Energy Research & Social Science 44 (2018) 41–49

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

Redefining green growth within planetary boundaries

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ARTICLE INFO

Keywords:
Green growth
Indicators
Nordics
Climate change
Science-based targets
Policy communication

ABSTRACT

Over the last decade, green growth policies have drawn increasing interest. OECD, UNEP, the World Bank and the EC have had several initiatives on the issue, and the Nordic countries have a special program on it. Definitions and indicator sets have been developed, though critics have pointed out that most initiatives amount to little more than a greenwashing of conventional economic growth. The paper proposes and discusses two definitions of green growth, one weak and one strong. Both build on resource- and carbon productivity measures, but whereas the weak definition requires absolute decoupling, the strong or "genuine green growth" requires sufficient decoupling to achieve science based targets for planetary boundaries. The approach is tested at country levels, starting with the climate boundary, by analyzing progress on carbon productivity ("CAPRO") in Nordic countries since 2000. Results show that so far, among Nordic countries, Sweden, Finland and Denmark have achieved genuine green growth, while Norway has not. Implications for policy and communication of green growth are discussed.

1. Introduction: defining green growth in a verifiable way

This paper's research question is two-pronged: What is "genuine green growth" – and to what extent can it be found in the Nordic countries? A natural starting point is to review and clarify some main definitions of 'green growth' proposed by intergovernmental bodies.

The Organisation for Economic Co-operation and Development, OECD, defines green growth as being "about fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. It is also about fostering investment and innovation, which will underpin sustained growth and give rise to new economic opportunities" [1, p. 18]. The World Bank writes: "Green growth is 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" [2, p. 2]. The European Commission, EC, writes that, "The aim is to **create more value** while **using fewer resources**, and substituting them with more environmentally favorable choices wherever possible" [3].

The United Nations Environmental Program, UNEP, defines a green economy as one that results in "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities." The word "significantly" is not clarified, but UNEP continues to say that "a green economy is low carbon, resource-efficient, and socially *inclusive*." UNEP does not distinguish clearly between "green economy" and "green growth". UNEP states that "In a green economy, growth in income and employment should be driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services" [4, p. 16].

These definitions all say something about the intended direction of green growth (environmentally friendly and socially inclusive). Yet, none of the above have given a definition that sets measurable criteria for what passes as green growth. There is a lack of clear, simple indicators of whether economic growth at different scales – from cities, nations to the world, is "green enough" to enable economies to evolve within the biophysical safe operating space of planetary boundaries. The latter requires science-based targets for stable Earth systems. Below we define this as "genuine green growth". To relate a certain economic development to measurable, physical boundaries is essential for assessing whether it is genuine green growth or simply "pale green" or "greenwashing".

Due to this vagueness, many critics claim that "green growth" rhetoric often aims primarily at incrementally better efficiency and somewhat more sustainable consumption and production, but still disregards ecological limits from ecosystem to the Earth system [5–13]. Therefore it becomes in practice mostly a continuation of the conventional economic growth model but just under a new label.

We argue for a transition from a "green growth" paradigm that essentially focuses on relative efficiency improvements to a "genuine

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https://doi.org/10.1016/j.erss.2018.04.030
Received 15 October 2017; Received in revised form 2 April 2018; Accepted 16 April 2018

green growth" paradigm that delivers absolute reductions in environmental impacts. Mounting scientific evidence shows that humanity is now the dominating force of change at the Earth system scale. We envision future economies that can thrive within physical planetary boundaries as a natural and necessary development of economic paradigms in the advent of the Anthropocene [14,15]. In this new context we propose a genuine green growth model that incorporates defined global budgets of, e.g., carbon, nitrogen, phosphorus, land, minerals, freshwater. One novelty of the current paper lies in linking concepts that governments and political economists are already very used to – such as value added, consumption – with physical flow accounts that highlight the connection of these economic activities to planetary boundaries.

Building on decoupling theory [16,17], we propose the following, simpler definition of 'green growth': *Green growth is an increase in economic output that lowers total environmental footprint.* "Economic output" is best understood as value added in an entity over a time period. "Total environmental footprint" can be operationalized in a number of ways; such as CO_2 emissions in tons per year (pa), in material flows in tons pa, or by ecological footprint (EF) measured as global hectares pa [18]. In principle, any material resource use directly relating to (a set of) the planetary boundary dimensions that have been transgressed beyond the safe operating space for humanity [19,20] can be included.

This definition can then be used to define green growth with precision. Let "ΔGDP" mean annual percentage change in real gross domestic product for a country. Annual resource productivity (RP) is measured in value added divided by physical units; i.e. in dollars/tons, dollars/kWh, or dollars/EF measured in global hectares [21]. Let "ΔRP" be the resource-productivity as the year-on-year percent change in real GDP/environmental resource use. Then the *definition of green growth is given by the inequality:*

$$(1)\ \Delta RP > \Delta GDP$$

To illustrate: If Sweden sees a GDP growth of 2% pa, and its carbon productivity improves by 4% pa, the country displays green growth in the climate dimension. The economy grows larger in real inflation-adjusted terms, while at the same time generating a ~2% less annual greenhouse gas (GHG) emissions. Green growth therefore relates to the rate of change in resource productivity relative to the overall growth rate of the economy. There is green growth when there is absolute decoupling of GDP growth from resource use: the economy grows while emissions fall.

"Gray growth" contrasts with green growth; gray growth can be defined as an *increase in economic output that also increases the total environmental footprint*. Here the environmental footprint grows in spite of a somewhat improved resource productivity. Each new car may have a somewhat more efficient combustion engine, but since more cars are produced and/or drive even more, the total environmental footprint from this economic output still goes up. This is similar to the "rebound effect," or "Jevon's paradox," that has characterized much of the economic growth model throughout the 20th century [22,23]. Using the same variables as above, we get: *Gray growth is*

$$(2)\ \Delta RP < \Delta GDP.$$

To illustrate: Norway has a GDP growth of 2% in one year, and yet their resource productivity only improves by 1%. A 2% larger economy that uses resources 1% more effectively will *increase* its total environmental footprint with a ~1% pa. In such gray growth, the volume of the economic output growth eats up all the resource efficiency gains: the economy grows along with a (smaller) growth in emissions.

Accordingly – as critics of green growth, such as those referenced above point out – many politicians publicly proclaim to work for green growth and a green economy. But this often equates with mainly *talking* about reducing climate emissions and other environmental impacts, while simultaneously pushing for as much conventional economic and job growth as possible. Consequently, what is labeled as green growth in practice becomes gray growth, a continuation of the 20th century growth model, such as in the illustration with Norway.

To avoid such greenwashing one must directly link all economic activities to their environmental impacts in a measurable and consistent way and invest in sufficient resource productivity over time. Otherwise, as politicians and governments continue to talk about green growth while delivering gray growth, more critics become firmly negative to any prospects of green growth, and – in the face of disruptive climate change – want to stop economic growth altogether. Instead, they claim that our developed society must aim for degrowth [7,24–26].

Many scientists, climate activists and even some politicians often call for immediate cuts and large reductions of society's carbon emissions in absolute terms, to be achieved for instance by stringent regulations or higher carbon pricing. Unfortunately, these calls generate widespread resistance from many citizens, vested interests and policy makers, even if clearly needed from a climate science point of view [27]. To become more effective in gaining public support for an economic transition that take planetary boundaries into account, one could rather than reinforce the perceived cut-and-degrowth framing [5,7,25,28], promote the green growth framing. This latter promises a more psychologically supportive win–win frame for engaging a broader public audience rather than the degrowth cut- and loss frame [29,30]. Loss framings tend to psychologically generate more aversion and resistance among the general public, lowering support for climate policies [31–35].

Critically though, if adopting a win–win green growth framing, the approach must be credibly linked to science-based targets. Without being credibly configured to attain economic growth within planetary boundaries over time, claims of green growth will lose validity and legitimacy. In this context even the above (1) definition of green growth may be too weak since the decoupling rate may not be sufficient: The global economy possibly requires a stronger, i.e. genuine version of green growth to take planetary boundaries fully into account.

To attain genuine green growth in the climate dimension the economic challenge is, then, how to break down the remaining global carbon budget [36–39] to a fair and clear share for each nation state, city, industry and corporation without removing the new economic growth opportunities, particularly from poorer economies. One promising way of doing that is with a simple, but positive and dynamic indicator of carbon productivity, to be introduced below.

In Section 2, this article will argue how to link carbon productivity with science based targets, as a first attempt to develop a genuine green growth methodology. In Section 3 we apply the method on the Nordic countries, since Nordic societies are widely perceived to be one of the leading green growth regions [40]. Section 4 discusses the dynamics of and common objections to the indicator, while Section 5 summarizes some policy conclusions and recommendations, particularly with respect to communicating green growth.

2. How to link green growth with science-based targets?

2.1. Prioritizing among green growth indicators

Among already established green growth indicator sets, carbon productivity (or its inverse carbon intensity) often gets a high priority [41–44]. This is no surprise given that the climate change problem is one of the foremost among the planetary boundaries that humanity has already transgressed [45, p. 46, 19,20]. For a shift toward a green economy, a reduction of carbon emissions through better carbon productivity is a first, necessary measure, even if insufficient alone. We also need science based targets and indicators for green growth for biodiversity, land, water, pollutants and chemical entities, nutrient loading (nitrogen and phosphorus) as well as for social dimensions such as innovation, poverty alleviation and social justice. Yet, carbon productivity is a good starting point, due to its relative ease of measurement, as well as the urgency of further climate disruptions that would