources Institute, 10 G Street, NE Suite 800, Washington, DC 20002, USA
23 Potsdam Institute for Climate Impact Research (PIK), 14473 Potsdam, Germany; johan.rockstrom@pik-potsdam.de
24 RM Architects, Clearwater Yard, 35 Inverness St, London NW1 7HB, UK
25 Institute for Global Environmental Strategies (IGES), Hayama 240-0115, Japan; o-saito@iges.or.jp (O.S.); watabe@iges.or.jp (A.W.)
26 School of Biological Sciences, University of Aberdeen, Aberdeen AB24 2TZ, UK; jo.smith@abdn.ac.uk
27 Institute of Biological and Environmental Sciences, University of Aberdeen, Aberdeen AB24 3UU, UK; pete.smith@abdn.ac.uk
28 International Livestock Research Institute, Addis Ababa 5689, Ethiopia; dodocreek@icloud.com
29 School of Literature, Drama and Creative Writing, University of East Anglia, Norwich NR4 7TJ, UK; steven.waters@uea.ac.uk
30 Rural Communities Australia Ltd., 209 Douglas Dawson Trk, Robe, SA 5276, Australia; geoff@ruralaus.com
* Correspondence: jpretty@essex.ac.uk

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Abstract: Just and fair transitions to low-carbon and nature-positive ways of living need to occur fast enough to limit and reverse the climate and nature crises, but not so fast that the public is left behind. We propose the concept of "Regenerative Good Growth" (RGG) to replace the language and practice of extractive, bad GDP growth. RGG centres on the services provided by five renewable capitals: natural, social, human, cultural, and sustainable physical. The term "growth" tends to divide rather than unite, and so here we seek language and storylines that appeal to a newly emergent climate-concerned majority. Creative forms of public engagement that lead to response diversity will be essential to fostering action: when people feel coerced into adopting single options at pace, there is a danger of backlash or climate authoritarianism. Policy centred around storytelling can help create diverse public responses and institutional frameworks. The practises underpinning RGG have already created business opportunities, while delivering sharp falls in unit costs. Fast transitions and social tipping points are emerging in the agricultural, energy, and city sectors. Though further risks will emerge related to rebound effects and lack of decoupling of material consumption from GDP, RGG will help cut the externalities of economies.

Keywords: Regenerative Good Growth; bad GDP growth; climate crisis; nature crisis; renewable assets; public engagement; story and hope; social tipping points; backlash; green authoritarianism; net zero

1. Interlocking Crises

The world's economies, societies, and cultures face unprecedented and connected crises of climate instability, nature loss, and social inequality. Between the pre-industrial period and mid-2020s, the average global temperature has risen by +1.2–1.3 °C (Figure 1a). Measured as global mean surface temperature (GMST: defined by the IPCC/Paris Agreement by moving decadal average in relation to the 1950–1980 average), the breaching of +1.5 °C is now expected to occur during 2030–2035. Meanwhile, +1.45 °C was reached in 2023 due to that year's human-amplified El Nino event, and +1.5 °C was touched during the early part of 2024. Overshoot of +1.5 °C seems inevitable, but there remains the potential for holding to +1.5 °C by 2100 if there is complete decarbonisation and worldwide nature recovery [1,2].

Simultaneously, nature worldwide is under threat. Between 1970 and 2018, monitored wildlife populations worldwide declined by an average of 69% (Figure 1b) [3,4]. In response, over the past 50 years, 17% of global land and 10% of marine environment have come under legal protection, and a total of 195 countries plus the EU have signed the Convention on Biological Diversity. However, the drivers of nature loss continue largely to be unaddressed [5].

At the same time, persistent social inequality within and between countries is driving ill-health and political conflict [6–9]. In recent years, inequality has decreased in some regions (Latin America, Africa, and Asia), but worsened in richer countries (USA, China, and Western Europe) (Figure 1c).

Together, the goals of a safe climate, biodiversity recovery, and human well-being form a "triple challenge" [10], articulated in such agreements as the UN Sustainable Development Goals, the Global Biodiversity Framework agreement at COP15 in 2023, and the 2015 UN Paris Climate Agreement.

However, the pressures of material consumption on the planet continue to rise and have reached a phase of major planetary risk. Six of the nine planetary boundaries that regulate functioning, resilience, and stability have now been breached: novel chemical entities, climate change, biosphere integrity, land system change, flow change, and biogeochemical flows [11]. Earth is losing resilience in the midst of these global crises [12]. Yet opinions on economic and environmental trade-offs remain strong. It has long been a theme of modern economies that care for the environment can only come at a cost to economic growth and human welfare. It is further deemed not possible to have a biodiversity-rich environment free from adverse climate impacts without substantial losses to jobs, national income, and tax returns. Many suggest the world is being failed by this neoliberal paradigm [13–16].

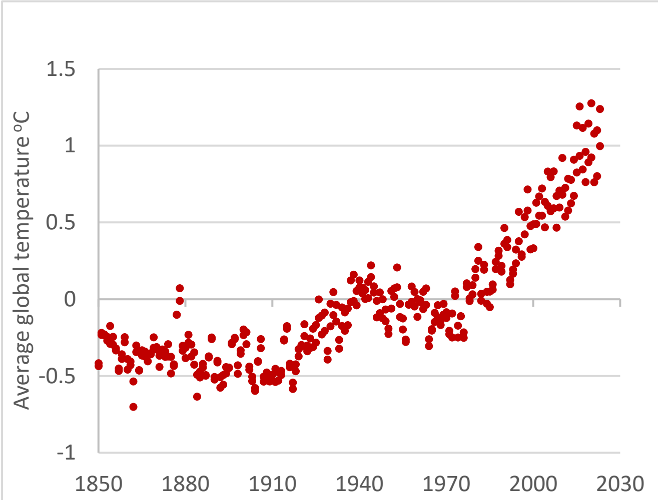
Many alternatives have been proposed, mostly with conceptual overlap but also some antagonism: these include green growth, stable-state economies, doughnut economics, post-growth, and degrowth [17–21]. Yet these tend to share a policy and public engagement challenge. They can seem attractive and thus have been co-opted by those not wishing to change the fundamentals of economies (e.g., green growth), or they can seem too alien to imagine, thus inviting rejection by the mainstream (e.g., degrowth). Where partial policy progress has been made, backlashes have begun to emerge when the public has not been offered options and choices [22,23].

Nonetheless, support for new low-carbon, nature-positive, and more equitable policies, institutions, and technologies is growing at international, national, and sub-national levels. By mid-2023, 149 countries had set net-zero targets, covering some 90% of global GDP, greenhouse gas (GHG) emissions, and global population [24]. Additionally, some 11,000 businesses and cities had adopted the Race to Zero guidelines. Solar, wind, and other renewable technologies have become more common, and sustainable practices in food, energy, and city systems are increasingly widespread.

It is evident that we are at a critical stage. Crises are worsening, and social transitions are urgently required [12]. Here, we seek to address three questions. Can shifts to new ways of living happen fast enough and engage a sufficient number of people to halt and reverse these crises? Can positive system tipping points be created that would more rapidly lead to sustainable ways of living for all? Will policy makers feel tempted to impose solutions, or will they seek methods and institutions that emphasise co-production resulting in the public feeling that they have made choices rather than being coerced?

After discussing how the bad GDP growth paradigm has failed, we propose in this paper six principles for guiding the multiple possible paths for Regenerative Good Growth:

1. Invest to build all five renewable assets so that they provide services at low running costs into the future, and ensure the components of these assets are multipurpose and circular producing positive and reinforcing side-effects for the same cost of investment (Section 3).
2. Ensure policy options always offer response diversity, where options are co-produced with the public so that they do not feel forced into actions they do not yet support (Section 4).
3. Deploy new forms of social capital to ensure the co-production of ideas, technologies and practises to transform businesses, communities, and the public sector (Section 5).
4. Use new forms of storytelling to inspire hope and create a sense of agency: good stories create public engagement (Section 6).
5. End toxic subsidies that encourage bad GDP growth, and use this finance to boost businesses and jobs, transform agricultural, food, and energy sectors, and redesign cities (Section 7).
6. Set Regenerative Good Growth at the heart of national and local government policy, trusting that all the public are on the same journey to create a new climate- and nature-positive world, but accepting that some have not yet begun this journey and will need guidance (Section 8).



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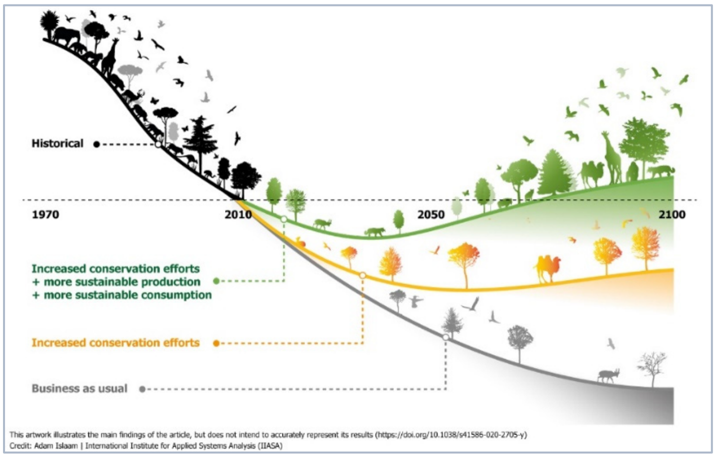

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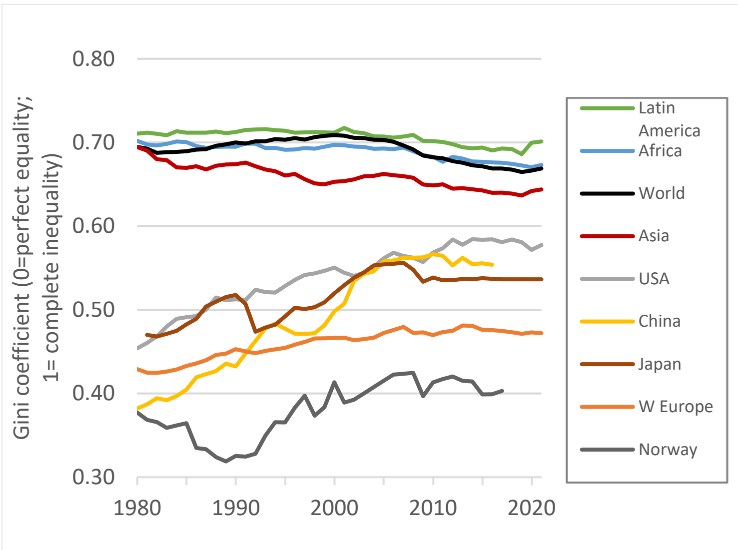

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Figure 1. (**a**). Global average land–sea temperature anomaly, 1850–2020s relative to 1961–1990. Average global temperature in °C. Data from Met Office Hadley Centre (2024), accessed from Our World in Data https://ourworldindata.org/grapher/temperature-anomaly, accessed on 1 November 2024 (**b**). Bending the curve of biodiversity decline. (**c**). Inequality within world, regions, and countries, 1980–2022.

This shows declines during 1970–2020 (black) and three potential scenarios to 2100: grey is business as usual; orange is increased conservation efforts; green is increased conservation together with more sustainable production and consumption. Source: WWF (2022) [4] and Adam Islaam (IIASA).

Data shown are Gini coefficients, where 0.00 (zero) represents perfect equality of distribution of income and 1.00 represents complete inequality. Source: World Inequality Database at https://wid.world/. accessed on 1 November 2024.

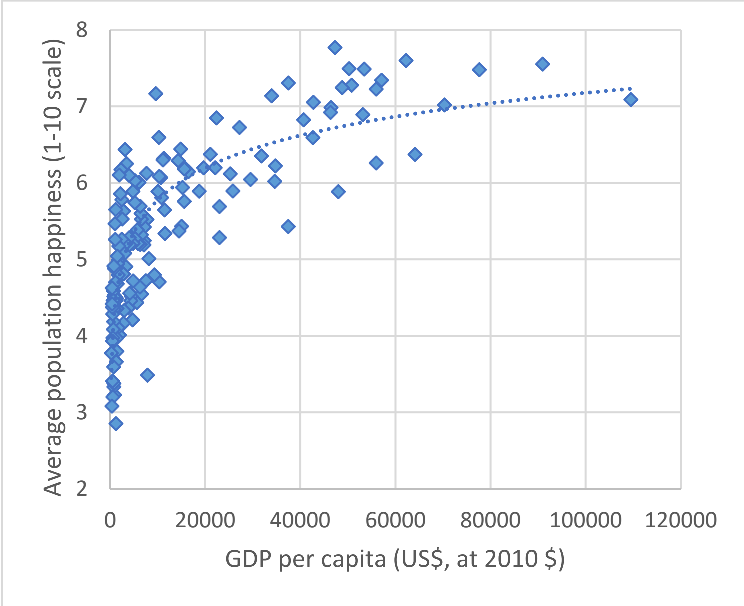
2. Failed by the Bad GDP Growth Paradigm

Gross Domestic Product (GDP) remains the predominant tool for assessing the success of contemporary economies. GDP assesses the monetary value of goods and services bought by final users and produced within a specified system (region, country, world). In the current paradigm, more GDP is always regarded as better. Less growth than previously or compared with others, especially negative growth, is a failure. GDP growth is assumed to translate into business success, more jobs, and greater individual incomes, thus permitting increased investment in health, education, energy, and other public services (including environmental) [19,25].

This growth paradigm can also lead to the assumption that poverty is best tackled through whole-economy growth and an implied reliance on technological innovation to address environmental problems. Yet it is now clear that trickle-down has not succeeded in bringing people out of poverty at scale, and there is no empirical support for an overall positive turn in the environmental Kuznets curve, where environmental impacts come to be reduced once countries and companies have become richer. Any decoupling of environmental impact from GDP has not occurred at rates fast enough to address the global nature and climate crises [26,27].

Externalities are prevalent in neoliberal economies. To cut costs, side-effects are shifted by companies and countries elsewhere in space or time. For a business, individual, or nation, these diverted costs give the impression of better performance. Yet inside the Earth system, all costs must be paid by someone or some system somewhere. These hidden costs are substantial. The negative externalities impacting natural capital have been calculated to be 10% of the entire global economy, equivalent to USD 8 trillion annually [28]. Pesticide markets worldwide amount to USD 45 billion annually on sales of 3.5 billion kg of active ingredient, yet the external costs of each kg amount to USD 4–USD 19 for each kg [29]. Systems of agriculture deploying integrated pest management without pesticides avoid imposing these costs.

GDP has also long been criticised for appearing to ignore many of the important things in life. As per capita GDP increases beyond a certain point, the composite measure of happiness shows no further marginal gains ([17]: Figure 2a); data within countries also show relatively stable happiness across whole populations over six decades, even though GDP has been increasing. Figure 2b illustrates per capita carbon footprints against GDP per person, with 222 countries separated into four income groups. Rising GDP has resulted in fast-rising carbon emissions [30,31]. The message is clear: low-income countries and people should be able to consume more to help escape poverty (noting that poverty is multifaceted; therefore, it needs more than just material consumption); high-income countries and people worldwide should consume and pollute significantly less.



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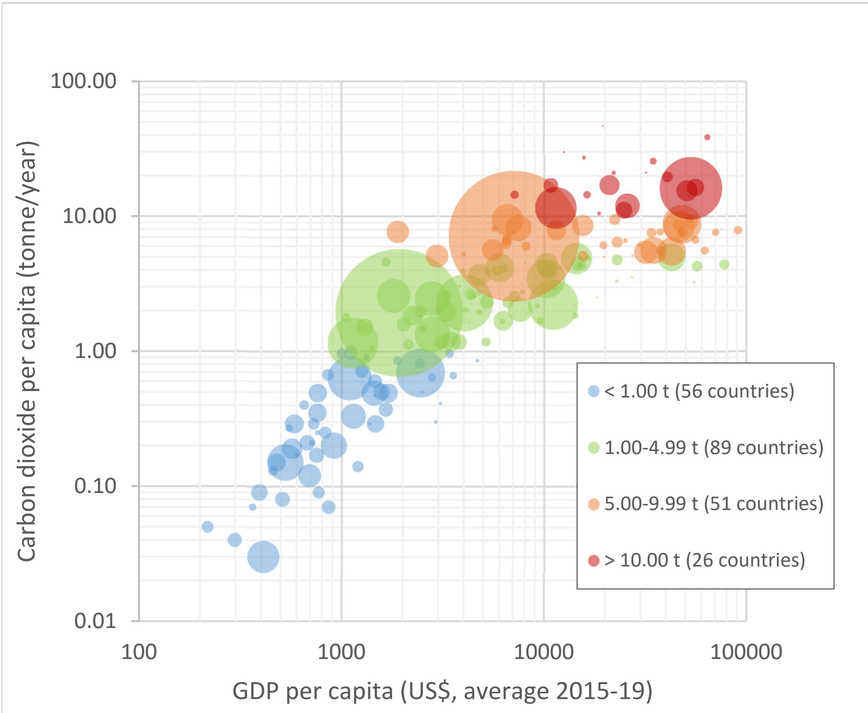

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Figure 2. (**a**). Country GDP per capita (mean 2015–2019) and population happiness (2018) (n = 151 countries). (**b**). Per capita GDP and carbon dioxide emissions by country.

Growth measured by GDP is still a popular narrative, dominating desires for national success [28,32]. This we call the bad GDP Growth paradigm, and it has five fundamental features:

i. It ignores or actively externalises bads (environmental harm and human ill-health), even subsidising them as good for growth [33], thus marginalising the incentives for their elimination;
ii. It allows breaches of biophysical planetary boundaries to occur [34];
iii. It implies that growth in consumption of material goods could continue indefinitely;

iv. It misses many relational values important to human well-being that have low or no financial transactions, such as togetherness, personal growth, health, and well-being, being in nature, contentment, and happiness [35];

v. It misses the ills of social inequality and continuing poverty in higher and lower-income countries, manifested particularly as a lack of essential food, clean water, sanitation, housing, education, and healthcare.

Despite these five problems, this bad GDP growth mindset remains powerful. Recently, 238 authors concluded that the EU should abandon GDP as a measure of success, and 15,000 authors from 150 countries called for the world's governments to drop GDP and focus on sustaining ecosystems and improving well-being [36,37]. However, the term "growth" is a powerful narrative, and still has salience with the public. Here, we propose a revised use of the term "growth" as a means to engage with an emerging "climate majority" [38].

GDP per capita is at USD at the 2010 baseline, mean for 5 years (2015–2019). Average happiness is on a scale of 1–10; data from 151 countries. Sources: World Bank and World Happiness Surveys.

Countries are divided into four categories by mean per capita carbon emissions (2020): <1.0 tonnes per person (blue), 1.0–4.99 tonnes (green), 5.0–9.99 tonnes (orange), and >10.0 tonnes (red). Countries = 222; population by bubble area (millions).

GDP per capita is at US$ at the 2010 baseline, mean for 5 years (2015–2019). Both axes are log scales. Sources: World Bank and OECD open-source datasets.

3. Principles of Regenerative Good Growth

We propose a new term and concept: Regenerative Good Growth. When myths fail, new storylines are needed that are powerful and meaningful [16,39]. We argue that Regenerative Good Growth could be one of these storylines.

Regenerative Good Growth seeks to help contemporary policy makers and business leaders appreciate that (i) there is something wrong with modern neoliberal systems; and (ii) there are multiple paths towards ways of living that are good for all people and for nature.

At its semantic core, regenerative means the capacity to be alive and creative (from the Latin regenerare: to create again). Buckton et al. [40] put it this way: "life creates the conditions conducive to life, in which humans are participating as nature to support continued co-evolution of the biosphere". Hawken and over 100 co-authors [41] indicated regenerative economic systems were those that would heal rather than steal the future. Regenerative systems are thus self-feeding and self-renewing, built on social processes of adaptive learning, and nourishing the capacity to thrive over long periods of time [42–44]. Regenerative economies have circular flows of energy, information, resources, nutrients, and money, and thus minimise the use of non-renewable resources and eliminate negative externalities.

We seek to use Regenerative Good Growth as both a term and a story to address the ills of bad GDP growth. It seeks to limit the externalisation of costs outside system boundaries (a business, a region, a country), and halt the depletion of vital natural assets that provide (largely free) environmental services to economies. It seeks system stability within biophysical limits, where consumption is high enough for health and happiness [17,19]. Regenerative dynamics offer opportunities for joint welfare and nature improvements [45].

Alongside this, we acknowledge that the term "growth" continues to divide rather than unite. Many cannot imagine economic, business, or political success without sales of goods and services increasing year on year; many others see such growth as the very source of all that is wrong with modern economies, and reject the use of the term growth and especially "green growth" [27,46].

By deploying the term Regenerative Good Growth, we are seeking to complement a range of concepts and terms designed to address world-spanning crises. These include (alphabetically) alternative hedonism, circular economies, convivial economies, degrowth, doughnut economics, the good life, nature-positive, post-growth, slowdown, sustainable consumption corridors, and well-being economies [17,19–21,47–52]. Each centres on ancient and well-understood principles for thriving cultures and economies that are active within natural and social limits. At the core of these proposed contemporary transitions is the concept of greater material and energetic circulation within systems combined with reductions in aggregate material consumption [42].

For advocates, these concepts mean reductions in environmental impact, fair redistribution of income and wealth, and the promotion of transitions to convivial societies [53]. In this context, for example, degrowth is considered an umbrella concept that aims to lead to planned reductions in energy and resource use [54,55]. Yet some of these terms can still sound like a choice for deliberate austerity, a post-financial-crash project that has not gone well for many industrialised countries [56].

The test today is urgency and the scale of the task. The planet is rapidly approaching tipping points, most notably the irreversible melting of major ice sheets and sea ice, abrupt thawing of permafrost, and collapse of major marine systems and forest biomes [12,57]. Regenerative Good Growth will require, as we aim to show, fast development and deployment of new sustainable and renewable practises and technologies that will be both nature-positive and people-positive [58]. This requirement for pace brings emergent risks of backlash [59]. To a lay and policy audience, arguing against growth is often still seen to be against the public good: we adopt the Regenerative Good Growth terminology to emphasise that sustainable futures do not mean declines in quality of life.

Regenerative Good Growth centres on the recognition, protection, and increase in five renewable capitals [40,41,59–62]. We define these as follows (noting that some have also included community, financial, and political capital: e.g., [63]):

i. Natural capital: the stocks of natural resources in whole ecosystems (clean air and water, flood control, tree and soil carbon, biodiversity) that provide beneficial services that sustain all economies and societies making human life possible;
ii. Social capital: the trust, reciprocity, and relationships that increase togetherness, kindness, connectedness, and collective action between and within communities, and that reduce the cost of transactions;
iii. Human capital: the capability and creativity of individuals, expressed in knowledge, skills, health, and nutrition, the value of which grows across healthy and long life-courses and is enlarged when citizens and organisations work together;
iv. Cultural capital: the assets created by people that comprise customs and rituals, arts and language, stories and laws, science and technology, and all forms of spiritual tradition;
v. Sustainable physical capital: the human-made assets and infrastructure (buildings, housing, factories, utilities, energy generation, transport, and communication systems) that are sustainable to produce and create positive externalities when in operation.

A key concept here is universality: all human systems worldwide contain these five renewable capitals, though quantity and quality differ. All can thus be grown to increase valued services; all can be diminished too. It is thus possible to say that Regenerative Good Growth is neither selective nor designed to benefit only some people, economies, or cultures. Neoliberal economies are presented as being beneficial to all people and economies, but evidently they are not. In most locations, these renewable capitals have been diminished, and Regenerative Good Growth has to start below the baseline needed for effective system functioning. Regenerative economies thus centre on building up these five assets to create diverse mixes suited to specific ecological and cultural circumstances [64,65]. Regenerative economies are also intended to be more circular, doing less harm and more good [66]. It should be noted that "regenerative" also carries its own historical baggage as a term. It has been widely used for urban redevelopment programmes that promised economic and cultural renewal, but then often failed local people (such as in the UK: [67,68]).

Nonetheless, regenerative ideas are being deployed by both nature conservation and business. Nature-Positive is a key concept and currency, suggesting an optimistic, intuitive, and clear summary of what governments, businesses, and civil society need to do to grow natural capital [5]. Similarly, Polman and Winston [69] have called for Net Positive approaches, and observe, "Businesses will grow and prosper over the long haul by serving the world, that is, by giving more than they take". However, the term Nature Positive is already being criticised as a vehicle for greenwashing [70].

Businesses cannot thrive in failing societies, and profits will come not from creating the world's problems, but rather from solving them [71–74]. Yet strong opposition to change continues to come from the existing economic paradigm (see, for example, [75] on the Global Climate Coalition; Andersen [14] on other deliberately created lobbying organisations). In the face of these challenges, Regenerative Good Growth can expect to fail without broad public and policy support. It can only obtain support through the development and deployment of multiple platforms and institutions of engagement that increase social and human capital [76]. G20 countries alone will be spending USD 114 billion annually on fossil fuel subsidies, and repurposing these could create multiple new opportunities to grow this engagement [64].

Response Diversity is defined as "a system's variety of responses to disruptions of all kinds", and here it is used to suggest that many policy and practice options should be offered for social and ecological resilience [73]. Response diversity will be key to preventing the emergence of backlash movements against single policy choices. These can, in turn, result in the loss from the public sphere of credible options to aid transitions, and an increase in new climate or green authoritarianism [56,77]. Green New Deals, for example, are, in principle, intended to be frameworks that bring people with them; yet, they can end up being top-down models used to impose climate and nature-related packages, particularly if architects are tempted to centre only on technocratic solutions [74]. If these are to succeed, regenerative cultures and economies will instead need to incorporate the design of new forms of social innovation and participatory democracy [39,78].

4. Transitions Will Need Favourable Public and Policy Engagement

We turn to both public engagement and opinion. Public engagement refers to how people interact to develop, adapt, and adopt ideas, solutions, and technologies and is thus focused on actions and behaviours. Public opinion refers to what people think and is typically measured by opinion polls and surveys. As Hawken [41] has put it, climate change action is becoming practical: through their own actions, the beliefs of people change. Transitions to regenerative economies and cultures will require new forms of thought and action.

It is common for the terms transition and transformation to be used somewhat interchangeably [76,79]. We have chosen to use the term "transition" to refer to social, cultural, and economic system switches, and "transformation" to mean inner and personal changes in individuals [80]. Another way to look at this is to consider transition to refer to configurations of mainly social and cultural capital, and transformation to changes in human capital. Favourable public opinion towards climate and nature is not a necessary prerequisite for both, but it helps.

Evidence is now showing that public opinion in richer countries is changing [81–85]. The proportion of the public believing climate change is both happening and caused by human action has increased in the past ten years: in China, Germany, Ireland, Italy, Norway, Poland, the UK, and the USA from the 40–60% range to 60–75%. The proportion of the public who do not believe in climate change or actively oppose actions generally varies from 5% to 14% (rising to a high of 24% in Norway).

In the UK, there is support for net zero action amongst all voters and age groups. The lowest support is amongst individuals with more than £96,000 income (across Western Europe, the wealthiest 10% of people emit 25% of carbon; the top 1% have individual carbon footprint emissions of 55 tonnes per year: 30). Voters are positive about net zero policies and like to hear of real impacts [86,87].

There is also high support amongst the public for the idea that climate action provides co-benefits [86]. Climate actions have many impacts: 53–76% of the UK public cite co-benefits of climate action to include reduced air pollution and reduced personal travel costs from increased adoption of battery-powered electric vehicles (BEVs). Priorities mentioned by the public include homes that are less costly to heat, improved energy security, improved air quality and health, close connections with nature, reduced risks of flooding, stronger communities, and more jobs. There is greater support for policies if they address immediate problems (e.g., congestion, pollution, cost of living) and have benefits for society [87–89]. Across six countries of Europe, half of people say they know what they should do, but 42% do not know and would like advice [82]. In the UK, 86.5% of people state they have already made some changes to their ways of living for the sake of the environment [89].

We turn now to engagement priorities and propose a 20-60-20 heuristic (rule of thumb). The 80-20 Pareto Rule in economics suggests that market tipping points occur once 80% of people or institutions have adopted a new practice (technology, behaviour). As indicated above, public opinion regarding the existence of climate change and its causes is within the 60–79% range. This is not enough, though, to cause social tipping points. These will only come about when opinions and beliefs become actively expressed choices.

As we will show below, the adoption of low-carbon options within sectors rarely exceeds 20%. In readiness for actions regarding climate, the first 20% of the public appear already committed, understand the climate crisis, and are taking some action (this includes the so-called radical flank). The last 20% comprises agnostics, deniers, and delayers, some of whom are visible and loud (and may be funded to lead backlash groups: 23, 59, 90). The middle 60% now comprises a climate majority [41]: they recognize that much is wrong with climate and nature but need guidance on how to address it.

This is the 20-60-20 heuristic. It is the middle 60% who will now determine the pace of change in climate actions, and this will be modelled by the types of public engagement deployed, and the range of options offered.

Public engagement (PE) is a concept that can combine communication, co-creation, dialogue, and the creation of social capital. Its use, methods, and approaches have differed widely, sometimes leading to sub-optimal outcomes. A number of typologies to express these variations have been developed and refined [90–92]. Each indicates a range from passive PE (people being told what has been decided) to consultative modes (people being asked set questions), to shared and interactive (people working together in joint analysis), to transformative (where the worldviews and actions of all actors change).

This is where we point to a dilemma. There is great urgency, yet it will be tactically clever to support different choices for individuals, households, and businesses. Good ideas and technologies can fail when they appear to be forced on people, seemingly undermining their autonomy [78]. Yet in the name of urgency, governments may be tempted to impose what seem to be good ideas and technologies, only for them to backfire politically.

Guston [93] has proposed a working principle: "No innovation without representation". Public engagement is vital for both innovation and support for implementation.

From this perspective, the better option is to go more slowly with patience, creating engagement through choice [93,94]. Fast implementation can mean unjust outcomes, leaving adherents of old polluting growth stranded on the wrong side of change. Transitions that are fair stem from the choice of paths, the mobilisation of alliances, shifts in public opinion, fast and beneficial technological changes, and politically accelerated consensus [95,96].

Without public engagement in choices, backlashes, and counter-narratives can emerge [22]. In the Netherlands, Urk island inhabitants organised to protest against wind turbine installations with song, litigation, petitions, and legal appeals, mainly because decisions were being made solely by distant provincial governments [97]. Also in the Netherlands, scientific concerns over the health impacts of reactive nitrogen through air and water pollution led to the declaration of national nitrogen regulations [98], and these provoked widespread farmer opposition and the emergence of new forms of extremism and anti-environmental action [99]. In the UK, opposition to a city policy to create clean air zones in London had national political consequences, even though clean air zones had already been successfully implemented in other cities (such as Bath, Birmingham, Bradford, and Bristol). By contrast, Norway has made the transition to battery electric vehicles (BEVs) easy for its citizens. Vehicle price is subsidised to make BEVs cheaper than internal combustion vehicles, and owners pay only half the costs for ferries, car parking, and road tolls, and are exempt from road tax [100].

A key question is therefore: can positive regime shifts be deliberately created through policy intervention and public/social action [12,96]? What can we learn from technological and social change in other sectors?

5. Fast Transitions and Positive Tipping Points Are Already Underway

Research on negative tipping points has identified a high risk of sudden changes occurring to climate and nature systems before 2050 [11,12,34,57]. Some of the prospects induce considerable concern: collapse of the North Atlantic Oscillation, death of the shallow tropical coral reefs, abrupt melting of the Arctic permafrost and mountain glaciers, the loss of Arctic and Antarctic sea ice, permanent shifts in the Sahelian and Indian monsoons, losses to Antarctic and Greenland ice sheets.

At the same time, there is the potential for positive tipping points, where small initial perturbations can also lead to large regime shifts [12]. Significant changes in public and policy worldviews could produce collective action and social norms that cascade across entire cultures and economies. What, then, are the prospects for new forms of social capital that build trust and reciprocity, create common obligations and collective action, prevent backlash, and help to spread regenerative economies?

Social capital is already helping personal transformation and social transitions in many ways [101–103]. There are now 8.54 million mainly rural collaborative groups, working on landscape-scale switches to sustainable uses of land, water, and pasture, integrated pest management, collective forest management, and microcredit support services [104]. There are 2000–3000 transition initiatives in fifty countries, spreading to towns, villages, and communities after the launch in the town of Totnes [105], and a further 10,000 ecovillages and intentional low-carbon communities. There are industrial clusters, alliances, hubs, circular spaces, place-based commissions, and agricultural and energy technology parks being promoted as intermediary social infrastructure to aid innovation [106,107]. Each of these could help with deep leverage and positive social tipping points [12]. These forms of new social capital could also be called cultural attractors [108]. Following the analysis of Steffen et al. [109] of 22 technological and social great (negative) accelerations of the Anthropocene, we could now call these "The Next Great Acceleration" (named after the analysis of past human cultural change by [110]).

The potential for positive tipping points for Regenerative Good Growth is beginning to look like good hockey sticks on graphs (see Figure 3a–d): at first slow increases in uptake, followed by rapid upturns [111,112]. Since 2015, worldwide:

- Solar PV installed capacity has grown by 400%, with 1 TW (1000 GW) now installed (equivalent to all installed energy in the EU);
- Battery Electric Vehicle (BEV) sales are up 1000%, with 25 million sold;
- Residential heat pumps are up 225%, with 600 GW installed;
- Stationary battery capacity is up 2500%, with 45 GW installed.

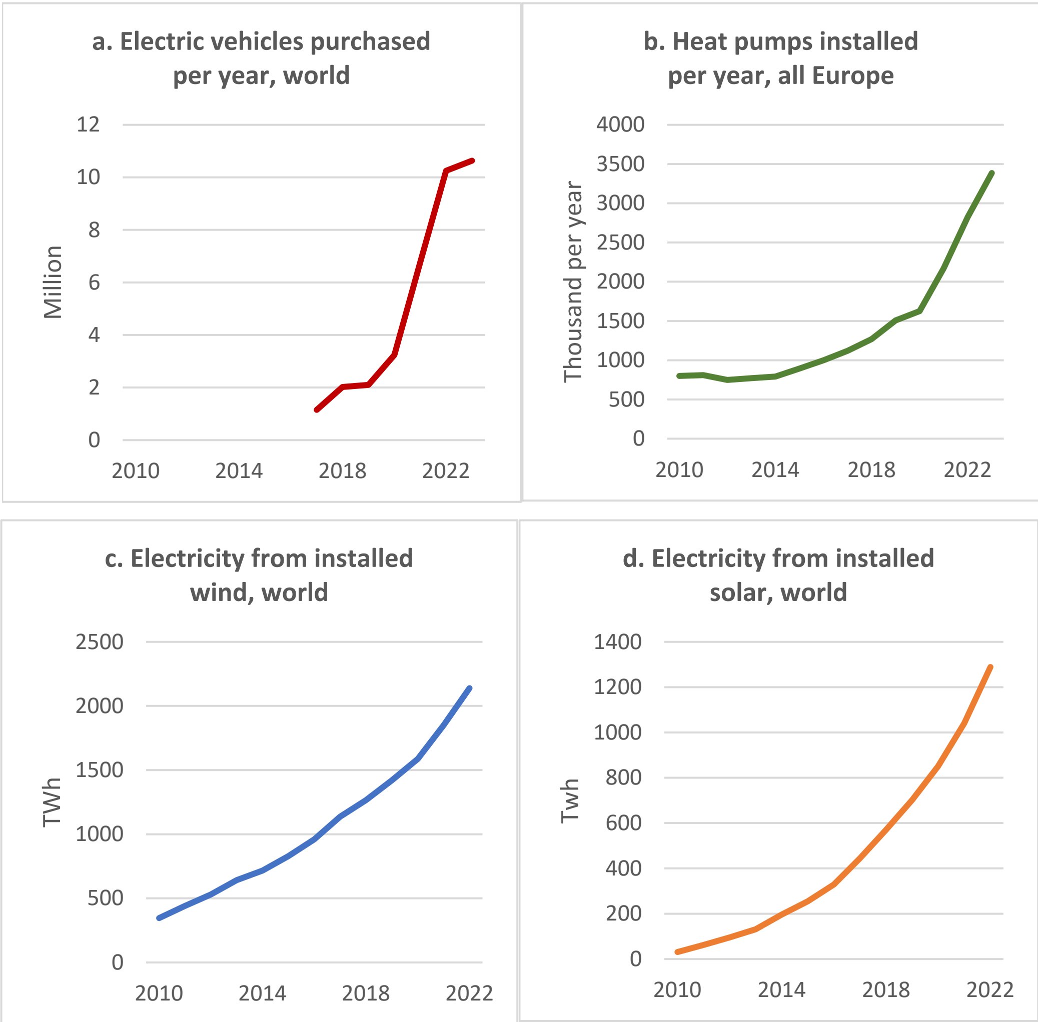

Figure 3. (**a**–**d**). The next great acceleration (positive hockey-stick curves) for global and regional adoption of four indicators of regenerative good growth, 2010–2022.

The International Energy Agency [112] has observed that clean energy markets are booming, and countries with supportive domestic policies will benefit the most in the coming years. Table 1 summarises illustrative examples of past ecological, social, and technological regime shifts and those underway (a number are not related to regenerative change). Some have been comprehensive and fast; others are at an early stage (less than 20% adoption or impact), and others still (in the third column) show slow to no movement.

In many cases, there was initial resistance to change, for example to the removal of sources of environmentally harmful chemicals and pollution in Europe [113]. There has also been opposition to sustainable agriculture, to trees in agricultural landscapes, to seat-belt legislation and smoking bans, to the designation of marine protected areas, and to the launch of autonomous vehicles. Once it was clear that personal welfare benefits were occurring and/or personal costs were falling (through prices and subsidies), then transitions have often proceeded swiftly.

Figure 3a: Electric vehicles purchased per year, million (red); Figure 3b: Heat pumps installed per year, Europe, thousand per year (green); Figure 3c: Electricity generated by installed wind power, TWh per year (blue); Figure 3d: Electricity generated by installed solar power, TWh per year (orange). Data: IEA [112].

Table 1. Illustrative examples of technological and practice regime shifts.

Regime Shifts Occurred (>80% Adoption Within Systems or Regions)	Early Stages and Growing (Approx. 20% Adoption; Some Higher, Some Lower)	No System Change Yet (Approx. 0–5% Slow or Low Adoption)
Renewable energy generation (14 countries at over 95% of domestic electricity use), 2010 to 2023	Electric vehicles (85% of all vehicles in Norway; 50% of new sales in the UK; 22% in the EU)	Retrofitting and insulating existing housing stock (named as a priority in many countries but implementation unfunded/low)
Rural social capital (8 million farmer and women's groups worldwide, 240 million members), 2000 to 2020	Sustainable and regenerative agriculture expansion (worldwide to 29% farms and 9% of the area, 2000–2020)	Air-, ground- and water-source heat pump installation: at the end of 2023, UK 0.5% of homes; Belgium, Germany 1.4–1.6%; Norway 30%, Finland 24%, Sweden 22%, Estonia 17% and Denmark 10%
Seat belt legislation (Europe and North America, 1980s): comprehensive adoption	Vegetarian diets (30% of young people in the UK; cultural legacy and traditions of 500 million people in India)	Regime shifts in food supply and behaviours, resulting in fast growth in obesity and type 2 diabetes, but no country has reversed incidence once it increased, 1990–2023 (plus a continued increase in other non-communicable diseases (NCDs)
Smoking bans in public places (Europe and North America, 2005 onwards): comprehensive adoption	Carbon removal by soils through sustainable and regenerative agriculture and rewilding	Fish capture management and regulation, plus marine protected areas, clearly lead to increases in fish stocks and catches
Ban of lead additives in petrol/gas, mid-1980s	Expansion of tree cover in Sahel through farmer-managed natural regeneration to 10 Mha, over 2000–2020 (50% land coverage in Niger)	Elimination of air pollution in cities and rural areas from vehicles
Smartphone development and uptake (Motorola, Nokia, and Blackberry had 97% of the world market in 2007, the date of the first iPhone release; in 5 years, their market share had fallen to 3%)	Plant-based milk adoption (40% of households in US; 93% in Germany)	Electrification of commercial planes ("eviation")
Switch from film to digital cameras, combined with consumers no longer paying to print photographs, 1990s-early 2000s	Green hydrogen economies (hydrogen generated by renewables, not fossil fuels)	Internationally legally binding agreement to end marine plastics pollution being developed with bans on single use plastics in place in EU
Horse to internal combustion engine (95%:5% in 1905 in Europe and USA; by 1925 5%:95%).	Sustainable construction methods and regulations for all new buildings	Autonomous driving vehicles and systems
	Designation of land and sea systems as protected areas (PA): 200,000 PAs on 15% of the world area	Analogue meat (cell culture and precise fermentation: developed, awaiting large-scale regulatory approvals)

Sources: RethinkX [114]; Dorr [115]; SCR Regime Shifts Database (2023): https://regimeshifts.org/, accessed on 1 November 2024; Rinaudo [116]; Henderson [117]; Eco-Experts [118]; Jacobsen [119].

6. Evidence for Regenerative Good Growth: Jobs, Agriculture, Energy, and Cities

6.1. Regenerative Good Growth Can Create Business Circularity and More Jobs

The World Bank and World Economic Forum (WEF) now endorse more sustainable approaches to agriculture, land, energy, transport, buildings, and industrial sectors. The World Bank [120,121] has called for inclusive green and clean growth and the ending of harmful fossil-fuel subsidies. Drawing on evidence from 830 sustainable development projects, it found 76% with dual economy–environment outcomes: if human health is enhanced, this benefits the economy; if pollution falls and/or ceases, this increases natural and physical assets and creates more employment. This "cleaner production" results in environmental co-benefits [122].

The WEF [123–125] recently called for stimuli in Green New Deals to speed transitions to net zero. The WEF has called this a critical leadership frontier, saying that climate and nature loss is business loss, and nature-positive approaches are a frontier for new opportunities. The WEF [123] estimated that net zero transitions could by 2030 have created USD 10 trillion worldwide alongside 395 million new jobs. In the UK, the statutory Climate Change Committee reported in 2023 that pro-net zero options could result in more jobs, reduce emissions, and reduce household costs [126].

In China, national policies on "ecological civilisation" and social progress are combining to produce innovation fitted to regional contexts with emissions from fossil fuel use starting to fall [127,128]. In California, it is estimated that substantial health benefits would accrue from a transition to net zero: greenhouse gas abatement costing USD 106 billion over 30 years to 2050, yet health benefits of USD 215 billion are being created [129]. For India, the WEF [124] concluded that a Green New Deal for India would result in "green transitions towards net zero [that] are not a drag on growth," creating 50 million new jobs in energy, transport, industry, green building, and agricultural sectors by 2050 [130]. In the USA, three million people now have jobs in the clean energy sector, exceeding the fossil fuel sector's employment of one million [117].

Circular economies (CEs) offer conceptual and practical opportunities for regeneration [131,132], with hundreds of CE projects underway and assessed for impact [133,134]. At an entry level, CEs set out to reduce, reuse, recycle, and recover. When more developed as innovative and diverse, they produce system shifts [133,135]. Finland is gaining EUR 2–5 billion per year for the national economy through the implementation of CEs [134]. An assessment of more than 350 CE projects found increases in job creation with reductions in carbon emissions [136,137].

Each year, circular economies produce USD 1 trillion of benefits [134]. Some are sceptical of CE's potential to address rising material consumption [138,139]. Material consumption in the mid-2020s amounts to 100 Gt per year (biomass, fossil fuels, metal ores, and non-metallic minerals), and is growing. Total flows add 38 Gt of emissions of carbon and other GHGs to this extraction total. Lehman et al. [140] call the idea of CEs a charade, creating "an illusion of validity" whilst gross consumption continues at unchanged and unsustainable rates.

A key strand of evidence comes from the observed changes in the direct costs of renewable technologies as adoption increases. Wright's Law suggests that as more technology is made, so unit costs fall: a doubling of production decreases unit costs by 15% [141]. Over the past ten years, the cost of electricity generation has fallen for offshore wind by 70%, and for solar PV by 90%, and lithium-ion battery costs fell over 20 years from USD 7500 per kWh to USD 181 (Table 2).

Table 2. Annual deployment growth and cost reduction in clean energy and historical technology transitions.

Sector	Years	Average Annual Increase in Deployment	Average Annual Unit Cost Reduction
EV batteries	2010–2020	+70%	−19% per year
Solar PV	2010–2020	+24%	−18% per year
Wind onshore	2010–2020	+15%	−4% per year
Wind offshore	2010–2020	+20%	−4% per year
US WWII aircraft	1939–1945	+75%	−14% per year
Ford Model T car	1910–1920	+35%	−10% per year
Gas turbines	1970–1980	+19%	−2% per year

Source: IEA (2023). At www.iea.org, accessed on 1 November 2024.

In this way, Regenerative Good Growth will come to pay for itself: it reduces costs in economies whilst increasing welfare gains (human capital) and stimulating innovation. Once capital is invested for installation, the marginal running costs fall quickly, there are fewer externalities, and net carbon benefits accrue as fossil fuels are removed from energy systems. This is a triple win. Another way to look at this: early movers both create new commons and reap private benefits. They bring down prices, help later adopters, and receive reputational benefits. We next demonstrate this virtuous cycle in the key sectors of food and energy.

6.2. Regenerative Agriculture and New Foods

Agriculture directly affects the natural, social, human, and cultural assets on which it relies for success [59,62,142,143]. These influences can be both good and bad. In 2023, the UN FAO published a new analysis of the hidden costs of agri-food systems in 154 countries. This covered environmental impacts, greenhouse gas and nitrogen emissions, blue water removals, the social costs of undernourishment, and health costs from non-communicable diseases (including obesity). Some impacts could not be monetised, such as costs associated with child stunting, pesticide exposure, land degradation, antimicrobial resistance, and illness from unsafe food.

The external costs measured amount to USD 13 trillion in 2020 (range of USD 11–15 trillion), some 10% of world GDP, and equivalent to USD 35 billion per day [59,62,144]. The FAO shows that negative externalities exceed the value of the food created in several countries. Worldwide, every USD 1 of agri-food value produces USD 0.31 in costs; in the USA, USD 1 creates USD 1.33 in costs, and in the UK, USD 1 creates USD 2 in costs. In the USA, this economic sector is worth USD 1.2 trillion, yet it shifts USD 1.6 trillion of costs to others. These are the measured costs of bad GDP growth and should logically be removed from measures of national and agricultural GDP.

By contrast, sustainable and regenerative approaches to agriculture seek to use ecosystem services without trading off desired productivity. When effective, such agroecosystems have a positive impact on renewable assets. There are some 5 billion hectares of farmland worldwide: sustainable agriculture is now practised on 9% of farmland and adopted by 30% of farmers [145]. Sustainable and regenerative systems increase productivity with diversity [146]. These systems are also multi-purpose, as they create new flows of ecosystem services that benefit farmers and the planet. Land system innovations are always more successful when they are fitted to local ecological and cultural circumstances [147].

Carbon sequestration in soils and in above-ground biomass has the potential to contribute to the race to net zero [116,148]: the removal potential of land has been put at 10 Gt of carbon per year, using known agricultural, forestry and pasture regeneration approaches [149]. These approaches are variously termed Nature-Based Solutions, Natural Climate Solutions, Negative Emissions Technologies, and Nature-Positive Production [65,150–152].

New technologies could offer opportunities for other forms of transitions in agricultural systems, also creating positive biodiversity and natural capital outcomes. Some could arise from an expansion in meat analogue manufacture [153,154]. These use plant/fungal feedstock or cell culture from the tissue of livestock. Low-cost and high-quality analogue meat could make some livestock production systems no longer viable. Most likely to fail will be intensive production; most likely to prevail will be grass-fed sustainable systems. The impact of such analogues on global supply chains of animal feed, especially soya (sourced from agricultural systems that cause tropical deforestation) could be considerable. There would be an added benefit from reduced methane emissions as ruminant numbers would fall. Carbon footprints would also fall: beef from intensive livestock systems produces 23 kg CO_2eq per kg of meat; plant-based meat analogues produce 2.2 kg CO_2eq per kg; fungal analogues produce 0.2 kg CO_2eq per kg [120].

6.3. Renewable Energy

Fossil fuels will soon have to be almost entirely removed from all national economies (with some exceptions, e.g., at high-latitude settlements that are dark and cold in winter); thus, the spread of renewable energy generation is central to preventing climate catastrophe. The main aim is to electrify everything [119,155], with a focus on electricity generation using wind, water, solar, and storage using batteries.

The majority of countries have committed to future targets of 100% renewables for their electricity supply. Some have made substantial progress (Table 3), and now have the resources to invest in other social priorities. Countries dependent on the income from oil will find transitions challenging, even some with substantial sovereign wealth. Qatar calls itself a "hydrocarbon-enabled economy". It has the highest per capita carbon emissions worldwide at 55 tonnes per year, and thus far has no renewables in its electricity supply.

Table 3. Proportion of domestic electricity supplied by renewables (solar, wind, geothermal, hydro, biomass), 2022.

Proportion of Domestic Electricity Consumption Supplied by Renewables	Countries
98–100%	Albania, Bhutan, Costa Rica, Iceland, Norway, Paraguay, Uruguay
90–95%	Ethiopia, Kenya, Kyrgyzstan, Lesotho, Namibia, Zambia, Tajikistan
60–80%	Brazil, Canada, Croatia, Denmark, New Zealand, Portugal, Sweden
40–50%	Ireland, Spain, UK
20%	China, India, Japan, Morocco, USA
Less than 0.2%	Bahrain, Brunei, Kuwait, Qatar, Saudi Arabia

Note: World 28%; Europe 35%; Low-income countries 66%; Upper-income countries 30%. Some of these high values are in countries that will need to consume more to escape poverty, and there will be a need to generate more renewable electricity than today. Biomass is included in data on renewable energy, yet comes at considerable health costs (smoke), environmental costs (pellets are from old natural forests or from peat), and produces CO_2 emissions. Sources: International Energy Agency (2023) (www.iea.org, accessed on 1 November 2024); Howell (2022); Jacobsen (2023); Our World in Data (www.ourworldindata.org, accessed on 1 November 2024).

Choices by governments do matter [78,96]. In the UK in 2023, the government chose to invest in a new nuclear plant (3 GW per year); in Denmark, the government has selected wind power on two new energy islands in the Baltic and North Seas (total of 6 GW capacity). These isles will be the largest infrastructure in Denmark and will be generating electricity by the early 2030s. Nuclear in the UK will take at least a decade longer to come online, so may be delivered too late to influence the meeting of 2050 net zero targets. China and South Korea are intending to install 1–6 GW of floating offshore islands over 2025–2030 [112].

The IEA Net Zero Roadmap [112] concluded there have been "extremely positive developments, and notably rapid progress of clean energy technologies, such as solar PV and BEVs, backed by significant policy efforts". Globally, the IEA believes strong growth in clean energy means the world can deliver fossil fuel emission cuts of 35% by 2030.

6.4. City Redesign and Biomimicry

Urban settlements and building infrastructure contribute considerably to carbon emissions. Most need to be redesigned on new low-to-no-carbon, energy efficiency, and nature-positive approaches. This is a massive challenge, involving retrofitting existing stock to higher standards of insulation and cooling whilst adding renewable energy capacity. New low-carbon high-access transport systems will need to be created. Redesign for net zero will need the adoption of ground-, water- and air-source heat pumps to replace gas and oil heating and cooling technologies. Uptake is high across the EU owing to the deployment of subsidies but remains low in the UK.

Nonetheless, cities and city regions are leading in low-carbon transitions [156]. In China, the Low Carbon Cities Project is working in 72 cities with 423 enterprises [157,158]. These cities have reduced carbon emissions, increased economic productivity and asset creation, and have higher levels of innovation and inward investment. A wide range of initiatives that increase well-being whilst cutting carbon emissions and other air pollution are being implemented worldwide: these include the 15 min cities, low-transport neighbourhoods (LTNs), transit-oriented development, post-fossil cities, minimum housing densities to support public transport, and biophilic design [159].

These urban innovations incorporate the regenerative principles of biomimicry and biophilia: greater access to nature in cities, sustainable and healthy lifestyles, and restoring and improving ecosystems [160,161]. There are numerous examples:

i. The Makoku floating school in Lagos lagoon: made of wood and bamboo with solar panels and rainwater harvesting, the children coming by canoe;
ii. The Singapore Park Connections: 300 km of linear garden and loops in the dense city, trails, and nature corridors that are "a city in a garden";
iii. The Milan Bosco Verticale: 900 trees on the terraces of two housing towers;
iv. The New York High Line Park: two km of the former NY Central Railroad spur, nine metres above the street, a public promenade in the sky;
v. The island city of Mexcaltitín de Uribe on a lake in western Mexico: a walkable and social place with a public square at the centre, and fishers setting off from waterside houses;
vi. Regenerative villages in Denmark and Germany built around agri-hoods and public green space;
vii. The emergence of the 15 min city and LTN movements (there are fifty 15 min locations in Paris), widely popular as a design that is human-centric, quiet, nearby, and environmentally sensitive [162], yet also provoking pro-car and "fair-fuel" movements [22].

Copenhagen was once a typical industrial city: the air, rivers, and harbour were polluted. Today it is a blue–green city with cycle routes, outdoor activity, harbour baths and wild swimming, renewable energy schemes, green corridors and walks, harbour cafés, and galleries. Traffic accidents have fallen, and noise and air pollution are down: USD 43 million of annual health costs are saved annually as a result of the expansion of active travel. The aim, says Meik Wiking [163] was "To change the story; how to make cities great, how to make them livable again". This is a working image for other city-wide regeneration that both requires and strengthens social capital [160].

7. How Stories Help Secure Multiple Choices

As we collectively find ourselves at the start of great transitions, we suggest there is a need for new forms of storytelling in order to inspire place-based actions that lead to social tipping points [16]. Storytelling is of course ancient tradition in every human culture, tested at the fireplace and hearth [164–166]. After food, someone begins a story. The children are wide-eyed. The story may be old itself or from that very day, it could be about a difficult choice, what was right and wrong. Perhaps a moment of crossing borders, a child is given duty over the horses, a young woman about to give birth, an elder preparing for a death ritual. Such a story always contains moral and social guidance. It tells listeners how to live well. It tells of journeys never before taken, both inner transformations and outer transitions.

All stories contain archetypes [164,167], patterns of individual and community change that all people identify from their own life experiences. Storytelling is thus a gate to a new hinterland, a wide meadow where past problems seem smaller. It opens a threshold from the ordinary world to a special world [168]. In the territory of the climate majority, the roughly middle-60%, people tend now not to want more bad news. They want to be inspired by hope and kindness, by values of togetherness and collective action [169,170]. In the face of the great interlocking crises, what kinds of language, stories, and values might we use to find multiple and complementary ways out of the dark woods? Could new forms of climate communication be created by thinking more about storylines [171]?

First, there will be a need for new forms of storytelling, combined with a language of kindness and generosity, and capabilities for new forms of leadership [172], where modern selfishness is the outlier [173]. Stories and evidence can help to create a canopy of hope, and then these can go on to create the agency and social capital to make the great transformations easier, thus encouraging positive tipping points [174,175]. Stories bring people together.

Second, there is not much comedy and laughter when it comes to the climate and nature crises [176–178]. There is little admitted vulnerability, certainly few fools and tricksters. Environmentalists rarely make fun, especially of themselves. It is all too serious. Yet laughter is both relief and social glue. In the dark times, many feel the need for hope and that things will get better. Laughter helps, and it creates togetherness of experience. This is especially hard in the climate and nature crises when people have been made to feel both victim and perpetrator [176].

No wonder anxiety is high [179]. And the challenge is this: too many still find the rhetoric of catastrophe an excuse for inaction. There is a need, as Young [178] has put it, to tackle difficult subjects without making others angry. This is the approach of "yes, and" that has been used by The Second City of improvisation in Chicago [180]. Saying yes-and is a form of "improv" that brings people together rather than forcing them apart [181]. It permits ensemble working and co-creation, avoids blame and failure, yet also involves deep listening to others.

Third, is hope. The central challenge now has shifted, not to persuade, but to help create hope. Facts rarely win arguments [177]. Rebecca Solnit [170] recommended we should not search for hope in the limelight but find it in the shadows. When you act with hope, you soon find others: hope helps move us from the individual to the cooperative [182]. But a dilemma remains: hope requires patience. It is a charged waiting, yet there is so little time available in the face of the advancing crises.

Storytelling and hope together create the capacity for performativity [174,183]. It gets us off the sidelines and into the game. We are going to have to imagine a convivial future, purposeful with shared outcomes, before we feel able to set out [184,185]. This means reinforcing the visions of a restored climate and nature that enhance the flourishing of humanity.

Hope and storytelling also help to create imaginary space. They are a cultural asset to help produce systems of meaning that enable collective interpretations. All good stories contain instructions for living [166–168]. Worldwide there are rising numbers of cases of successful renewal centred on the principles of regeneration. These tend, so far, to be islands of success, often not well known nor understood. This evidence of hope centres on redesigning configurations of the five renewable assets to create visions for new futures [39,186].

Good stories are forever about engagement with the public, whether audiences or consumers. An organisation succeeds when it creates a story not about itself, but about how it is improving lives and helping people make the world a better place. The listener recognises this and turns towards the organisation. Such successes can form the basis for new regenerative stories to inspire hope. And there are great stories to tell; the evidence in Table 2 could form the basis for inspiring stories of hope if framed and delivered in the right way. Storytellers need to be brought on board to frame and deliver these stories in ways that resonate with the public.

8. Agency and Engagement: Whole System Transitions

Bad GDP growth is extractive and creates externalities. Even in narrow financial terms, when all the costs of externalities are included, total costs can outweigh not just profits but the total size of economic sectors. Regenerative Good Growth, by contrast, benefits human and natural assets whilst providing the resources, goods, and services that help people thrive and flourish. It has beneficial feedback loops and seeks to reduce inequality. Bad GDP growth has self-amplifying harmful feedback loops and raises inequality.

This has been known for a while, but the evidence now shows that public and private investment in clean innovation and nature-positive approaches creates jobs, and politically accelerated transitions will help us reach a nature- and people-positive world faster [187,188]. We also know that 1.5 °C lifestyles were not only possible but could already have brought fairer and higher-welfare good lives [189]. However, a transition to these kinds of lifestyles will need the ushering in of giant leaps, bending of curves, new great accelerations, and turnarounds [4,111], and such new economic cycles can be initiated by individual actions [190].

Yet, this is already going to be a long democratic emergency [78,96,191]. We are already working in medias res, in the middle of things [93]. Time is tight, and there is urgency. Making positive change at scale is proving difficult in the 2020s. Promised emission cuts are not occurring, policies are being slowed or reversed, and fossil fuels continue to be used while burgeoning conflicts and environmental crises distract and redirect political energy into short-term fixes.

The priorities for action are spread across all sectors [126]. Greater surges will be needed in the renewable wind, water, and solar installation, stationary and mobile battery technology, green hydrogen, sustainable food, and agriculture systems, complementary wilding of landscapes, changes in dietary choices, development of analogue meats, decentralised and intelligent energy grids, bio-principles for circular economies, active and public transport systems at scale, retrofits for existing buildings, heat pumps, green finance, and climate litigation in the courts. Each requires a substantial project of change; each will reduce carbon emissions and biodiversity loss. Together this suite of actions offers choices, and the potential for individuals, businesses, cities, and countries to create multiple new paths towards future sustainability. Where these have been combined into ambitious policy packages with public funding, such as the European Green Deal and the UK's Great British

Energy publicly owned energy generation vehicle, then there is an even greater likelihood of positive change [190].

Yet governments continue to deploy public subsidies to support fossil fuel extraction and use. These, combined with damaging agricultural and fishery subsidies, currently amount to USD 7 trillion per year, approximately 8% of global GDP [121,152]. Localised air pollution from vehicles is increasingly inescapable, adds to health system costs, and causes 7 million preventative deaths worldwide each year [192]. It is estimated that only 10% of progress has been made towards achieving the 17 UN Sustainable Development Goals (SDGs) (the target date is 2030). Some USD 4 trillion needs to be spent each year in low- and medium-income countries to meet these targets. Such resources could come from "repurposing the environmentally harmful subsidies" currently allocated to fossil fuels [121], together with innovative deployment of public and private finance and the use of green bonds [188,193].

There also remains a significant challenge for comprehensive citizen engagement. The climate crisis will force all people worldwide to undergo dramatic shifts in the way they live. Some will be directly afflicted by extreme events. David Orr [78] asks about the climate crisis, "In our circumstances, how do we tell the truth, without inducing despair and fatalism?" How do we also avoid backlash, the emergence of green authoritarianism, and the creation of green fascism?

Climate change litigation is a fast-growing form of action being used to amend behaviours of public and private institutions [194]. Climate cases in courts have risen to 3000 worldwide since 2015 [195], some being used to oppose novel climate action, the majority to limit or prevent existing extraction and externalities. The Urgenda Foundation v State of Netherlands in 2014 was significant, with Urgenda winning a case that concluded the state was not acting quickly enough to reduce GHGs. This led to 48 replica cases, with notable successes in Austria and Switzerland. Other unconcluded cases are seeking to limit the actions of large fossil fuel companies, notably Shell v Milieudefensie (Friends of the Earth Netherlands) in The Netherlands. A lower court ruled against Shell in 2021, limiting the company's capacity to sell fossil fuel assets and/or open new oil and gas fields.

As indicated earlier, public engagement can lead to the rapid formation of social capital and the promotion of regenerative culture. Christian Wahl [39] notes: "A regenerative future requires the capacity to listen and learn from diverse perspectives". Deploying public engagement implies generative models of practice, where creativity leads to new ways of describing the world and acting in it. This will mean new forms of intermediary institutions and third-sector activism, such as the Third Act in the US which focuses on the over-60s, who tend to be time-rich and vote more. An increase in agency can come about through intermediary processes: participatory technology assessments, national citizens' assemblies, citizen science, crowdsourcing, farmer field schools, participatory budgeting, user assemblages, hybrid actors, transitioners, real-world labs, municipality change labs, industrial clusters and municipality change labs [93,196,197]. Such collective action, volunteering, and healthy lifestyles could improve health and well-being, as could universal policy innovations such as the 4-day working week and universal basic income and services packages [198,199].

The regional and local climate action commissions in the UK [200,201] are becoming effective innovation intermediaries to aid place-based decarbonisation and transitions [202,203], creating green jobs and economic benefits through effective co-production. The Essex Climate Action Commission, for example, made 100 recommendations for pathways to net zero [204], and this has unanimous cross-party political support, with impacts on 64 areas within 3 years. It has helped produce an Essex Design Guide for net zero planning, green infrastructure standards for developers, a sub-regional Climate-

Focused-Area for land and nature transformation, created local nature partnerships and sustainable transport, and developed village and town-based climate groups. All have led to significant inward investment in the county [200]. As indicated earlier, net zero policies in the UK are now widely supported, especially when they are non-coercive and offer multiple choices [86,87].

In the USA, calls for a Green New Deal morphed into the 2022 Inflation Reduction Act (IRA), containing USD 500 billion of new spending and tax breaks to boost clean energy, reduce healthcare costs, increase tax revenue, and reduce carbon emissions. The Act broke the discredited idea of inevitable trade-offs between economic and environmental/health objectives. Similarly, progressive policy packages have been announced in the EU (Net Zero Industry Act; Green Deal Industrial Plan) and China (ecological civilisation targets declared in 2022 as part of the 14th Five-Year Plan) [205].

We summarise ten policy paths to help implement Regenerative Good Growth (Table 4). To achieve this, decision-makers across the public, private, and third sectors will need to listen to diverse perspectives, seeking to learn from experiences that go beyond their own. This will help create long-term change for the triple challenge of climate, biodiversity, and well-being [10].

Table 4. Ten policy paths to Regenerative Good Growth.

1.	Stop burning materials to create energy; build renewable assets to eliminate all greenhouse gas emissions, using a range of approaches including nature-based solutions rather than technological pathways focusing on carbon capture and storage.
2.	Electrify everything and expand the green hydrogen economy by setting ambitious national targets for renewable energy and retrofitting homes for both insulation and renewables.
3.	Ensure policies and practises at national and local levels reflect and create hope by being nature- and people-positive, and that businesses are acting to be net-positive in their operations.
4.	Eliminate all toxic subsidies that encourage bad GDP growth.
5.	Use policy to offer direct personal incentives to redirect consumption broadly; including encouraging the adoption of low-carbon and low-running cost technologies (BEVs, microgeneration, housing refits, heat pumps) and shifting towards more sustainable and healthy choices.
6.	Only use green charges/taxes as a last resort (except carbon taxes, which raise large sums for some countries), as increased prices for consumers can be politically charged and create backlashes.
7.	Avoid the temptation to tax emerging green sectors as they grow; the greater win comes from the emergence of a new regenerative economy that creates jobs and has a low-cost base.
8.	Enhance policy support for the transition to regenerative agriculture, urban redesign, and food systems that reduce emissions and remove atmospheric carbon.
9.	Support the formation of local and intermediary-level initiatives and civil society transitions, and the co-creation of solutions with the public and businesses.
10.	Learn to tell powerful new stories of hope and transformation, which resonate with the public and policy makers and enable people to see a course towards a better future.

9. Concluding Comments: Dangers and Prospects

There are considerable challenges to shifting from bad GDP growth to Regenerative Good Growth. Economies in transition will continue to have substantial material needs that cause significant harm to natural and social capital, particularly in lower-income countries and regions [141]. Net zero is a widely used policy concept and target, but new net negative emissions targets are going to be needed to stop world heating. The need to move slowly to create public engagement and support may feel contradictory to the need to go faster [195,206]. There is hope we might be on the edge of "The Next Great Acceleration" [109]; perhaps also a Great Turning or a new Green Renaissance [68]. Climate models show that emissions cessation would provide rapid and universal benefits, with most land regions experiencing "fast and continuous early responses" [207].

However, advances also bring backlashes, especially from within the 15–20% of public opinion who currently hold that climate change is either not happening or not caused by human action. Some movements are well organised, funded, and vocal. They also feature issue leakage, starting in one place (such as 15 min cities), becoming pro-car and fair fuel, and gathering support from those fearing social engineering, wanting automotive freedom, concerned about gentrification, and who are suspicious of government and planning [22,77,162]. Many of these fears and concerns have foundations in people's lived experiences, making trust-building particularly challenging.

There remain further dangers, especially regarding decoupling and the rebound effect [25,27]. Regarding the decoupling of environmental impacts from growth in GDP, this has been found to occur in several countries and sectors, but it is not happening fast enough to solve the climate and nature crises. Many new forms of regenerative economies are still unproven.

Regarding the rebound effect, this occurs when money saved by efficiency advances is spent on increasing consumption of existing and damaging goods and services. Leakage effects are created when new natural capital is rapidly spent or lost. For example, the 200 Mha of zero-tillage conservation agriculture implemented over the past 25 years has created substantial soil carbon sinks, yet if re-ploughing were to occur, this sequestered carbon would be released back into the atmosphere.

The upside of Regenerative Good Growth is this: if policy creates healthy ecosystems and healthy cultures, it reduces economic burdens. It cuts hidden costs and drags on productivity. It increases personal and national health, wealth, and happiness. It also has the potential to be universal, benefitting all. It will get businesses, countries, and world economies onto paths towards new economies that favour building the five renewable assets, paths that are fairer and more just, and that enable climate and nature recovery. But it will be hard, especially where these assets are already in a damaged state, and where there is significant self-interest among powerful elites in maintaining current systems.

A critical challenge is that the use of all natural assets that constitute the foundation of the economy must remain within safe and just Earth system boundaries. In short, a safe and just future has to operate within finite global budgets of natural assets and processes that keep the planet stable, resilient, and liveable. This is what poses the largest justice challenge for a Regenerative Good Growth paradigm: how to distribute fairly the ecological and biophysical space on Earth to all citizens.

A regenerative future lies in both ecosystem restoration and avoided damage, the creation of renewable economies, and circular and resource-efficient economic models. It will also require the attitude of a pilgrim [39], becoming a scouting expedition into possible futures [78]. We do not know the answers. We do know that co-learning and experiential learning across multiple sectors will help develop novel solutions. We do know that individual actions can initiate whole new economic cycles and environmental systems of technology and behaviour [190]. There will be contradictions and conflict. It is our hope that the concepts and language used here could aid and speed the great transitions and transformations that lie ahead. Regeneration means, after all, putting life at the centre of every action and decision.

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