Geoforum 99 (2019) 11–21

Contents lists available at ScienceDirect

Geoforum

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

The American anthropocene: Economic scarcity and growth during the great acceleration

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ARTICLE INFO

Keywords:
Economic growth
Scarcity
Environment
Anthropocene
Great acceleration
Fossil fuels

ABSTRACT

The anthropocene is an increasingly important lens through which to observe relationships between natural resource exploitation, economic growth, and the consequent ecological impacts these entail. However, there has been little work that specifically addresses the postwar 'great acceleration' of economic growth, resource extraction and environmental impacts as a qualitatively distinct moment of the anthropocene. This paper uncovers the impact of the US President's Materials Policy Commission (PMPC), more commonly known as the Paley Commission after its Chairman, William S. Paley. It does so in order to address the key, but currently little studied issues of the timing, institutional development, sociotechnical and conceptual underpinnings of the great acceleration. The Paley Commission's 1952 report Resources for Freedom: Foundations for Growth and Security was crucial to the development of a globe spanning US-led 'growth paradigm', the rapid expansion in fossil fuel extraction and use that powered this growth, and ultimately helped spark the great acceleration of a distinctly American anthropocene age.

> There never was a nation that consumed so much coal and steel and soil and copper and lumber and water and strange minerals and everything that comes out of the earth, and at the same time gave so little thought to where it came from.
> – Edward R Murrow 'Resources for Freedom' CBS Broadcast, January 10th 1954

1. Introduction

The anthropocene is an increasingly important lens through which to observe relationships between natural resource exploitation, economic growth, and the consequent ecological impacts these entail. It names a transformation in human-nature relations so profound as to constitute a new geological period (e.g. Crutzen and Stoermer, 2000; Steffen et al., 2011; Lewis and Maslin, 2018), one where 'human actions overshadow the quiet persistence of microbes and the endless wobbles and eccentricities in the Earth's orbit, affecting the governing systems of the Earth, and therefore define the age' (McNeill and Engelke, 2014:2). However, there has been little work that specifically addresses the postwar 'great acceleration' of economic growth, resource extraction and environmental impacts (Steffen et al., 2015) as a qualitatively distinct moment of the anthropocene. In this paper I uncover the impact of the US President's Materials Policy Commission (PMPC), more commonly known as the Paley Commission after its Chairman, William S. Paley, in order to address the key, but currently missing issues of the timing, institutional development, sociotechnical and conceptual underpinnings of the great acceleration. The Paley Commission's 1952 report *Resources for Freedom: Foundations for Growth and Security* was crucial to the development of a globe spanning US-led 'growth paradigm' (Dale, 2011; Schmelzer, 2015), the rapid expansion in fossil fuel extraction and use that powered this growth, and ultimately helped spark the great acceleration of a distinctly American anthropocene age.

The term 'great acceleration' was first used in a workshop in 2005 by Will Steffen and colleagues to highlight that since 1945 three quarters of all anthropogenic carbon dioxide has been released into the atmosphere. At the same time, the number of automobiles increased from 40 million to 850 million, the number of people tripled, the number living in cities rose from 700 million to 3.7 billion, while the tons of plastics and nitrogen (largely for fertilisers) produced rose from 1 million tons to 300 million tons and from 4 million tons to 85 million tons respectively. Since the end of the second world war, humans have become 'the most important factor governing crucial biogeochemical cycles' - namely the carbon, sulphur and nitrogen cycles (McNeill and Engelke, 2014:4). The conceptualisation of the postwar anthropocence as a great acceleration was specifically intended as an homage to Karl Polanyi's 1944 *The Great Transformation*. Echoing Polanyi's emphasis on the social context of the market economy, the great acceleration was understood as a term highlighting that 'the driving forces behind

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https://doi.org/10.1016/j.geoforum.2019.01.003
Received 21 January 2018; Received in revised form 2 January 2019; Accepted 7 January 2019
Available online 12 January 2019

anthropogenic global ecological change are embedded in societies and their traditions, while all human history is embedded in the evolving biophysical environment' (McNeill and Engelke, 2014:213).

But rather than embedding ecological change in and through societal transformation, the great acceleration has almost exclusively been defined through brute macro-social categories and the impacts of a totalised humanity (see e.g. Steffen et al., 2007, 2011, 2015; Zalasiewicz et al., 2015). While McNeill and Engelke (2014) refer to economic growth as leading to surging global trade, communications and travel, increased international migration and technological advances, growth itself is seen as being driven primarily and straightforwardly by energy use and population expansion (see also Lewis and Maslin, 2018). These analyses recapitulate a consequentialist bias in much anthropocene oriented work - namely the tendency to reduce the drivers of global environmental change to broad and abstract categories (Moore, 2015). There is a burgeoning social science scholarship focused on a critical engagement with the changes to the natural environment wrought in the anthropocene (Bonneuil and Fressoz, 2016; Chakrabarty, 2009, 2016; Haraway et al., 2016; Lövbrand et al., 2015; Tsing, 2015), and indeed one critical of the name itself - frequently preferring the more causally appropriate designation of the capitalocene (Malm, 2016; Malm and Hornborg, 2014; Moore, 2015, 2016). As Donna Haraway unequivocally put it:

> *anthropocene* implies that this is somehow a species act; that it's the separation of whatever it is that makes us human from all else, and that it's another human exceptionalist move. But that's just wrong. It's empirically, morally, ethically, and emotionally wrong.' (Haraway, 2016)

Interestingly, work from a critical perspective that seeks to addresses this bias - particularly analyses focused on locating global ecological degradation in the specific socio-natural relations of capitalism (e.g. Malm, 2016; Malm and Hornborg, 2014; Moore, 2015, 2016) - overlooks the specificity of the great acceleration. Here the acceleration of economic growth, fossil fuel use (specifically in the form of oil) and concomitant ecological degradation is viewed largely as a simple quantitative change. The postwar period represents history catching up with the altered socio-natural relations of industrial (or earlier) capitalism. As the environmental historian Frederik Albritton Jonsson put it in a presentation in May 2018, the economic and political causes of the anthropocene must be sought in the 19th Century, and the great acceleration is simply the result of these changes (Albritton Jonsson, 2018). For Malm and Hornborg, these causes are straightforward:

> [A] clique of white British men literally pointed steam-power as a weapon - on sea and land, boats and rails - against the best part of humankind, from the Niger delta to the Yangtzi delta, the Levant to Latin America' (Malm and Hornborg, 2014:64)

In opposition to these approaches to the anthropocene and great acceleration, in this paper I employ a broadly performative reading of the postwar history of the economy, growth and scarcity that draws both theoretically, and in terms of its empirical starting point, from the work of political theorist and historian Timothy Mitchell (1998, 2005, 2011). In a single footnote in his 2011 *Carbon Democracy*, Mitchell notes that through the 1950s and '60s, postwar American fears over the death of plenty were laid to rest by the Paley Commission. Neither the Commission, its report nor its impacts are mentioned again in any of Mitchell's works. This paper brings together economic and environmental history in order to understand the nature and significance of this claim. I highlight how the Paley report transformed the measurement of natural resources into an economic idiom of scarcity; and in the process, laid the groundwork for the explosive growth and impact of the US and global economy from the postwar years on. In other words, it is an investigation of the history of economic thought in environmental practice.

The Paley report played a key role in three intimately related but often separately considered aspects of postwar history. First, it helped secure 'the economy' as an apparently tangible, discrete object, defined by a naturalised law of limitless growth irrespective of any material constraints (Mitchell, 1998, 2005). Second, the Paley report was crucial to the development and stabilisation of an economic 'growth paradigm' as the overarching political priority of the twentieth century (Borowy and Schmelzer, 2017; Dale, 2011; McNeill, 2001:236; Schmelzer, 2015, 2016). Third, it technically enabled and politically prioritised the further expansion of fossil fuels - most specifically oil - to power this growth (Altvater, 2006; Pfister, 2010).

By highlighting these developments, I aim to take seriously McNeill & Engelke's Polanyian framing of the anthropocene as embedded in societies and their traditions while simultaneously focusing on the specific, qualitative changes underpinning the great acceleration from the 1950s onwards. While the recent concept of the anthropocene correctly designates the anthropos and its drive for growth as bearing responsibility for the ecological derangements of the contemporary age, this should not be understood as a universal humanity outside of time. Instead, this is an anthropos with a comparatively brief history, reconstructed conceptually through an American economic idiom and politically as part of the institutionalisation of the planet-wide economic exploitation of the natural world. The oxymoronic phrasing of the American anthropocene used here captures several key facets of this development. It locates the initial genesis of naturalised and naturalising economic accounts of growth and scarcity within the production of the Paley report and shows the role these played in the global expansion of the 'American environment' – the extraction and exploitation of fossil fuels through the planet-spanning supply chains of US state-supported corporate actors. It is the global spread of the American economic technologies and discourses traced here that naturalised economic growth conceptually and in practice from the 1950s onwards, and played a central role in the initiation of the great acceleration.

In the second section of this paper I introduce the Paley Commission, its composition and immediate reception in the context of the early Cold War. The third section focuses on the use of an economic account of scarcity in the Paley report, and how this differs from earlier natural material evaluations reliant solely upon geological measurements. The fourth section then traces the impact of this approach to resource measurement with respect to the economy, growth and oil expansion. The paper concludes by reiterating the importance of these developments for the contemporary framing of environmental governance practices.

2. Resources for Freedom, resources for growth

As the grinding mechanical howl of the Second World War began to fade, a concern with the availability of natural resources began to take hold in the US. There were intermittent shortages in all of the major fuel sources following the war alongside a concern with the potential shortfall in the availability of uranium. Observation of the hugely disruptive British coal shortages bore down on the American political psyche just at the moment when the US shifted from a net exporter of oil to net importer. At the same time, Truman's decision to involve the US in the economic recovery of Europe through the Marshall Plan raised difficult questions about what this would mean for America's already depleted resource base (Goodwin, 1981:32; Mitchell, 2011).

These concerns were bolstered in the late 1940s by the influential research report *America's Needs and Resources* by the liberal think tank the Twentieth Century Fund. The report, edited by economist J. Frederick Dewhurst, noted the alarming fact that while the US was 'blessed with a wider abundance of natural resources than any other industrial nation (with the possible exception of the Soviet Union)' (Twentieth Century Fund, 1947:675), it was not self-sufficient in a wide array of essential raw minerals. Moreover, Dewhurst and his co-authors reinforced the view that the preceding global conflagration had burned

too bright, for too long, and in the process:

> 'chewed up' enormous quantities of iron, copper, lead, zinc and aluminium, much of which will never be recovered for further use. The war also resulted in a vast consumption of petroleum, and to a less extent of other exhaustible mineral fuels. (Twentieth Century Fund, 1947:675)

The concern that the nation's material bounty had been exhausted was spread like a pox through the broader American public by a glut of popular books that followed the Dewhurst report. In 1948 Fairfield Osborn published his best-selling book *Our Plundered Planet* (1948), and this was shortly followed, also in 1948, by the even more popular *Road to Survival* (1948) by William Vogt. These stoked fears of a global apocalypse driven by resource depletion and rapidly increasing population (Desrochers and Hoffbauer, 2009; Foster, 1998; Hays, 1959:41–42). *America's Needs and Resources* was reprinted for a fifth time in 1949 alongside a simplified graphical representation of the report's findings in a volume entitled: *U.S.A., Measure of a Nation*, and a series of three essays based on this new volume were printed in 40 of the nation's leading newspapers (Twentieth Century Fund, 1950). 1949 also saw significant pessimistic concerns over global resource constraints raised by the geologists, mineral specialists and other natural scientists attendant at *The United Nations Scientific Conference on the Conservation and Utilization of Resources* (Barnett and Morse, 1963:31; Goodwin, 1981:26; Mahrane et al., 2012).

This was not, however, a simple return to Reverend Malthus and his iron theology of geometric population growth rates outrunning limited material supplies. Instead the postwar neo-Malthusian doctrine was novel in several respects. First, a new understanding of the economy '… came into being between the 1930s and 1950s as the field of operation for new powers of planning, regulation, statistical enumeration and representation.' (Mitchell, 1998:91; see also Speich, 2011; Tooze, 2001). As part of this, the construction of national accounts and measures such as Gross National Product (GNP)[1] - and the comparability between nation states that these enabled (Speich, 2011) - highlighted the concern that if the economy could grow, then it must grow, because if ours didn't, theirs would. At this point then, a concern with the growth of the economy was added to a concern with the growth of the population and this growth was cast in a more dismal light. For Malthus, a geometric population increase was the natural growth rate and therefore accorded with god's plan for mankind to fully cultivate the earth (Dale, 2017:88). The innovation of newly comparable national accounts enabled the upward ratchet not of a divine plan, but of a very mortal life or death race between America and the Soviet Union at the end of the 1940s (Norgaard, 2001: 94–95).

Second, for Malthus, 'Limits were a challenge, to be sure, but one that could be overcome or greatly forestalled' (Dale, 2017: 88) and therefore any putative limits to growth were a far-off concern. In the immediate postwar years, the development and spread of a planetary imaginary at work in different ways in e.g. Vogt and Osborn's popular books as well as in global geological prospecting, helped reduce the vast empty spaces revealed by Mercator's maps into a more tightly interconnected, densely packed and closer planet (Robertson, 2008; Mahrane et al., 2012). Under the earth, while advances in geology had discovered an immense yet hidden underground bounty, the war, having 'chewed up' vast quantities of these resources, increased the concern that these were no longer hidden but entirely absent. Combined, these rendered the threat of material exhaustion not as a theoretical question for some far flung future populace to deal with, but as something that was (to borrow a good title from a bad book) *extremely loud and incredibly close.*

Were there enough resources available for the life-or-death growth of the economy? Were the lights going to go out? Was the US, and with it the free world, in danger of being left behind in the cold gloom of the Soviet shadow? These urgent questions were rendered explicit by the 1949 report of the Hoover Commission. The Hoover Report stated clearly and starkly to Truman and Congress that, with respect to natural resource policy: '…Federal activities in this field must therefore be studied in the full light of the part which these resources play in our whole manner of life…*our country has reached a point in its development that calls for a new concept of the relation of natural resources to its economy*.' (Hoover, 1949, Appendix L:1; emphasis added). Three years later, the Paley Commission's report provided this new conception.

William S. Paley was the Chairman of the Columbia Broadcasting Service (CBS), and while he initially balked at the idea of heading up a Presidential Commission, his ability to publicise the reports prospective findings was clear. Subsequent appeals to his patriotic streak and entreaties by Oscar L. Chapman (the Secretary of the Interior), Lyndon B. Johnson (then Chair of the Senate Preparedness Committee) and President Truman himself brought Paley round (Bedell Smith, 1990:312; Burkhardt, 2005:38). Alongside Paley, the Commission comprised five other commissioners, and ultimately over 130 staff members. The Executive Director position was occupied by Amherst College economics professor Philip Coombs. Coombs had previously been employed at the Economic Cooperation Administration (ECA) set up in 1948 to administer the Marshall Plan. He had also been a previous candidate for the position of Director of the Division of Minerals and Fuels when it was first created in the Interior Department in 1950 (Goodwin, 1981:45). Edward Mason was the Dean of the Harvard School of Public Administration and was suggested by Coombs. Mason had recently served on the Gray Commission on foreign economic policy and was a respected expert on public policy (Burkhardt, 2005:40).

Two political appointments were made to maintain bipartisanship. George Rufus Brown was a Houston businessman who with his brother Herman ran the construction firm Brown & Root. The Brown brothers bankrolled Lyndon Johnson's political career, and it was Johnson who suggested Brown's name to Paley. The appointment of Brown raised conflict of interest issues due to the oil and gas construction projects undertaken by his firm - a key issue addressed by the Commission. This conflict was quietly and conveniently resolved by an Executive Order exempting commissioners from federal conflict of interest statutes (Burkhardt, 2005:42). Arthur Bunker was a powerful Republican fundraiser and former CBS board member who had moved from investment banking at Lehman Brothers to the minerals extraction company Climax Molybdenum, and his connections within the industry were widespread (Burkhardt, 2005:41–42). Eric Hodgins rounded out the Commission and was the editor of Fortune magazine, an engineer from MIT and former editor of the MIT Technology Review. He was employed precisely because of his skills as a writer (Bedell Smith, 1990:313). He served as editor-in-chief of *Resources For Freedom* and was widely credited as the reason for the report's much lauded readability (Burkhardt, 2005:44).

The Commission was tasked with assessing the prospect and potential extent of mineral, energy and agricultural shortages, and to propose policy responses to deal with these. Given this remit, it might seem puzzling that the commissioners began their report by stating that:

> …we share the belief of the American people in the principle of growth. Granting that we cannot find any absolute reason for this belief we admit that to our Western minds it seems preferable to any opposite, which to us implies stagnation and decay. (PMPC Vol. 1 1952:3)

However, it was only during the 1950s that economic growth became a primary policy goal (Mitchell, 1998, 2005; Schmelzer, 2015: 264, 2016; Speich, 2011). And it was only a decade earlier, in 1940, that the British economist (and one of the fathers of national accounting metrics) Colin Clark had published his influential comparative study of

[1] And later Gross Domestic Product (GDP).

the economic performance of nation states, revealing for the first time along a single quantitative metric that the world is 'a wretchedly poor place' (Clark, 1940:2). Clark rediscovered for economists, politicians and policy makers that the creation of wealth was a crucial global problem (Speich, 2011:10) - a problem largely forgotten in Anglo-American economics after the marginal revolution of the 1870s. In fact, 'hardly a line is to be found in the writings of any professional economists between 1870 and 1940 in support of economic growth as a policy objective' (Arndt, 1978:13).

The Paley report documented clearly the concerns with resource scarcity, and indicated how, in the US alone, consumption of petroleum and other mineral resources since the beginning of WWI had been greater than the total consumption of all the previous centuries put together (Kula, 1998:112). This expansion in consumption was accompanied by a shift in the US position from net materials exporter to importer. In 1900, it produced 15 per cent more materials than it consumed, but by 1950 it was consuming 9 per cent more than it produced (Andrews, 1999:183). Alongside these assessments of historical material resource use, the economy was now given a future history through the commission's 25-year growth projections of the 'basic economic characteristics of our society' (PMPC Vol. 1 1952:3). The Paley report's growth projections were for a doubling of the size of US nominal GNP, from 273 billion dollars at the start of 1950 to almost 550 billion dollars in 1975.[2] The increase in resource use was projected to result in American consumption of up to 20 per cent more raw materials than the nation would produce over the same period, further increasing US reliance on overseas imports - particularly of oil (Andrews, 1999:183; Calel, 2011:7). As Fortune magazine put it in their account of the report's release:

> Some time during the 1940s the U.S. passed a point of no return. Few noticed it at the time; not until this week was the event fully described and its meaning assessed. This was done by the President's Materials Policy Commission in a monumental report called "Resources for Freedom." This report could prove to be as important a guide to the next century of America's development as was Alexander Hamilton's great Report on Manufactures (1791) to the century in which we became the world's No.1 industrial nation. (Fortune, 1952)

This meant that the question of whether the growth of the economy could be maintained in the face of scarce resources (particularly fossil fuels), which lay at the heart of *Resources for Freedom* could be forcefully stated: 'It took nature over 500 million years to store in the ground these stockpiles of "fossil fuels" which civilisation is now consuming in a flash of geologic time' (PMPC Vol. 1 1952:104). Given these findings and the perceived importance of the Paley report:

> It was no accident that the majority of commissioners were Republicans…And they were not just ordinary Republicans but important figures. We were likely to come out with controversial policy recommendations for government and industry. If you had a bunch of flaming liberals, you wouldn't be taken seriously. It was pretty hard to make an attack on Bunker, who was a fund-raiser for Republicans. Some might call that calculation, I called it common sense. (Philip Coombs, Quoted in Bedell Smith, 1990:314)

Another commissioner, Edward Mason, called it public relations (Mason, cited in Burkhardt, 2005:38); a point reiterated by Colin Clark[3] in his 1954 'Afterthoughts' in *The Review of Economics and Statistics*. The influence of Brown and Bunker meant that public relations might more appropriately be described as industry relations however. This is evident in the internal Commission debates and conflicts over issues of synthetic fuels, hydropower and the oil depletion tax allowance[4]. These conflicts were ultimately resolved in the report in favour of the oil and electricity industries over government funded synthetic fuels and large scale public hydropower. Arguments for the maintenance of the depletion allowance were also retained. Burkhardt highlights the role of Brown and Bunker here, who acted as both oil and extractive industry advocates as well as being against government oversight and expansion more generally (Burkhardt, 2005:54–64).

In the case of the oil depletion allowance, this pitted the Commission staff advocating for change against the majority of the commissioners themselves, who opposed any changes to the allowance. Commission staff took four months to produce an extensive study of the impact of the allowance, and ultimately concluded that it was an arbitrary benefit to the oil industry that had unpredictable effects on exploration and development rates and was unlikely to actually foster exploration and the production of oil. As such it should be modified in order to actually bring the allowance in line with actual exploration and development costs. This report split the Commissioners. As Eric Hodgins acidly put it:

> Messrs Paley, George Brown, and Arthur Bunker, being men of considerable wealth, were quite sure that the 27 1/2 percent depletion allowance was merely the manifestation of what providence had intended all along. Professor Edward mason of Harvard and I being peons of the Commission…in pocketbook, felt strongly that we should criticize this depletion allowance… Mr. Paley was extremely anxious for a unanimous report, and in the face of this wholly understandable desire and the force of such overpowering dollar opposition as Professor Mason and I encountered, we rather let this go. (Hodgins, quoted in Bedell Smith, 1990:315)

In the end, the final report simply ignored the staff study and agreed in favour of promoting continuation of the allowance (Burkhardt, 2005:60-62).

Overall though, the commission aimed at reaching as wide an audience as possible, in part as a means to influence policy makers who would be '…directly impressed if they see an impressive display of the Report and its recommendations on our major media' but also because the audience for the report was considered by one commissioner as 'everybody who ought to be interested in it' (Goodwin, 1981:58–59). Prior to its release, a series of hearings were held on its various aspects, and these focused especially on issues around energy resources as they were 'a major limiting factor in shifting from scarce to abundant sources of production materials' (Goodwin, 1981:58). Ten thousand copies of the final report were initially printed, at a cost of $55,000, and it drew high praise from the press, including editorials, features, front covers and interviews. Fortune magazine referred to the report as 'one of the greatest, most readable government documents of the century' (quoted in Bedell Smith, 1990:317). Paley followed up the publication of the report with a documentary, similarly entitled *Resources for Freedom,* which was televised on CBS in 1954. This featured deferential interviews with each of the commissioners and was anchored by the network's star newsman, Edward R. Murrow.

The report's 25 year projections of economic growth and material resource use were not uncontested in the academic literature however (e.g. Clark, 1954). Similarly, Commission staff such as Palmer Putnam and Arnold C. Harberger disagreed with the final report, and publically argued that its population predictions were implausibly low (Goodwin, 1981:54 footnote 112). These predictions were derived from the work of Census Bureau statisticians who maintained that the postwar baby boom was transitory, a presumption that didn't quite tally with the then

[2] Which itself fell vastly short of the actual increase to a 1.689 trillion nominal GDP. Source: https://www.bea.gov/national/xls/gdplev.xls.

[3] The same Colin Clark who produced the 1940 comparative economic analysis of nation states.

[4] First implemented in 1926, the depletion allowance allowed 27 and a half percent of profits from the production of domestic oil and gas to be exempt from income taxation.

prevalent neo-Malthusian arguments on population growth (Clark, 1954:207). Further criticisms fell into two camps. The mining industry responded with a narrow protectionist critique, arguing that the report had underestimated the potential of technology and the market to adapt to scarcities. A broader critique came from the *New York Times* which argued that technological change made it impossible to predict the relative prices of raw materials in advance. Meanwhile, the Wall Street Journal railed against the report as an excuse for further planning and government controls (Burkhardt, 2005:88–89). The report's release was also unfortunately timed in the middle of a presidential campaign, and where the ultimate winner, Eisenhower, was significantly less enthusiastic than Truman had been about the commission's work (Bedell Smith, 1990:319).

However, the Paley Commission was considered important and influential at the time for several reasons. It was separate from the two main sources of attention on materials and energy scarcity within government up to that point: congressional committees and the Interior Department, and it brought together a wide range of economists and other specialist from all the relevant parts of the government as well as industry and universities (Goodwin, 1981:53). As such, its independence afforded it broad legitimacy and reach within both federal agencies and industry and served for some time as an 'encyclopedia' of information on natural resource management in the US (Robertson, 2008:569). In fact it was considered, as the Harvard economist Arthur Maass noted at the time, 'the most original and significant contribution to the study of resources and public policy since the 1933 report of the Mississippi Valley Committee and the early reports of the National Resources Committee' (Maass, 1953:210).

The broader significance of the Paley report's contribution does not simply lay with its perceived independence, readability, wide reach or its skillful influence of public opinion - important as these were. Instead, what is crucial is that it undertook a fundamental break with the neo-Malthusian pessimism of previous assessments of the natural resources position of the US (Landsberg, 1987), through a novel technical redefinition of the way that resource scarcity was measured: from the absolute scarcity of previous assessments to a relative, price-based definition of scarcity. And it was this innovation that enabled the report to respond to the call of the Hoover Commission of 1949 and play a key role in the great acceleration of the American anthropocene in the postwar years.

3. Scarcity and the foundations for growth and security

The scope of the Paley report, much like America's resource demands, exceeded its borders. The Korean mobilisation and cold war backdrop to the Commission lent its work an unprecedented global scope, casting the state as a 'consumer of raw materials for military goods' (Burkhardt, 2005:46) and one that shaped the Commission's economic focus on raw materials. In fact, economics was the most common point of departure for the Commission's staff:

> It not only served as a common language for staff and commissioners, but it was also a way of trying to create commensurability between resource data. For them, economics was the "natural" way of approaching the problems they were asked to confront and their mobilisation experiences seemed to be more appropriate models for solving these problems than were any published studies. (Burkhardt, 2005:45).

How then did the Paley report's economic approach to the scarcity of material resources differ from the assessments undertaken by its closest precedent - *America's Needs and Resources?* In Dewhurst's study, Wilbert G. Fritz had the responsibility for drafting the chapter on natural resources. Fritz was a former Director of the Wartime Energy Resources Survey, and in 1947 a member of the War Assets Administration. He maintained that several factors determined the ability of resource supplies to meet the demands of a growing economy: the extent and exhaustibility of existing reserves, economy in the use of materials, use of a wider variety of materials, and discovery of new sources. In calculating the first and last of these factors, Fritz collated figures from the National Resources Committee, the National Resources Planning Board, his own previous reports, *Oil and Gas* journal estimates and most importantly from the Bureau of Mines reports: The *Minerals Yearbook* and *Mineral Resources of the United States*.

The figures from these sources were based on the measurement and estimation of the physical stocks of reserves in ground. For example, for crude oil, estimations of reserves at the time were generally made through volumetric analysis (Bowden, 1985:212), which involved four basic steps: First, the likely geographical distribution of oil basins was established; second, estimates of oil content per volume of sediments in known areas were collated; third, comparable amounts of oil per volume of sediment were assumed in similar but unexplored geological areas; and fourth, total reserves were calculated by multiplying the volume of unexplored sediments by the estimates of oil per unit volume in known areas.

Postwar volumetric analyses, alongside the other geological estimations of absolute scarcity that formed the basis of *America's Needs and Resources* resulted in an apparent redrafting of David Ricardo, with Fritz stating that: 'It is inevitable of course, as time goes on, that our supplies of mineral resources will come nearer to exhaustion and that our needs will be satisfied with less ease and at higher cost than before.' (Twentieth Century Fund, 1947:598). But with respect to oil production in the US, the neo-Malthusian writing was very evidently on the wall:

> Although new supplies of petroleum will undoubtedly continue to be discovered in the future, we have probably passed the peak of discoveries. Naturally, every oil field found diminishes the chances of finding another one, and almost every new pool that is tapped produces at a steadily diminishing rate over its useful life. Thus, there may be diminishing production from diminishing reserves. (Twentieth Century Fund, 1947:588)

The Bureau of Mines itself published an updated *Mineral Resources of the United States* in 1948. This estimated the physical reserves for the thirty-nine most important minerals used by industry, and similarly to the assessment of raw materials in *America's Needs and Resources*, economic costs were not utilised in its analysis. While it surveyed potential developments within geological prospecting and processing methods as well as reserves estimations, its projections of future reserve levels at the then current rates of production and consumption had no economic measures - a fact remarked upon by Philip Coombs during a discussion of the Paley Commissions work (Burkhardt, 2005:49)

Both Fritz' analysis of the nation's long-term reserves of crude oil and the Bureau of Mines updated mineral resource estimates should in fact be seen as a continuation of pessimistic assessments of ultimate US oil reserves going back all the way back to the first United States Geological Survey (USGS) survey of reserves undertaken in 1909 by David T. Day. This initial assessment was integrated into the national inventory of mineral wealth and conducted under the supervision of the new National Conservation Commission, chaired by the head of forestry and renowned conservationist Gifford Pinchot (Maduriera, 2012:143–144). The 1909 survey indicated that between 10 and 24 billion barrels of oil remained underground, and that this would last the country less than 25 years, if upward production and consumption trends continued (Day, 1909; cited in Madureira, 2012:144). While assessments of ultimately recoverable US oil were continually revised upwards over the intervening 40 years, they retained the pessimistic conclusion of imminent mineral exhaustion, a fact that did not go unnoticed by the Paley Commission:

> Public judgements of the prospects for future petroleum supplies have frequently been distorted because of popular misconceptions concerning the nature of proved reserves. Time after time the fact that proved reserves were equivalent to only about 12 to 15 years'

> production has come to the attention of publicists who have then sounded the alarm that the United States was about to run out of oil. (PMPC vol. 3 1952:5)

In comparison to volumetric measures and other geological assessments of natural resources as used in the Dewhurst and Bureau of Mines studies, the Paley Commission's estimates and predictions focused instead on economic factors such as the costs and prices of end products derived from natural resources, and where '[t]he growth of demand is at the core of the materials problem we face' (cited in Maass, 1953:206). The Commission members stressed the distinction between physical and cost limitations on material resource supplies from their very first meeting:

> As a nation we have tended to "skim the cream" from our natural resources - that is, to consume first the higher grade and least costly portion of our reserves - and to postpone the use of lower grade and accessible reserves. Thus, as we eat deeper into our reserves - particularly of "exhaustible resources" - we face increasing costs per ton of materials unless ways can be found to avoid higher costs through new techniques, substitutes, or low-cost foreign supplies. (Agenda for the First Meeting of PMPC, Tuesday, January 30, 1951; cited in Burkhardt, 2005:51)

Resource depletion here was expressed through rising costs and was not concerned with the absolute depletion of physical stocks but of the relative depletion of stocks with respect to each other. This crucial shift from absolute to (relative) price depletion combined geology and reserves estimation with an economic account of relative scarcity. Relative scarcity here is driven by an inherent and unlimited human demand, not limited material supply (e.g. Baumgärtner et al., 2006). The division of scarcity into its absolute and relative forms within the history of economic thought has been placed as early as the development of neoclassical economics (Dale, 2012:874; Daoud, 2010). Dale notes, drawing from Fine (2010), that scarcity plays a role for the neoclassical tradition not in either its methodology or substance, but in defining its subject matter - namely as the science of limited resource allocation among competing, unlimited goals (Dale, 2012). The 'restless quality' of human needs here, meant that: 'By systematising the postulate of scarcity in this way, neoclassical economics discovered what the eighteenth century had invented: a universal condition of scarcity' (Xenos, 1989:69)

The concept of relative scarcity is most closely associated with the work of Lionel Robbins, who took this as denoting a disciplinary marker. Robbins wrote in 1932 that 'Economics is the science which studies human behaviour as a relationship between scarce means which have alternative uses.' (Robbins, 1932:15). But at the beginning of the 1950s this definition was still widely contested within the discipline, dismissed as both too narrow and too broad (Backhouse and Medema, 2009a, 2009b) and was later referred to by Robbins himself as 'the greatest mistake of my professional career' (cited in Fine, 2010:77). While neither Robbins nor his 1932 text are mentioned explicitly in the Paley report, it is the application of the concept of relative scarcity to mineral reserves calculations that allowed the commissioners to abstain from the then common concern with resources running out (Landsberg, 1987:85) and shift to a new conception of reserves:

> Reserves must be considered not as a total reservoir from which all future production is to be drawn, but as the basis of operations, a sort of working inventory. Proved reserves are indeed like a reservoir, but a reservoir into which there is an inflow as well as an outflow. (PMPC vol. 3, 1952:5)

In the early 1950s - at the initiation of the great acceleration of the anthropocene age - the Paley Commission publicly reconceptualised material resource reserves from the geological metaphor of an absolutely exhaustible reservoir, to a business accounting metaphor of a replenishable working inventory. The inflow into an oil reservoir could be maintained by ensuring that the cost of new discoveries did not exceed the general price level of crude oil and associated petroleum products. Therefore, as Hans Landsberg put it in his Afterword to the reissued Paley report in 1987 'It is a mistaken notion…that on a given day the world will find that the last ounce or foot of a given resource has been used up. *At a cost* there is always more.' (Landsberg, 1987:85; emphasis in original). This novel technical innovation of resources understood as working inventory, based on the combination of economic theory and reserves evaluation, had the interesting property of effectively *inverting the relationship of cost to material scarcity*.

For analyses prior to Paley, natural resource costs were high because they were absolutely scarce. However for Paley, high costs actually enabled the production of ever more resources - through substitutions, technological advances and the exploitation of previously non-economically viable resource extraction - and therefore 'The fact that at any time reserves are only a little more than a decade's outflow need not of itself be alarming if a steady inflow can be anticipated.' (PMPC vol. 3 1952:5). This lead the Commissioners to emphasise the 'real cost' of resource extraction, focusing on comparative analyses of labour, capital and energy expenditures between domestic and overseas resources. This resulted in the report advocating for the expansion of overseas extraction instead of domestic self-sufficiency, and the conservation that the latter would have implied. In his 1953 review of the report Arthur Maass wrote that:

> …the Paley approach can be used to introduce a degree of flexibility into analyses of conservation which, too often in the past, have become stuck on inflexible concepts of physical stocks of resources…No other approach to conservation and resources problems offers a framework of analysis so broad and yet so useful and meaningful. (Maass, 1953:206)

The Paley report provided more than just a broad, yet useful and meaningful framework of analysis. It helped undermine a postwar politics of resource conservation and demand management underpinned by a neo-Malthusian conception of absolute physical scarcity. By replacing this account of scarcity with an economic, relative concept, and applying this to material reserves calculations through the innovative reconstruction of these as working inventory, the Paley Commission broke the direct connection between material resources and the growth of the economy. It meant that being no longer bound by physical and material constraints, the economy was understood as free to continue a trajectory of continuous growth, a trajectory effectively denied by the neo-Malthusian presumption of an absolutely fixed resource supply in the geological measurements developed in the postwar era and exemplified through the work of Dewhurst.

As characterised by Fortune Magazine at the time, America had 'outgrown its resource base'. For the Paley Commission, this meant that securing the resources for freedom meant that 'we must find or create that environment outside our shores' (Fortune, 1952). Growth, and therefore security, was enabled through the Paley report creating that environment for continued resource extraction not simply outside of America's shores, but inside the pages and tables of material reserves calculations.

4. The spread of the Paley approach

In his 1954 CBS documentary on the importance of his report, Paley stated that:

> The only cause for alarm would be if we closed our eyes to the threat of creeping scarcities and higher costs and pretended that somehow the materials problem would blow over. It won't…The material problem is everybody's problem. (quoted in Bedell Smith, 1990:318)

The material[s] problem then, although everybody's problem, was for the Paley Commission, eminently solvable. The apparent solutions to this problem, as understood through what Maass called the 'Paley

approach' (1953:206) were key to the great acceleration of the American anthropocene in three distinct yet intimately related ways: The approach provided the ongoing conceptual basis for reconsidering the relationship between growth and natural resources within the (global) anglo-american economics discipline; it underscored the political prioritisation of growth given the necessity for the 'least cost' management of materials extraction; and it enabled the further expansion of the use of fossil fuels - specifically oil - to power this growth.

First, the technical innovations undertaken by the Paley Commission in the way that natural resources were measured, considered scarce, and related to the growth of the economy, supported the burgeoning development of both a growth focus, and specifically growth theory within the economics discipline from the mid-1950s (Schmelzer, 2015). In 1953 Paley and members of a committee on resource availability and economic growth within the Ford Foundation set up a non-profit organisation entitled Resources For the Future (RFF) with an initial USD 150,000 grant. RFF was intended to continue the assessment and analysis of natural resource prospects and problems after the incoming Eisenhower administration declined Paley's suggestion for this to be undertaken by the Federal Government (Landsberg, 1987). Research undertaken throughout the 1950s and early 1960s continued the Paley approach to natural resource scarcity. In the early 1960s, RFF published companion reports by Potter and Christy (1962) and Barnett and Morse (1963) that became key economics texts, and formed the orthodoxy on natural resource use, providing the economic mainstream with proof that a general resource scarcity did not represent an impediment to continued and continual growth (Baumgartner et al., 2006; Daly, 1991:40; Lane, 2014; Pearce, 2002:58; Perez-Carmona, 2013:87). As Barnett & Morse put it: '[a]dvances in fundamental science have made it possible to take advantage of the uniformity of matter/energy, a uniformity that makes it feasible without preassignable limit to escape the quantitative constraints imposed by the character of the earth's crust.' (1963:11).

These empirical analyses were intimately related to and supported the development of growth theory within the economics discipline after the publication of Arthur Lewis' *The theory of economic growth* (1955) and Robert Solow's *A Contribution to the Theory of Economic Growth* (1956). The innovative replacement of an absolute, neo-Malthusian natural resource scarcity with relative, price-based scarcity rapidly came to represent the 'economic orthodoxy' on natural resources (Perez-Carmona, 2013: 87), and Solow indeed assumed that nature is 'infinitely expandable, infinitely convertible (or at least infinitely substitutable) and infinitely plowable' (Walker, 2007:178). As Walker goes on to note, in his later models, Solow maintained that some natural resources were required for economic growth, 'but the amount of "growth" that could be accomplished with some unspecified initial quantity was again unlimited' (2007:178). The Paley approach, continued through the research and publications of RFF, provided the conceptual redefinition of natural resource scarcity and the empirical description of its relation to the economy as an object defined by a propensity to and ability for unlimited growth. This enabled both the later analysis of Simon Kuznets - who reviewed the entire manuscript of Scarcity and Growth - in his 1971 *Economic Growth of Nations*, and Robert Solow's conceptual claim three years later, in the wake of the Club of Rome's *Limits to Growth* report, that 'the world can, in effect, get along without natural resources' (Solow, 1974:11).

Second, the innovation of price scarcity enabled the Paley report to foster the political priority of growth that the commissioners, to their Western minds at least, could not help but believe. The focus on the 'real cost' of natural resources was related to the crucial concern with ongoing war-preparedness measures, and the Commissioners made recommendations to balance the supply and demand of materials not through domestic conservation measures, but through the overseas expansion of materials production and distribution - particularly in the areas of steel, aluminium, oil and electricity (PMPC Vol. 1 1952:156). This led the Commission to reject the simple preservation of natural resources and a narrow goal of self-sufficiency (Andrews 1999:182–183; Landsberg, 1987; Maass, 1953:206). Instead, it urged the expansion of overseas extractive industries under the banner of the 'least cost principle' as a means to the govern material resources (Landsberg, 1987:84) and ensure future economic growth. This expansion was to be undertaken by 'unfettered private enterprise, free from government controls and regulated to the greatest extent by the "spur of the profit motive," "the competitive market structure," and "the price system"' (Maass, 1953:209).

Crucially, this was a growth that was envisioned in the report as occurring on a global scale, or at least for America's partners and material resource providers in the 'free world'. The rhetoric of the 'free world' is used repeatedly throughout the report in order to diffuse the tension between the promotion of overseas natural resource extraction by the 'unfettered private enterprise' of US firms, and new nationalist or anti-colonial governments in the postwar era who might not take kindly to the espoused creation of an American environment under their feet. As Burkhardt notes, '[f]or the Paley Commission, growth was the solvent for all dilemmas: conflicts of interest would dissolve, as economic growth buoyed the rich and poor, the developed and underdeveloped' (Burkhardt, 2005:82). Through the novel synthesis of mineral reserves estimations and economic scarcity that defines the Paley approach, the report helped secure the 'absolute reason' for the principle of growth as the absolute solvent to all political and distributive dilemmas.

Six years after the publication of the Paley report, growth was explicitly given the 'absolute reason' that the Paley Commissioners had in practice helped bring about. In 1958, Nelson and Laurence Rockefeller tasked Henry Kissinger with preparing a report entitled; *The Key Importance of Growth to Achieve National Goals* (Dale, 2011; Purdey, 2010:80). Heading a panel comprised of economists from large corporations and key universities, Kissinger identified the importance of economic growth as the solution 'for all major ailments of Western economies' (Purdey, 2010:80). The report began by stating that '[t]he first basic conclusion that emerges from our analysis is the very great importance of maintaining a high rate of growth' (Rockefeller Brother's Fund 1958; cited in Lekachman, 1966:179). Hewing closely to the inherent properties of the 'Western minds' of the Paley Commissioners, the Rockefeller's report pre-emptively clarified the American role in the great acceleration of the anthropocene:

> The adventure of the American economy is a continuing reality. The dynamism that has produced the present level of well-being holds out the promise of a still more challenging future. Our nation is dedicated to economic growth (Rockefeller Brother's Fund 1958; cited in Lekachman, 1966:179)

The least cost principle and the role it espoused for the expansion of US industries and economic control overseas fed into the burgeoning narrative and programmes of development and dovetailed with Walt Whitman Rostow's later *Stages of economic growth: a non-communist manifesto* (1961). Rostow's 'organismic' metaphor of the process of industrialisation of the national economy assumed a set of stages of development from embryonic to maturity. Here the developmental pathway of North American and Western European economies was argued to be recapitulated, at different stages, in the less developed nation states of the world. Rostow imagined the universal mature endpoint of the national economy in the apparent consumer cornucopia realised in the US in the 1950s, a state achieved through a transition to what he referred to as a modern 'Newtonian' view of a systematically manipulable and transformable nature. This enabled the mature state of an economy to transcend senescence and decline, and instead, through the realisation of 'unlimited production functions', allow growth to become its normal condition (Walker 2007:179).

During the 1960 Presidential election campaign the growth of the economy was a major campaign issue (Arndt, 1978:55). Although Nixon dismissively refused to join with Kennedy 'in playing what is rapidly becoming the most fashionable parlour game of our time - a

game we might call "growthmanship"' (Nixon 1960, cited in Arndt, 1978:55), the game was played without him. Kennedy's campaign platform promised a growth rate of 5 per cent, which became a central objective once he became President. As Arndt put it, the 5 per cent growth rate became 'the most conspicuous signpost' of Kennedy's promised New Frontier. By the start of the 1960s, the growth of the economy resided in an 'exalted position' (Tobin, 1964:1) among government goals and policies, and in December 1961, the US and 19 other OECD countries signed an agreement to aim at a 50% growth of collective real GNP during the coming decade (Arndt, 1978:56–57). This 'growth paradigm' (Dale, 2011) was further propagated through rich nations of the world via the continued proselytisation of the OECD (Schmelzer, 2015, 2016); and through poor ones via the politics and programmes of development. In the case of the latter, Rostow's prescriptions in particular were central to the development approach undertaken at the World Bank during Robert McNamara's thirteen-year tenure as president from 1968 to 1981.

Third, the increased foreign investment in the mineral and extractive industries - particularly for oil - proposed in the Paley report, meant that while private enterprise was unfettered, it was most definitely supported (Maass, 1953:209; Andrews, 1999:183). This was driven by both the centrality of energy to the economy for the Commission and its claim that 'Energy is not a commodity in the same sense that other materials are' (cited in Burkhardt, 2005:55), as well as the focus on 'real costs' of raw materials highlighted above. In order to fully grasp the importance of the Paley report's ultimate advocacy for the expansion of international oil extraction, an important point regarding the complex political economy of the mid-20th century oil industry needs to be highlighted. From the late 1920s until the early 1970s, US government tax breaks, price supports and production quotas with respect to domestic oil and helped to underwrite not just domestic, but also international oil profits, and thereby maintained continued increasing global oil extraction.

From 1928 until the end of the second world war, global oil prices were directly tied to domestic US prices through the cartel agreement made between the seven sisters (Mitchell, 2011:166). An important aspect of this agreement was the use of the so-called basing-point formula which set the price of middle eastern oil sold in Europe at the same price as Texas oil, plus an entirely fictitious transportation cost from the Gulf of Mexico to the point of purchase (Stork, 1975:59). In 1944 the British Navy launched an investigation into oil prices and the use of the Texas basing point system. In response to this investigation oil companies dropped the fictional transportation cost from the gulf of Mexico, but retained the Texas point price. In effect, the Persian Gulf became a second basing point (Stork, 1975:59) where Middle Eastern oil was still priced equivalently to oil produced in the US, despite significantly lower production costs. That is, the governance infrastructure that maintained the prices and profits of domestic American oil, resulted in even greater profits for Middle Eastern oil, given its lower production costs. This pricing regime remained in place until it was eclipsed by the growing power of the Organisation of Petroleum Exporting Countries (OPEC) at the beginning of the 1970s, and whose quota system was in fact modelled on that of the US (Mitchell, 2011:167–170).

The postwar threat of diminishing domestic American oil supplies precisely undermined the rationale for oil price support and production regulation. The possibility of diminishing supplies was highlighted in *America's Needs and Resources* detailed above, and espoused most clearly and alarmingly for the industry at large by the oil geologist M. King Hubbert with his influential 'Peak Oil' thesis in 1956. The regulation of oil production through quotas, tax exemptions and allowances - with both the continued high levels of production and profits they resulted in - made no sense in the face of depleted oil fields and the apparent Cold War need for a strategic oil reserve (Bowden, 1982). As Secretary of the Interior Oscar Chapman stated In October 1951: "…[I]f another full-scale war should come, make no mistake about it, petroleum will be more vital to victory than ever before in our history" (quoted in IPAA, 1952:2).

The Paley Commission, as indicated above, ultimately advocated in its report the ongoing provision of free government services, tax relief, and continued subsidies for exploration costs, while simultaneously arguing for the maintenance of production quotas to ensure the necessary inflows into resource inventories below the price of final natural resource products. In the case of the depletion allowance, this recommendation was quickly incorporated into oil industry publications, including the American Petroleum Institute's publication *Percentage Depletion and Its Appropriate Rate* (Burkhardt, 2005:62). The report's projections of energy use were also used as evidence by the oil majors during attempts by the Justice Department to prosecute them for anti-trust violations (Kaufman, 1978).

Alongside the threat of the removal of production subsidies and tax treatments in order to maintain strategic reserves, '[t]he uncertainty of oil exploration infects, as it were, the economics of investment in competing supply sources. For example, investment in nuclear power is reasonable given one set of expectations of oil discoveries and costs, and wasteful given another.' (Adelman, 1972:41). In 1953, President Eisenhower gave his famous 'Atoms for Peace' speech to the UN General Assembly, where he claimed: 'The United States knows that peaceful power from atomic energy is no dream of the future. The capability, already proved, is here today.' (Eisenhower, 1953). In 1955, the UN hosted the International Conference on the Peaceful Uses of the Atom in Geneva, otherwise known as the Atoms for Peace conference, and in 1957 Eisenhower's proposed an International Atomic Energy Agency (IAEA) under the aegis of the UN. Article II of its statute maintained the drive '… to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world.' (IAEA, 1957).

The ongoing pressure on the growth of the economy, with both the potential and apparent Presidential advocacy for a shift to alternate forms of energy, most importantly nuclear, resulted in the calculation of much larger oil reserve estimates than those given by Hubbert, Dewhurst and other previous analyses based on volumetric, geological measures independent of economic factors (Bowden, 1982, 1985). Utilising the Paley approach to scarcity, oil company executives directly rebutted these estimates. For example, a series of addresses and articles from 1956 to 1963 by Morgan Davis and Richard Gonzalez of Humble Oil[5] challenged Hubbert's findings from a price-oriented economic perspective (Bowden, 1985: 220; Hemmingsen, 2010:536). Echoing the Paley report, they maintained that 'economic, rather than physical, factors account for the existence of scarcity in the marketplace' (Bowden, 1985:221) and that instead of peaking this would allow oil production trends to continue in a straight line.

In 1958 RFF published *The Future Supply of Oil and Gas* by the economist Bruce Netschert. Netschert, who was one of the Paley Commission Staff, reviewed a series of reserve estimates in order to come to an overall resource base figure for US oil reserves on the order of 500 billion barrels - over three times higher than Hubbert's central estimation of 150 billion barrels. By the early 1960s, more direct critiques of the peak oil thesis shifted from the oil industry to the USGS, with assistant chief geologist Vincent McKelvey becoming a champion of price-based reserves calculations against Hubbert. The application of the Paley Report's technical innovation in economic accounts of scarcity enabled previously unimagined amounts of oil to be discovered, hidden not in the porous rocks of the earth, but in the apparently faulty calculations of oil geologists.

The diffusion of the Paley approach helped enable the creation of the global environment both shaped by and oriented towards increasing natural material resource extraction and exploitation. The development

[5] Humble oil was a majority owned affiliate of Standard Oil of New Jersey, and in 1960 Humble and Standard along with Standard's other affiliates were consolidated into the single Exxon corporation.

of price scarcity central to the approach enabled the conceptual development of the economy as an object that could grow irrespective of resource constraints in both economic theory and as employed in practice. At the same time, the Paley approach and its shift to a 'least cost principle' as a new mode of natural resource governance enabled the prioritisation of the politics of growth and the stabilisation of the 'growth paradigm' (Dale, 2011). Finally, the rapid, heavily government-supported expansion of oil production and use in order to address the 'real costs' of future American energy supplies enabled the now necessary growth of the economy. It is the creation of this global environment by the Paley report and the approach it advocated that is key to understanding the unique, qualitative shift inherent in the great acceleration of the American anthropocene beginning in the early 1950s.

5. Conclusion

In his panoramic survey of the environmental history of the 20th century, John McNeill argued that '…economic theory by 1935 to 1960 crystallised as a bloodless abstraction in which nature figured, if at all, as a storehouse of resources waiting to be used. Nature did not evolve, nor did it twitch and adjust when tweaked. Economics, once the dismal science, became the jolly science.' (McNeill, 2001: 335–336). A fundamental part of this 'bloodless abstraction' is that in the post-war period neo-Malthusian scarcity was 'quietly abolished as a fundamental constraint upon economies' (Walker, 2007:179; Bonneuil and Fressoz, 2016). In this paper I have sought to highlight how the innovations of the 1952 Paley report were central to this abolition and helped usher in the American anthropocene age. By reconstructing the role and importance of the Paley report through the synthesis of postwar histories of the economy, growth and natural resource use, I have shown how the Paley Commission was key to the postwar development of the economy as an object conceptually de-linked from specific natural materials and characterised by the potential for continuous, illimitable and self-sustaining growth through the paradoxical exploitation of an ever increasing volume of material resources.

The Paley report enabled this growth (at an average rate of 7.19 per cent from 1950 to 1973 in the US[6]) to be fueled through the expansion of cheap and abundant oil and other resource extraction following the least cost principle (Altvater, 2006; Pfister, 2010). The report both explicitly proposed government price supports and production props, and was subsequently used in a variety of ways by the oil and gas industry to argue in favour of the continuation of these. The innovative replacement of geological, volumetric measurements of mineral reserves prefaced upon an assumption of absolute scarcity, with price-based measurements utilising the economic concept of relative scarcity enabled the Paley approach to institutionalise the high price of cheap oil. By the mid-1980s, estimates on the preferential tax treatment given to the oil and gas industry ranged from 400 million to 2.5 billion dollars annually over the fifty years they had been in effect (Vietor, 1984:20). More recent figures for fossil fuels generally, range from USD 544 billion globally in 2012, to USD 2 trillion, including post-tax subsides (UNEP, 2015). Subsidies in OECD countries alone amounted to USD 55 to 90 billion every year between 2005 and 2011 (OECD, 2008).

This helped usher in the 'golden age' of the contemporary, global, growth paradigm (Dale, 2011; see also Borowy and Schmelzer, 2017; Schmelzer, 2015, 2016). But as the multiple, intersecting ecological catastrophes of the great acceleration of the American anthropocene have made abundantly clear: from the sixth great extinction; soil erosion; freshwater eutrophication; oil and chemical spills; ozone depletion; deforestation; coral bleaching; the plastics teeming in our oceans, in our drinking water, in our bodies; the sheer bloody, bellowing horror of industrial animal farming to the leering nightmare of climate change; its that this was an age of fool's gold all along.

And yet, the recognition of and response to the impacts of the great acceleration are ones still fundamentally founded upon the conceptual coordinates mapped out as a core part of the American anthropocene – namely, national economies that both can and must grow without limit. These economies are understood as - in principle - capable of being decoupled from both their natural resource requirements and environmental effects. Nearly half a century after he first wrote it, Robert Solow's 1974 proclamation (quoted above) that 'the world can, in effect, get along without natural resources' (Solow, 1974:11) still stands as the ur-statement of contemporary green growth and green economy policies and their presumption of limitless growth founded upon material decoupling (e.g. Grubb, 2014; UNEP, 2011; World Bank, 2012). This approach is also central to both the UN's 2020 Sustainable Development Goals initiative, the 10- year framework of programmes on sustainable consumption and production patterns adopted by countries at the Rio + 20 Conference (UNCSD, 2012), The EUs circular economy plan (2015) and is widely considered a prerequisite for tackling climate change (OECD, 2011).

The possibility of absolute decoupling has by now been widely critiqued, not least through the work of the entire discipline of ecological economics and the development of materials flow accounting (e.g. Mir and Storms, 2016, Ward et al., 2016; Schandl et al., 2018). What has not been so rigorously investigated is the history of the concepts, narratives and institutional developments that informed the construction of the mainstream of both economic thought and practice that subsequently enabled the hegemony of green growth (Coffey, 2016; Dale et al., 2016). And it is here that I have focused in this paper.

Ten years after Solow's claim, the influential cornucopian economist Julian Simon predicted a future 7 billion years of economic growth, interrupted only in the instance of the extinction of the sun (McNeill, 2001:336). Not content with a mere 7 billion years growth however, Simon later went on to claim the potential resurrection of a phoenix-like earth:

> [t]here is no physical or economic reason why human resourcefulness and enterprise cannot forever continue to respond to impending shortages… and leave us with the bonus of lower costs and less scarcity in the long run. The bonus applies to such desirable resources as better health, more wilderness, cheaper energy, and a cleaner environment (Simon, 1996:588)

In this paper I have sought to uncover the specifically American history of this understanding. Through the economic theories, growth policies and fossil fuel expansion that followed in its wake, I have argued that the Paley Commission is an important, but overlooked initiating element of the great acceleration of a distinctly American anthropocene. Of course, if the actual, observable and continual ecological impacts of the relentless search for growth have anything to teach the governance of the economy in the anthropocene, even in its supposedly green contemporary incarnations, it's that in order to rise like a phoenix from the ashes, the earth will first be burned.

Acknowledgement

This research was funded by the Economic and Social Sciences Research Council as part of a PhD Undertaken within the Dept. of International Relations, University of Sussex.

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