## 1NC – Theory

#### New, un-disclosed affs are a voting issue –

#### Testing – they make it impossible to adequately test the aff without adequate pre-round prep – favors newness over engagement – disclosure solves their offense – you can break new affs, you just have to disclose the plan text personally or disclose it on the wiki before round

#### Negative ground – they make negative ground concessionary to the goodwill of the aff and results in extremist generics that heavily skew ground in favor of the aff

## T\_A

#### Interpretation—the aff may not specify a just government

#### That outweighs—only our evidence speaks to how indefinite singulars are interpreted in the context of normative statements like the resolution. This means throw out aff counter-interpretations that are purely descriptive

#### Violation—they specified Brazil

#### Vote neg:

#### 1] Precision –any deviation justifies the aff arbitrarily jettisoning words in the resolution at their whim which decks negative ground and preparation because the aff is no longer bounded by the resolution.

#### 2] Limits—specifying a just government offers huge explosion in the topic since they get permutations of hundreds of governments in the world depending on their definition of “just government”.

#### Topicality is a voting issue that should be evaluated through competing interpretations – it tells the negative what they do and do not have to prepare for

#### No RVIs—it’s your burden to be topical.

### 1NC -- Econ

**Growth makes war inevitable**

Manuchehr **Irandoust 17**, Department of Economics and Finance, School of Business Studies, Kristianstad University, “Militarism and globalization: Is there an empirical link?” *Quality and quantity*, June 16, 2017, Springer Open Access

[GLOB = globalization index, MIS = militarized spending]

The results of the bootstrap panel Granger causality test are shown in Table 2. The findings show that **GLOB and MIS are causally related** in most of the countries under review. There is a bi-directional causality in UK, US, Saudi Arabia, and Russia. The causality is unidirectional running from GLOB to MIS in Australia, Brazil, India, and China, and running from MIS to GLOB in Turkey. The degree of significance level varies from country to country. There is no any causal relationship between military spending and globalization in France, Italy, South Korea, Germany, and Japan. Overall, this evidence shows a **relatively robust association** between changes in globalization and changes in military expenditure. In other words, countries experiencing greater globalization have relatively **large increases in militarization** over the past 20 years.

However, it has been shown that globalization may not lead to more peaceful relations or demilitarization. As we discussed in Sect. 2, bilateral trade increases the opportunity cost of bilateral war and may hinder bilateral war. Globalization (equivalent to multilateral economic openness) **reduces this opportunity cost with any given country** and devitalize the incentive to make concessions during negotiations, and, therefore, **increases the probability of war** between any given pair of country. Thus, an increase in trade or openness between two countries may restore peace between those but may increase the probability of conflict with third countries.

6 Conclusion

While previous studies mostly focused on the causal nexus between military expenditure and economic growth, those studies have not considered the role of globalization. This study uses data from the top 15 military expenditure spenders over the period 1990–2012 to examine the relationship between militarism and globalization. The bootstrap panel Granger causality that accounts for both cross-sectional dependence and heterogeneity across countries is utilized to detect the direction of causality. The results show that military expenditures and globalization are causally related in most of the countries under review. Despite the increasing role of globalization, the results show that **military expenditures are growing** and pointing to a strengthening in nationalist sentiments and militarism. This paper suggests that changes in domestic political and economic conditions might hinder the process of globalization. The results are consistent with those of Acemoglu and Yared (2010) who conclude that high military spending endangers globalization. This study also supports the results of Martin et al. (2008) who find that an increase in multilateral trade raises the chance of conflict between states. The policy implication of the findings is that greater military spending by a country increases the likelihood of military conflict in the future, the anticipation of which discourages globalization.

**Collapse is inevitable**

Kallis '18 [Giorgos; 5/31/18; ICREA Research Professor at Universitat Autònoma de Barcelona, environmental scientist working on ecological economics and political ecology, formerly Marie Curie International Fellow at the Energy and Resources Group of the University of California at Berkeley, PhD in Environmental Policy and Planning from the University of the Aegean in Greece, et al.; "Annual Review of Environment and Resources: Research On Degrowth," Annual Review of Environment and Resources, Vol. 43, p. 296-29]//GJ

3. ECOLOGICAL ECONOMICS: THE LIMITS OF GREEN GROWTH

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

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

Historical data corroborate ecological economic theory (40). Ayres & Warr (38) find that the use of net energy after conversion losses explains a big portion of the **U**nited **S**tates’ total factor productivity and economic growth. At the global level, GDP and material use have increased approximately 1:1. Carbon emissions have increased somewhat slower than GDP, but still have **increased** (34). **This is unlikely to be a coincidence**. Exceptions may exist, but cross-panel data analysis shows that overall, 1% growth of a national economy is associated with 0.6% to 0.8% increase in its carbon emissions (41) and 0.8% growth in its resource use (42).

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

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

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

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

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

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

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

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

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

**Growth ensures extinction:**

**Insect loss**

Robert **Hunziker 18**, MA in Economic History from DePaul University, environmental journalist for over fifty publications, 3/27/18, “Insect Decimation Upstages Global Warming,” https://www.transcend.org/tms/2018/04/insect-decimation-upstages-global-warming/

Everybody’s heard about global warming. It is one of the most advertised **existential** events of all time. Who isn’t aware? However, there’s a new kid on the block. An alarming **loss of insects** will likely **take down humanity** before global warming hits maximum velocity.

For the immediate future, the Paris Accord is riding the wrong horse, as global warming is a long-term project compared to the insect catastrophe happening right now! Where else is found 40% to 90% species devastation?

The worldwide loss of insects is simply staggering with some reports of 75% up to 90%, happening much faster than the paleoclimate record rate of the past five major extinction events. It is possible that some insect species may **already be close to total extinction!**

It’s established that species evolve and then go extinct over thousands and millions of years as part of nature’s course, but the current rate of devastation is simply “off the charts, and downright scary.”

Without any doubt, it is difficult to imagine how humanity survives without insects, which are dropping dead in bunches right before our eyes. For proof, how many insect splats do people clean off windshields nowadays? Not many…. How many fireflies do children chase at night? Not many….

Several naturalists and environmental writers believe the massive loss of insects has everything to do with three generations of **industrialized farming** and the vast tide of **poisons** pouring over the landscape year-after-year, especially since the end of WWII. Ours is the first-ever pesticide-based agricultural society. Dreadfully, it’s an experiment that is going dead wrong… all of a sudden!

Insects are basic to thousands of food chains; for example, the disappearance of Britain’s farmland birds by over 50% in 40 years. Additionally, North America and Europe species of birds like larks, swallows, and swifts that feast on flying insects have plummeted.

But, these are only a few of many, many recorded examples of massive numbers of wildlife dropping dead right before our eyes.

Significantly, insects are the **primary source for ecosystem creation and support**. The world literally crumbles apart without mischievous burrowing, forming new soil, aerating soil, pollinating food crops, etc. **Nutrition for humans happens because insects pollinate**.

**Chemical emissions**

Julian **Cribb 17**, Fellow of the Australian Academy of Technological Sciences and Engineering, 2017, “The Poisoner,” in Surviving the 21st Century, p. 113-117

There are two essential points about the Earthwide **chemical flood**. First it is quite **new**. It began with the industrial revolution of the late nineteenth century, but expanded dramatically in the wake of the two world wars—where chemicals were extensively used in munitions—and has exploded in deadly earnest in the past 50 years, attaining a new crescendo in the early twenty-first century. It is something our ancestors never faced—and to which we, in consequence, lack any protective adaptations which might otherwise have evolved due to constant exposure to poisons.

Second, the toxic flood is, for the most part, preventable. It is not compulsory—but **is an unwanted by-product of economic growth**. Though driven by powerful industries and interests, it still lies within the powers and rights of citizens, consumers and their governments to demand it be curtailed or ended and to encourage industry to safer, healthier products and production systems.

The issue is whether, or not, a wise humanity would choose to continue poisoning our children, ourselves and our world.

Regulatory Failure

Despite the fact that around 2000 new chemicals are released onto world markets annually, most have not received proper health, safety or environmental screening—especially in terms of their impact on babies and small children. Regulation has so far failed to make any serious curtailment of this flood: only 21 out of 144,000 known chemicals have been banned internationally, and this has not eliminated their use. At such a rate of progress it will take us more than 50,000 years to identify and prohibit or restrict all the chemicals which do us harm. Even then, bans will only apply in a handful of well-regulated countries, and will not protect the Earth system nor humanity at large. Clearly, national regulation holds few answers to what is now an out-of-control global problem.

Furthermore, the chemical industry is relocating from the developed world (where it is quite well regulated and observes its own ethical standards) and into developing countries, mainly in Asia, where it is largely beyond the reach of either ethics or the law. However, its toxic emissions return to citizens in well-regulated countries via wind, water, food, wildlife, consumer goods, industrial products and people. The bottom line is that it doesn’t matter how good your country’s regulations are: you and your family are still exposed to a growing global flood of toxins from which even a careful diet and sensible consumer choices cannot fully protect you.

The wake-up call to the world about the risks of chemical contamination was issued by American biologist Rachel Carson when she published Silent Spring in 1962, in which she warned specifically about the impact of certain persistent pesticides used in agriculture. Since her book came out, the volume of pesticide use worldwide has increased 30-fold, to around four million tonnes a year in the mid-2010s. Since the modern chemical age began there has been a string of high-profile chemical disasters: Minamata, the Love Canal, Seveso, Bhopal, Flixborough, Oppau, Toulouse, Hinkley, Texas City, Jilin, Tianjin. Most of these display a familiar pattern of unproductive confrontation between angry citizens, industry and regulators, involving drawn-out legal battles that deliver justice to nobody. By their spectacular and local nature, such events serve to distract from the far larger, more insidious and ubiquitous, universal toxic flood.

Chemists and chemical makers often claim that their products are ‘safe’ because individual exposure (e.g. in a given product, like a serve of food) is too low to result in a toxic dose, a theory first put forward by the mediaeval scholar Paracelsus in the sixteenth century. This ‘dose related’ argument is disingenuous, if not dishonest—as modern chemists well know—for the following reasons: Most chemicals target a receptor or receptors on certain of your body cells, to cause harm. There may be not one, but hundreds or even thousands of different chemicals all targeting the same receptor, so a particular substance may contribute an unknowable fraction to an overall toxic dose. That does not make it ‘safe’. Chemicals not known to be poisonous in small doses on their own can combine with other substances in water, air, food or your body to create a toxin. No manufacturer can truthfully assert this will not happen to their products. Chemical toxicity is a function of both dose and the length of time you are exposed to it. In the case of persistent chemicals and heavy metals, this exposure may occur over days, months, years, even a lifetime in some cases. Tiny doses may thus accumulate into toxic ones. Most chemical toxicity is still measured on the basis of an exposed adult male. Babies and children being smaller and using much more water, food and air for their bodyweight, are therefore more at risk of receiving a poisonous dose than are adults.

Chemicals and minerals are valuable and extremely useful. They do great good, save many lives and much money. No-one is suggesting they should all be banned. But their value may be for nothing if the current uncontrolled, unmonitored, unregulated and unconscionable mass release and planetary saturation continues.

Chemical Extinction

Two billion years ago, excessive production of one particular poisonous chemical by the inhabitants of Earth caused a colossal die-off and threatened the **extermination of all life**. That chemical was oxygen and it was excreted by the blue-green algae which then dominated the planet, as part of their photosynthetic processes. After several hundred million of years, the planet’s physical ability to soak up the surplus O2 in iron formations, oceans and sediments had reached saturation and the gas began to poison the existing life. This event was known as the ‘oxygen holocaust’, and is probably the nearest life on Earth has ever come to complete disaster before the present (Margulis and Sagan 1986). Since it developed slowly, over tens of millions of years, the poisonous atmosphere permitted some of these primitive organisms to evolve a tolerance to O2—and this in time led to the rise of oxygen-dependent species such as fish, mammals and eventually, us. The takehome learning from this brush with total annihilation is that it is possible for living creatures to **pollute themselves into oblivion**, if they don’t take care to avoid it or rapidly adapt to the new, toxic environment. It’s a message that humans, with our colossal planetary chemical impact, would do well to ponder.

While it is unlikely that human chemical emissions alone could reach such a volume and toxic state as to directly threaten our entire species with extinction (other than through carbon emissions in a runaway global warming event) or even the collapse of civilization, it is likely they will emerge as a serious contributing factor during the twenty-first century in combination with other factors such as war, climate change, pandemic disease and ecosystem breakdown. Credible ways in which man-made chemicals might imperil the human future include: **Undermining the immune systems**, physical and mental health of the population through growing exposure to toxins Reducing the intelligence of current and future generations through the action of nerve poisons on the developing brains and central nervous systems of children, rendering humanity less able to solve its problems and adapt to major changes; and by increasing the level of violent crime and conflict in society, which is closely linked to lower IQ. Bringing down the economy through the massive healthcare costs of having to nurse, treat and maintain a growing proportion of the population disabled by lifelong chronic chemical exposure. By poisoning the ecosystem services—clean air, water, soil, plants, insects and wildlife—on which **humanity depends for its own survival** and thereby contributing to potential global ecosystem breakdown By augmenting the global arsenal of weapons of mass destruction and hence the risk of their use by nations or uncontrollable fanatics.

#### Economy causes WMD build up—results in the spread of dual-use technology

Kassenova 1/25/12 (Togzhan Kassenove- associate in the Nuclear Policy Program at the Carnegie Endowment and a Stanton Nuclear Security Fellow. She specializes in weapons of mass destruction nonproliferation issues, with a regional focus on Central Asia and Southeast Asia; nuclear security; strategic trade management; and civilian nuclear energy programs, January 25, “Preventing WMD Proliferation Myths and Realities of Strategic Trade Controls”, <http://carnegieendowment.org/files/wmd_proliferation_Togzhan_Jan_25_2012.pdf>)

WMD-relevant technology and materials are all around us. Semiconductors, for instance, are indispensable in the advanced electronics we use every day (including computers), but they can also be utilized in a variety of military equipment, such as satellites, infrared imaging products, and transistors. Freezedrying technology used to make instant coffee or instant noodles can also be used in biological-warfare research. Encryption technology has many civilian applications—for instance, in train-signaling systems—but malicious actors can also use it to communicate without being detected by law enforcement agencies. Similarly, satellite technology may have civilian applications, weather monitoring for example, or military ones, such as missile guidance. The broad applications for dual-use goods and technology in everyday life result in constant flows of proliferation-sensitive items across borders. And this poses a real danger. Gradual acquisition of components and technology from various sources that can enable a nonstate or state actor to build a WMD program is a more likely proliferation threat than an actor acquiring an already-built weapon from an external source. The best illustration of how real this threat is in the nuclear realm is the story of the A. Q. Khan network. Pakistani scientist A. Q. Khan and his associates successfully exploited gaps in controls of nuclear exports in Pakistan and beyond during the 1980s and 1990s. The network assisted Iran, North Korea, and Libya in acquiring a whole range of nuclear weapons–relevant items. 1 According to a recent report by nonproliferation expert Joshua Pollack, India, surprisingly, was the fourth customer of the Khan network, procuring uraniumenrichment technology. 2 Unfortunately for the proliferation outlook, progress in high-tech industries, especially in the fields of electronics and biotechnology, as well as the expansion of nuclear power and the globalization of trade, further exacerbate the challenge of firewalling international trade from WMD proliferation.

#### Free trade results in deregulation which makes nuclear materials easier to access

Jackson 11/10/11 (Beckett Jackson, Master’s Candidate at Georgetown University’s Security Studies Program and works as a Security and Military Intelligence Analyst within IHS Jane’s A&D Consulting Practice, “Proliferation Networks Capitalize on Limited Oversight of Service-Based Economies”, <http://journal.georgetown.edu/2011/11/10/proliferation-networks-capitalize-on-limited-oversight-of-service-based-economies/>)

Despite all of the benefits of an increasingly globalized economy, certain authoritarian governments have shunned the system. While these states attempt to limit their societies’ exposure to an increasingly interconnected world, they still use the global economic system for their own benefits. Increasingly, globalization and technological advancement have created a security risk for the United States. High-strength aluminum alloys used in aerospace components also have applications in the production of uranium enrichment equipment. Non-destructive testing machines designed to identify anomalies in automobile parts can be used in the production of solid rocket motors for ballistic missiles. Despite the enactment of sanctions against regimes involved in the proliferation of weapons of mass destruction (WMD), states have exploited a fundamental characteristic of the global trade system to access dual-use equipment and materials used in the fabrication of WMD. In a global economy where the customers, manufacturers and suppliers of a product span multiple continents, delivery times and shipping costs are a priority for commercial enterprises. As a result, financial and transit hubs, such as Hong Kong, Dubai and Singapore, rely on the speed of customs clearance, minimal financial regulations and favorable business policies for consistent GDP growth. However, these services also create a proliferation security challenge. For instance, in Hong Kong, the ease and minimal oversight involved in establishing a business provides a favorable environment for proliferation networks. In 2011, the South China Morning Post reported, “the sheer volume of goods passing through Hong Kong…attracts businesses looking to slip through the cracks.” The U.S.-China Economic Security Review Commission, which provides annual congressional reports on security issues related to trade with China, has identified a single address in Hong Kong out of which 30 Chinese front companies operate. This example illustrates the lack of oversight in Hong Kong and is a symptom of the imbalance between trade facilitation and security in service-based economies.

#### Nuclear war

**Kroenig 15** (Matthew, Associate Professor and International Relations Field Chair in the Department of Government and School of Foreign Service at Georgetown University, 2015. “The History of Proliferation Optimism: Does It Have a Future?” *Journal of Strategic Studies*, Volume 38, Issue 1-2, 2015)

The spread of nuclear weapons poses at least six severe threats to international peace and security including: nuclear war, nuclear terrorism, global and regional instability, constrained US freedom of action, weakened alliances, and further nuclear proliferation. Each of these threats has received extensive treatment elsewhere and this review is not intended to replicate or even necessarily to improve upon these previous efforts. Rather the goals of this section are more modest: to usefully bring together and recap the many reasons why we should be pessimistic about the likely consequences of nuclear proliferation. Many of these threats will be illuminated with a discussion of a case of much contemporary concern: Iran’s advanced nuclear program. Nuclear War The greatest threat posed by the spread of nuclear weapons is nuclear war. The more states in possession of nuclear weapons, the greater the probability that somewhere, someday, there will be a catastrophic nuclear war. To date, nuclear weapons have only been used in warfare once. In 1945, the United States used nuclear weapons on Hiroshima and Nagasaki, bringing World War II to a close. Many analysts point to the 65-plus-year tradition of nuclear non-use as evidence that nuclear weapons are unusable, but it would be naïve to think that nuclear weapons will never be used again simply because they have not been used for some time. After all, analysts in the 1990s argued that worldwide economic downturns like the Great Depression were a thing of the past, only to be surprised by the dot-com bubble bursting later in the decade and the Great Recession of the late 2000s.48 This author, for one, would be surprised if nuclear weapons are not used again sometime in his lifetime. Before reaching a state of MAD, new nuclear states go through a transition period in which they lack a secure-second strike capability. In this context, one or both states might believe that it has an incentive to use nuclear weapons first. For example, if Iran acquires nuclear weapons, neither Iran, nor its nuclear-armed rival, Israel, will have a secure, second-strike capability. Even though it is believed to have a large arsenal, given its small size and lack of strategic depth, Israel might not be confident that it could absorb a nuclear strike and respond with a devastating counterstrike. Similarly, Iran might eventually be able to build a large and survivable nuclear arsenal, but, when it first crosses the nuclear threshold, Tehran will have a small and vulnerable nuclear force. In these pre-MAD situations, there are at least three ways that nuclear war could occur. First, the state with the nuclear advantage might believe it has a splendid first strike capability. In a crisis, Israel might, therefore, decide to launch a preventive nuclear strike to disarm Iran’s nuclear capabilities. Indeed, this incentive might be further increased by Israel’s aggressive strategic culture that emphasizes preemptive action. Second, the state with a small and vulnerable nuclear arsenal, in this case Iran, might feel use them or lose them pressures. That is, in a crisis, Iran might decide to strike first rather than risk having its entire nuclear arsenal destroyed. Third, as Thomas Schelling has argued, nuclear war could result due to the reciprocal fear of surprise attack.49 If there are advantages to striking first, one state might start a nuclear war in the belief that war is inevitable and that it would be better to go first than to go second. Fortunately, there is no historic evidence of this dynamic occurring in a nuclear context, but it is still possible. In an Israeli–Iranian crisis, for example, Israel and Iran might both prefer to avoid a nuclear war, but decide to strike first rather than suffer a devastating first attack from an opponent. Even in a world of MAD, however, when both sides have secure, second-strike capabilities, there is still a risk of nuclear war. Rational deterrence theory assumes nuclear-armed states are governed by rational leaders who would not intentionally launch a suicidal nuclear war. This assumption appears to have applied to past and current nuclear powers, but there is no guarantee that it will continue to hold in the future. Iran’s theocratic government, despite its inflammatory rhetoric, has followed a fairly pragmatic foreign policy since 1979, but it contains leaders who hold millenarian religious worldviews and could one day ascend to power. We cannot rule out the possibility that, as nuclear weapons continue to spread, some leader somewhere will choose to launch a nuclear war, knowing full well that it could result in self-destruction. One does not need to resort to irrationality, however, to imagine nuclear war under MAD. Nuclear weapons may deter leaders from intentionally launching full-scale wars, but they do not mean the end of international politics. As was discussed above, nuclear-armed states still have conflicts of interest and leaders still seek to coerce nuclear-armed adversaries. Leaders might, therefore, choose to launch a limited nuclear war.50 This strategy might be especially attractive to states in a position of conventional inferiority that might have an incentive to escalate a crisis quickly to the nuclear level. During the Cold War, the United States planned to use nuclear weapons first to stop a Soviet invasion of Western Europe given NATO’s conventional inferiority.51 As Russia’s conventional power has deteriorated since the end of the Cold War, Moscow has come to rely more heavily on nuclear weapons in its military doctrine. Indeed, Russian strategy calls for the use of nuclear weapons early in a conflict (something that most Western strategists would consider to be escalatory) as a way to de-escalate a crisis. Similarly, Pakistan’s military plans for nuclear use in the event of an invasion from conventionally stronger India. And finally, Chinese generals openly talk about the possibility of nuclear use against a US superpower in a possible East Asia contingency. Second, as was also discussed above, leaders can make a ‘threat that leaves something to chance’.52 They can initiate a nuclear crisis. By playing these risky games of nuclear brinkmanship, states can increase the risk of nuclear war in an attempt to force a less resolved adversary to back down. Historical crises have not resulted in nuclear war, but many of them, including the 1962 Cuban Missile Crisis, have come close. And scholars have documented historical incidents when accidents nearly led to war.53 When we think about future nuclear crisis dyads, such as Iran and Israel, with fewer sources of stability than existed during the Cold War, we can see that there is a real risk that a future crisis could result in a devastating nuclear exchange. Nuclear Terrorism The spread of nuclear weapons also increases the risk of nuclear terrorism.54 While September 11th was one of the greatest tragedies in American history, it would have been much worse had Osama Bin Laden possessed nuclear weapons. Bin Laden declared it a ‘religious duty’ for Al- Qa’eda to acquire nuclear weapons and radical clerics have issued fatwas declaring it permissible to use nuclear weapons in Jihad against the West.55 Unlike states, which can be more easily deterred, there is little doubt that if terrorists acquired nuclear weapons, they would use them.56 Indeed, in recent years, many US politicians and security analysts have argued that nuclear terrorism poses the greatest threat to US national security.57 Analysts have pointed out the tremendous hurdles that terrorists would have to overcome in order to acquire nuclear weapons.58 Nevertheless, as nuclear weapons spread, the possibility that they will eventually fall into terrorist hands increases. States could intentionally transfer nuclear weapons, or the fissile material required to build them, to terrorist groups. There are good reasons why a state might be reluctant to transfer nuclear weapons to terrorists, but, as nuclear weapons spread, the probability that a leader might someday purposely arm a terrorist group increases. Some fear, for example, that Iran, with its close ties to Hamas and Hizballah, might be at a heightened risk of transferring nuclear weapons to terrorists. Moreover, even if no state would ever intentionally transfer nuclear capabilities to terrorists, a new nuclear state, with underdeveloped security procedures, might be vulnerable to theft, allowing terrorist groups or corrupt or ideologically-motivated insiders to transfer dangerous material to terrorists. There is evidence, for example, that representatives from Pakistan’s atomic energy establishment met with Al-Qa’eda members to discuss a possible nuclear deal.59 Finally, a nuclear-armed state could collapse, resulting in a breakdown of law and order and a loose nukes problem. US officials are currently very concerned about what would happen to Pakistan’s nuclear weapons if the government were to fall. As nuclear weapons spread, this problem is only further amplified. Iran is a country with a history of revolutions and a government with a tenuous hold on power. The regime change that Washington has long dreamed about in Tehran could actually become a nightmare if a nuclear-armed Iran suffered a breakdown in authority, forcing us to worry about the fate of Iran’s nuclear arsenal. Regional Instability The spread of nuclear weapons also emboldens nuclear powers, contributing to regional instability. States that lack nuclear weapons need to fear direct military attack from other states, but states with nuclear weapons can be confident that they can deter an intentional military attack, giving them an incentive to be more aggressive in the conduct of their foreign policy. In this way, nuclear weapons provide a shield under which states can feel free to engage in lower-level aggression. Indeed, international relations theories about the ‘stability-instability paradox’ maintain that stability at the nuclear level contributes to conventional instability.60 Historically, we have seen that the spread of nuclear weapons has emboldened their possessors and contributed to regional instability. Recent scholarly analyses have demonstrated that, after controlling for other relevant factors, nuclear-weapon states are more likely to engage in conflict than nonnuclear-weapon states and that this aggressiveness is more pronounced in new nuclear states that have less experience with nuclear diplomacy.61 Similarly, research on internal decision-making in Pakistan reveals that Pakistani foreign policymakers may have been emboldened by the acquisition of nuclear weapons, which encouraged them to initiate militarized disputes against India.62 Currently, Iran restrains its foreign policy because it fears major military retaliation from the United States or Israel, but with nuclear weapons it could feel free to push harder. A nuclear-armed Iran would likely step up support to terrorist and proxy groups and engage in more aggressive coercive diplomacy. With a nuclear-armed Iran increasingly throwing its weight around in the region, we could witness an even more crisis prone Middle East. And in a poly-nuclear Middle East with Israel, Iran, and, in the future, possibly other states, armed with nuclear weapons, any one of those crises could result in a catastrophic nuclear exchange.

**Degrowth is the only way to avoid invisible thresholds that cause extinction**

Ghebremichael '16 [Asghedom; 2016; Research Economist, The Environment and Natural Resources, Department of Natural Resources, Government of Canada; "Frontiers of the Biosphere Inhibit Perpetual Economic Growth: Exploring Pathways to Genuine Sustainable Development," http://www.opensciencepublications.com/wp-content/uploads/ESS-2454-5953-3-125.pdf]//GJ

Nature has its own set of rules, solidly grounded in laws of physics and chemistry, and emergent principles of geology and biology, which are not artificial constructs. The natural rules are real, and they govern human well-being. Earthquakes, tsunamis, volcanic eruptions, hurricanes, tornadoes, floods, droughts, famines, civil conflicts, wildfires, poverty, and disease epidemics demonstrate dramatically that our planet Earth is at risk. Moreover, the outbreak of novel diseases, such as Ebola and AIDS, in socially, economically, and ecologically impoverished regions is a clear signal of the global predicaments of inequality and poverty. These natural and anthropogenic disasters are clear indicators of **ecological overshoot**, meaning anthropogenic disturbances beyond the **carrying capacity of ecosystems** that lead to **ecological crash**, causing an eventual die-off, hence environmental disasters [3]. The frequency, scale, and adverse effects of these challenges must be of great concern to humanity.

“Human alteration of the Earth was substantial and growing, transforming between one-third and **one-half of the global land surface**; CO2 concentration in the atmosphere increased by nearly 30% since the beginning of the Industrial Revolution; more atmospheric nitrogen was fixed by humanity than by all natural terrestrial sources combined; humanity consumed more than half of all accessible surface-**freshwater**; and about one-quarter of the **bird species on Earth** were driven to extinction” [4]. The UN’s Millennium Ecosystem Assessment [5], a global landmark study, which involved more than 1,360 scientists, technical experts, and policy makers from around the globe, summarized its findings as follows (paraphrased): (i) although living standards of “the few” have improved over the past two centuries, human activity is putting such strain on nature, undermining the Earth’s capacity to support current and future generations; (ii) we are living beyond our means: the current gains in enhanced quality of life have come at a considerable cost to health and integrity of ecosystems on which human well-being depends; (iii) **if we act now**, we can avoid **irreversible damage** to ecosystems and to our well-being; and (iv) we can no longer treat Nature’s bounty as free and limitless.

The information summarized in Table 1(Ecological Foundations section below) makes it all clear that human well-being depends on the life sustaining multiple services of ecosystems. Furthermore, a team of renowned scientists from N. America, Europe, Australia and the Scandinavian countries identified the following nine ecological thresholds, which define “the safe operating space for humanity”: (i) climate change, (ii) rate of terrestrial and marine biodiversity loss, (iii) human interference with the natural cycles of nitrogen and phosphorus, (iv) stratospheric ozone depletion, (v) ocean acidification, (vi) global freshwater consumption rate, (vii) land-use-change, (viii) chemical pollution, and (ix) atmospheric aerosol loading. The team concluded that humanity was approaching to the boundaries for freshwater consumption, land-use-change, ocean acidification, and interference with the global phosphorus cycle, while the boundaries for **climate change**, **biodiversity loss**, and interference with the **nitrogen cycle** **have already been transgressed** [6]. An urgent call for an anthropogenic balancing act not to transgress ecological thresholds is in order. Halting short-sighted excessive anthropocentric activities that lead to overexploitation of natural resources is imperative. The naturally imposed limiting frontiers, the ecological thresholds, must be respected and protected.

Rooted in the doctrine of laissez-faire, neoliberalism promotes perpetual economic growth (PEG), which means unfettered expansion of an economy’s productive capacity realized through enabling institutional arrangements. But, PEG is inherently **not compatible with ecological integrity**, environmental quality, and genuine sustainable development (GSD). Drawing on the findings , conclusions, and recommendations of Rockström’s team [6], I define GSD as a dynamic process by which human well-being is improved in an inclusive, a just, and an environmentally safe operating space, achieved through inventions, innovations, diffusion, and adoption of appropriate technologies as well as learning-by-doing.

GSD is in a stark contrast with the highly publicized and politicized concept of sustainable development (SD) of the UN’s Brundtland Commission, which is also known as World Commission on Environment and Development (WCED) (1987) [7]. The highly generalized and vague definition of SD is: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: (1) the concept of “needs”, in particular the essential needs of the world’s poor, to which overwhelming priority should be given; and (2) the idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs”. Our Common Future, p.143.

Given all its good intentions, the WECD failed to explain the consequences of PEG strongly. Unfortunately, SD’s exact definition continues to be globally politicized and linked always to strategic policy goals and objectives one would like to talk about. SD does not give any specific guidelines pertinent to alleviation of the human predicaments associated with inequality, poverty, perversely globalized markets, destruction of the health and integrity of ecosystems, and climate change.

Research questions, goal, and organization of the paper

What are the theoretical and practical foundations of the PEG doctrine? Are PEG and GSD compatible? Addressing these questions has become a persistent challenge to both social and natural scientists. The overarching goal of this article is to demonstrate the incompatibility of PEG with GSD.

Rooted in neoclassical microeconomic theory, neoliberalism advocates for PEG, which is unfettered expansion of an economy’s productive capacity in the finite, materially closed (except the constant inflow of solar energy), and non-growing biosphere [8]. For this doctrine to be realized, neoliberal economists prescribe globalized perfectly competitive markets, where multinational corporations play the dominant economic games against all policies and strategic practices of GSD.

Let me be clear at the outset. As a trained economist, who went through the grueling processes of acquiring a PhD, I understand the importance of all the fundamentals of microeconomic and macroeconomic theories. My argument is against the misuse and, in some case, abuse of these scientific theories to promote personal ideological perceptions. I am motivated to add my “voice” to those voices of many preeminent scholars, whose extensively published works inspired me to learn more on the adverse effects of neoliberalism on ecological integrity and human well-being [6, 8-12].

The paper is organized into six sections: this introduction, ecological foundations for GSD, the fallacies of the PEG doctrine, anthropogenic effects on ecological integrity, selected pathways to GSD, and concluding remarks and policy recommendations, in that order.

Ecological Foundations of Genuine Sustainable Development

In this section, I summarize the ecological foundations of GSD, using taxonomy of the following key scientific terms: ecological principles of holism, biodiversity loss, sustainability, resilience, ecological integrity, biogeochemical processes, carrying capacity, and overshoot.

Principles of holism

Ecological principles of holism mean that everything is interconnected with everything. This can be summarized by the dictum: “A whole is more than the sum of its parts or members”. The totality of the whole of any living system-biological, social, or economic-is not fully embodied in its individual parts or members. Wholes have properties that are not present in any of their separate parts; they emerge only when the parts are combined together, forming mutually reinforcing synergistic nexus, in a coherent whole; and the specific properties of individual parts disappear when they are part of the whole.

Thus, relationships among the parts of wholes matter; when relationships change, the whole is changed. For example, water, air, and soil are polluted with chemical and biological waste, because we humans fail to appreciate the importance of their holistic relationship with Nature and thereby with our well-being. Respiratory problems, cancer, food poisoning, and general poor health as well as the cost of healthcare are some of the consequences of ignoring the imperatives of holism.

Government policies that influence agriculture, forestry, mining, manufacturing, labor relations, capital investments, employment, economic growth, all have direct and indirect impacts on the natural environment-locally, nationally, and globally. We have **no way of knowing** how large or small our individual or collective adverse effects may be, but understanding the ecological principles of holism is necessary condition to preserve ecological integrity and foster human well-being.

Consequences of biodiversity loss

Biodiversity (i.e., biological diversity) is the number, variety and variability of genes, populations, species, communities, ecosystems, and ecological processes. Biodiversity underpins the multiple services of ecosystems that sustain human well-being; is the foundation of resilience of life on Earth; and an integral part of the fabric of all the world‘s cultures. It is a common knowledge of the science of ecology that no feature of Earth is more complex, dynamic, and varied than the layer of organisms that occupy its surfaces and its seas; and no feature is experiencing more dramatic changes at the hands of humans than this extraordinary, singularly unique and beautiful feature of the Earth, biodiversity. **Critical ecological processes** (i.e., ecosystem functions) that depend on prevailing scale of biodiversity at the ecosystem level influence plant productivity, soil fertility, water quality, atmospheric chemistry, and many other local and global environmental conditions that ultimately affect human welfare.

Substantial changes have already occurred, especially local and global losses of biodiversity. The primary cause has been widespread human transformation of once highly diverse natural ecosystems into relatively species-poor managed ecosystems. Recent studies suggest that such reductions in biodiversity can alter both the magnitude and the stability of ecosystem processes, especially when biodiversity is reduced to the low levels typical of many managed natural systems. We humans ought to remind ourselves that barren deserts are capable of supporting very little life (if any), because they lack biological diversity. Ecosystems that completely lack diversity have **no high quality, low entropy, energy left to support life**.

Diversity enables living systems to adapt and evolve to accommodate their ever-changing natural environment. Even if we do not understand fully the specific nature of a threat, it should be clear that loss of biodiversity represents a growing threat to the future of human life on Earth. There is **no way of knowing** how many more species can be lost before the **ecological balance is tipped toward extinction of all species**.

#### Economic crisis transitions to degrowth society – pessimism about conflict is wrong – only transition can avoid climate catastrophe

Read and Alexander '19 [Rupert and Samuel; June 2019; Associate Professor of Philosophy at the University of East Anglia; lecturer at the University of Melbourne, co-director of the Simplicity Institute, research fellow with the Melbourne Sustainable Society Institute, This Civilization is Finished: Conversations on the end of Empire—and what lies beyond, Chapter 13, p. 52-60]//GJ

SA: You alluded earlier to the saying that every crisis is an opportunity—from which the optimist infers that the more crises there are, the more opportunities there are! Of course, this statement must not be seen to be romanticising or desiring crisis like some dreamy-eyed fool. In fact, our entire dialogue seems to have been based on a deep pessimism about the prospects of smoother and less disruptive modes of societal transformation. So perhaps crisis might be our best hope for disrupting the status quo and initiating the transition to something else.

When the crises of capitalism deepen, as they seem destined to do in coming years and decades, the task will be to ensure that such destabilised conditions are used to advance progressive humanitarian and ecological ends rather than exploited to further entrench the austerity politics of neoliberalism. I recognise, of course, that the latter remains a real possibility, as did the arch-capitalist Milton Friedman, who expressed the point in these terms:

Only a crisis—actual or perceived—produces real change. When that crisis occurs, the actions that are taken depend on the ideas that are lying around. That, I believe, is our basic function: to develop alternatives to existing policies, to keep them alive and available until the politically impossible becomes the politically inevitable.

It is not often that I am in agreement with Friedman. With reluctance I have come to the conclusion that it is probably only through deepening crisis that the comfortable global consumer class will become sufficiently perturbed that the sedative and depoliticising effects of affluence might be overcome. In fact, I feel it is better that citizens are not in fact protected from every crisis situation, given that the encounter with crisis can play an essential consciousness raising role, if it triggers a desire for and motivation toward learning about the structural underpinnings of the crisis situation itself.

RR: Yes, the danger, if we are protected from crisis for too long, is that we wait even longer than we would have done otherwise before addressing it. This is why Jared Diamond and others have emphasised the grave danger of highly unequal societies (such as, disastrously, the one we now inhabit): for the elite in such societies can fool themselves into thinking that things are basically OK way past the point of no return, while the masses suffer and start to experience collapse; and then it is surer that the society as a whole will collapse.

SA: And yet, as I have noted, crisis can go in many directions—it might be the wake-up call we need… or it might simply hasten the civilisational degeneration into barbarism. What role does crisis play in your views on transition? Is the world ready for the profound challenges that, in one form or another, lie ahead?

RR: We are now committed to climate disasters, and they will worsen, for a long time to come. But we do not yet know whether we are committed to climate catastrophe. It is just possible that the former may help enable us to avoid the latter. Consider the literature on ‘Disaster Studies’, in particular Rebecca Solnit’s amazing book A Paradise Built in Hell: The Extraordinary Communities that Arise in Disaster. Solnit observes that disasters are often recalled by their survivors as periods of great joy and profoundly meaningful experience.

She argues that this is because, at these moments, the social order is revealed to be ‘something akin to… artificial light: another kind of power that fails in disaster’. Its failure reveals a truer light, that comes from within us, that we can share and grow with one another. It unshackles moral resources which we had available to us all along—within ourselves, and in community waiting to spring into being—allowing ‘a reversion to improvised, collaborative, cooperative and local society’. Moments of crisis allow us to see and to start to make, for the first time, a vision of a world we always sensed was possible, but had been unable to articulate, let alone to instantiate.

This is one vitally important way in which the long crisis we are enter-ing into is without doubt an opportunity. The widespread assumption that disasters always unleash a cruelty or indifference endemic to human nature is false. This is the meaning of the title of Solnit’s book: disasters often spontaneously produce not barbarity but generosity, community, something like a spontaneous non-dogmatic ‘communism’.

The coming ecological and climate disasters could yet yield an improvement in human goodness. And even a consciousness—a determination—that we have to stop such disasters from multiply-ing into catastrophe. It is perhaps unlikely that this will come into being (enough); it is probably likelier that, instead, people’s focus will too often stay narrowly present and local,48 and that the bigger picture will be ignored or even denied. But the possibility of a new consciousness and conscientiousness is one of the few great hopes we have at present of civilisational transformation.

In any case, even if it turns out that the best that we can hope for is the second of the three ‘options’ with which I greeted your opening question to me—the option of seeding a successor-civilisation from the very-likely wreckage of this one—then it’s still imperative to seek out the silver linings of disaster (and even of catastrophe). Learnings that will help us deeply adapt. Such as the way that the survivors of previous ecological collapses seem to have learnt humility with regard to nature. Our indigenous ancestors who decimated the world’s megafauna in Europe, Asia, and Australasia, and who in many cases suffered dire con-sequences from doing so, learned better how to live in harmony with and in natural systems.49 We will learn this lesson. The question is only whether we learn it as we die (1), or as we (or rather, probably, a few of us) survive collapse and start to construct a new way of living (2), or in order to transform ourselves and prevent collapse (3).

Similarly, we will go back to the land in pretty large numbers. The only live issue is whether we will do so in a part-planned and part-voluntary way sooner,50 or in a catastrophically desperate, forced way later.

The crisis we face is above all an opportunity to learn, and to imagine and hope and do better. But some of that learning has to be pre-emptive. By the time collapse occurs, it may/would be too late.

SA: The prospect of societal collapse is gradually getting discussed more regularly these days, even in some mainstream forums, like prominent newspapers and ‘serious’ magazines. If it was once a fringe territory of ‘doomsayers’, today one might even say that col-lapse is the expected course of action. Slavoj Zizek would say this is functioning to ‘normalise the apocalypse’. But for all the attention this notion of collapse is given, it is not always discussed with much rigour or definition. What do you mean when you use the term collapse? Is there any prospect of a ‘prosperous descent’? Or will any collapse scenario necessarily be full of pain and suffering?

RR: This is a crucial question. The way I have been talking about ‘this civilisation’ (as finished) has been shorthand. What for? Basically, for what Joanna Macy calls ‘industrial growth society’. That is what is finished. The fantasy of endless ‘progress’ (aka endless economic growth) is dead. Every further bit of material ‘progress’ now takes us further over the cliff-edge, reduces even further our slim chances of clawing our way to some safety. We are eating into our life-support systems.

Growthism, a central part of the ideology that rules this civilisation globally, is deadly because it always makes our task harder. You and I, Sam, are among those who have shown that net green economic growth while remaining within planetary boundaries is deeply implausible.51 But even if we were somehow wrong about this, it would still be true that growthism tends toward deadliness; for, by making our collective aim into GDP growth, and thus by endlessly increasing pressure upon those boundaries, we provide a rod for our own backs.

Even if net (i.e., economy-wide, not sector-specific) green growth were possible, it’s a rod for our collective backs. The intelligent thing to do, obviously, is to remove the rod!

As for industrialism, nearly everyone assumes that the industrial revolution was an inevitability and obviously a good thing. But this evinces a lack of imagination. As the consequences of industrial-growthism lead us steadily toward the white swan of climate catastrophe and ecological breakdown, with the sixth mass extinction well underway at our hands, surely we have to re-assess this assumption. Surely we have to take up a more critical and thoughtful stance toward it, as the Dark Mountain Project has helpfully done. Surely we have to ask: couldn’t the whole thing have been done with more precaution, more slowly? And couldn’t—mustn’t—we be more selective about which industries we choose to permit and to develop now?

We need to rein in the reckless growth of industry, and to radically roll back the many industries that are killing us and our other-than-human kin, and steadily eliminating our kids’ future. We need to choose which products and processes of industrial society we want to seek to preserve. For example, I hope that, in our radically relocalised future, we may be able to preserve some of the internet as a mode of communication, to help us share knowledge and wisdom, to continue to tackle global issues (such as climate), and to help prevent a growth in xenophobia. But we’ll have to see. Without doubt, much of what we are accustomed to will have to go.

The sheer enormity and audacity of this task, and the way that it contradicts our ruling ideas of the allegedly endless technical ingenuity of humanity, the allegedly beneficent nature of technology, the ideology of ‘progress’ and ‘development’, etc., mean that it is hard to see how we could possibly do this. So what I am saying is: such a transformation, resulting in a society on a radically different footing, is not something that any wise person would bet on us succeeding in. A prosperous descent—which is path (3) of the possible paths that I laid out earlier—would be wonderful, and remains possible, and so it is painful (not to mention unbearably frustrating) to admit the fact that humanity appears very unlikely to be capable of it.

This is why, as I argued earlier, we need the insurance policy not only of transformative adaptation but also of deep adaptation; to help prevent path (2)—that of a successor-civilisation after a collapse-event—itself collapsing into being path 1 (total collapse; the default outcome, the white swan that probably awaits us, on even a reformed business-as-usual path). Some kind of collapse, quite likely driven by the interaction of water shortage and consequent food shortage, but quite possibly driven by other things instead or as well (e.g., by pollinator failure due to the insect-apocalypse, or possibly by plague among a climatically-weakened population), has to be considered our likely fate. Not just in Africa, Asia, and the Middle East, but in Australia, Europe, and North America.

Industrial-growth society is finished. We will rapidly transform it into something better, or it will collapse, either to seed something differ-ent or to simply end us. And any collapse event will be chock full of pain. It will be challenging to prevent it from becoming a more or less total collapse; for instance, as we have already discussed, stopping nuclear waste—spent fuel rods, not to mention live reactors—from becoming virtually endless drivers of death and suffering will require concerted effort at a time when we will be ill-placed to make that effort. (In countries like England or the USA, do we even have the collective will to make the sacrifices that may well be required under such circumstances? Is the combination of voluntary and forced heroism that prevented the disaster of Chernobyl from becoming a catastrophe replicable in countries like ours that pride themselves on an ideology of atomised individualism, countries which toy with the idea that there is no such thing as society?)

And yet, where the greatest danger lies, there too can be found the saving power. As we dare at last to gaze into the abyss, as we find the courage to contemplate these matters that you and I are discussing here, as we take the measure of the beauty of what we have and the folly of our squandering it, as we feel the heart-pain of what we are committing our children to, so we can rise to the challenge. Rise up to meet it. The greatest challenge of the entire history of our species is upon us. What an awesome and even thrilling responsibility—and, of course, terrifying.

As I set out in answer to your previous question, one thing that in this great and terrible moment gives me very real hope is that, when human beings are subject to the gravest of threats and the most unexpected of utter challenges, we really do tend spontaneously to become our best selves, selfless and creative of real community.

So it is possible that the disasters which are definitely coming and the collapse which they are likely to lead up to may yet be the making of us.

SA: You are suggesting then that even in a collapse scenario, we might be surprised to discover that some tragic events have a silver lining of sorts. Perhaps you could unpack that counter-intuitive idea a little further.

RR: Yes. We are living, nowadays, in ways that involve us in a virtually permanent absence of community. Disasters enable this to be overcome. They enable us in our small selves, our limited and limiting egos, to be overcome. For such overcomings to be possible and to take place, there must be a full-scale disaster, not merely an accident or something bad. Charles Fritz, who is a key influence on Rebecca Solnit’s work in this area, emphasises this point.52 He writes that disasters need to be big enough to not leave behind ‘an undisturbed, intact social system’. Only if that system is disrupted sufficiently can new and realer forms of community emerge. ‘Disaster provides an unstructured social situation that enables persons and groups to perceive the possibility of introducing desired innovations into the social system,’ according to Fritz.

When we picture collapse, we tend to imagine human beings at their worst. But what is sometimes revealed in disaster is real community identity, which fulfils our modern lack; and this is the very opposite of what the Hobbesian ‘script’ would have us imagine.

The etymology of the word ‘apocalypse’ is uncover/reveal. I am suggesting that, while any collapse will necessarily involve much pain and indeed death, as we will no longer be able to support our artificially bloated population53 and our decadent standard of living, it doesn’t have to reveal a human nature that is red in tooth and fist. If we proceed from a place of love and fellowship rather than from a place of distrust, the human nature that gets revealed even in collapse could be one of unexpected solidarity and care and sacrifice.

Writers such as Margarete Buber-Neumann, Victor Frankl, and Primo Levi have made clear how, even in environments designed to break the human spirit, unexpected possibilities of loving-kindness often flowered. So it won’t be beyond our wit (or our hearts), when under stress, to foster such flowerings in the years of living dangerously to come.

In collapse, our social system would of course get thoroughly—utterly—perturbed. What I am saying is that, in the less structured situation that emerges, there is a very real chance that we can find each other and find some deeper togetherness. So yes, this is a potential silver lining even of collapse, especially if we can turn a partial-col-lapse scenario into a breakthrough of the human spirit. A blitz spirit for our times. An arising of consciousness that could seed a successor-civilisation, a civilisation which someone like Gandhi would think a good idea.

#### No econ impact

Walt 20 — (Stephen M. Walt, Robert and Renée Belfer professor of international relations at Harvard University., “Will a Global Depression Trigger Another World War?“, Foreign Policy, 5-13-20, Available Online at https://foreignpolicy.com/2020/05/13/coronavirus-pandemic-depression-economy-world-war/, accessed 11-5-2020, HKR-AR)

One familiar argument is the so-called diversionary (or “scapegoat”) theory of war. It suggests that leaders who are worried about their popularity at home will try to divert attention from their failures by provoking a crisis with a foreign power and maybe even using force against it. Drawing on this logic, some Americans now worry that President Donald Trump will decide to attack a country like Iran or Venezuela in the run-up to the presidential election and especially if he thinks he’s likely to lose.

This outcome strikes me as unlikely, even if one ignores the logical and empirical flaws in the theory itself. War is always a gamble, and should things go badly—even a little bit—it would hammer the last nail in the coffin of Trump’s declining fortunes. Moreover, none of the countries Trump might consider going after pose an imminent threat to U.S. security, and even his staunchest supporters may wonder why he is wasting time and money going after Iran or Venezuela at a moment when thousands of Americans are dying preventable deaths at home. Even a successful military action won’t put Americans back to work, create the sort of testing-and-tracing regime that competent governments around the world have been able to implement already, or hasten the development of a vaccine. The same logic is likely to guide the decisions of other world leaders too.

Another familiar folk theory is “military Keynesianism.” War generates a lot of economic demand, and it can sometimes lift depressed economies out of the doldrums and back toward prosperity and full employment. The obvious case in point here is World War II, which did help the U.S economy finally escape the quicksand of the Great Depression. Those who are convinced that great powers go to war primarily to keep Big Business (or the arms industry) happy are naturally drawn to this sort of argument, and they might worry that governments looking at bleak economic forecasts will try to restart their economies through some sort of military adventure.

I doubt it. It takes a really big war to generate a significant stimulus, and it is hard to imagine any country launching a large-scale war—with all its attendant risks—at a moment when debt levels are already soaring. More importantly, there are lots of easier and more direct ways to stimulate the economy—infrastructure spending, unemployment insurance, even “helicopter payments”—and launching a war has to be one of the least efficient methods available. The threat of war usually spooks investors too, which any politician with their eye on the stock market would be loath to do.

Economic downturns can encourage war in some special circumstances, especially when a war would enable a country facing severe hardships to capture something of immediate and significant value. Saddam Hussein’s decision to seize Kuwait in 1990 fits this model perfectly: The Iraqi economy was in terrible shape after its long war with Iran; unemployment was threatening Saddam’s domestic position; Kuwait’s vast oil riches were a considerable prize; and seizing the lightly armed emirate was exceedingly easy to do. Iraq also owed Kuwait a lot of money, and a hostile takeover by Baghdad would wipe those debts off the books overnight. In this case, Iraq’s parlous economic condition clearly made war more likely.

Yet I cannot think of any country in similar circumstances today. Now is hardly the time for Russia to try to grab more of Ukraine—if it even wanted to—or for China to make a play for Taiwan, because the costs of doing so would clearly outweigh the economic benefits. Even conquering an oil-rich country—the sort of greedy acquisitiveness that Trump occasionally hints at—doesn’t look attractive when there’s a vast glut on the market. I might be worried if some weak and defenseless country somehow came to possess the entire global stock of a successful coronavirus vaccine, but that scenario is not even remotely possible.

If one takes a longer-term perspective, however, a sustained economic depression could make war more likely by strengthening fascist or xenophobic political movements, fueling protectionism and hypernationalism, and making it more difficult for countries to reach mutually acceptable bargains with each other. The history of the 1930s shows where such trends can lead, although the economic effects of the Depression are hardly the only reason world politics took such a deadly turn in the 1930s. Nationalism, xenophobia, and authoritarian rule were making a comeback well before COVID-19 struck, but the economic misery now occurring in every corner of the world could intensify these trends and leave us in a more war-prone condition when fear of the virus has diminished.

On balance, however, I do not think that even the extraordinary economic conditions we are witnessing today are going to have much impact on the likelihood of war. Why? First of all, if depressions were a powerful cause of war, there would be a lot more of the latter. To take one example, the United States has suffered 40 or more recessions since the country was founded, yet it has fought perhaps 20 interstate wars, most of them unrelated to the state of the economy. To paraphrase the economist Paul Samuelson’s famous quip about the stock market, if recessions were a powerful cause of war, they would have predicted “nine out of the last five (or fewer).”

Second, states do not start wars unless they believe they will win a quick and relatively cheap victory. As John Mearsheimer showed in his classic book Conventional Deterrence, national leaders avoid war when they are convinced it will be long, bloody, costly, and uncertain. To choose war, political leaders have to convince themselves they can either win a quick, cheap, and decisive victory or achieve some limited objective at low cost. Europe went to war in 1914 with each side believing it would win a rapid and easy victory, and Nazi Germany developed the strategy of blitzkrieg in order to subdue its foes as quickly and cheaply as possible. Iraq attacked Iran in 1980 because Saddam believed the Islamic Republic was in disarray and would be easy to defeat, and George W. Bush invaded Iraq in 2003 convinced the war would be short, successful, and pay for itself.

**planetary boundaries are *already* being crossed and decoupling is impossible – decline solves warming**

Mastini '18 [Riccardo; 6/1/18; PhD student in ecological economics and political ecology in the Institute of Environmental Science and Technology at the Autonomous University of Barcelona; "Work in a World Without Growth," https://www.greeneuropeanjournal.eu/work-in-a-world-without-growth/]//GJ

A fixation with growth in economics has seen GDP increase in proportion to **environmental damage**. As planetary limits draw ever closer and are even being surpassed, such a model **cannot be sustained**. Riccardo Mastini explains how a job guarantee could open up the way to a sustainable economic model.

Since the dawn of capitalism, market economies have placed a high emphasis on labour productivity. Continuous improvements in technology geared towards productivity increases lead to more output being produced for a given amount of labour. But crucially these advances also mean that fewer people are needed to produce the same amount of goods and services each year. As long as the economy expands fast enough to offset increases in labour productivity there is no problem. But if the economy does not grow, people lose their jobs.

Economic growth has been necessary within this system just to prevent mass unemployment. Communities and the politicians that represent them celebrate the construction of a new factory not so much for the increase in supply of some needed product, but because of the jobs it creates. In advanced economies, the shortage of employment has become more pressing than the shortage of products. Basically, we produce goods and services mostly to keep people employed rather than to cater for their needs.

But what if economic growth were to slow down and, eventually, come to a halt in the near future? More than half a century of ‘growth propaganda’ supporting the dogma that pursuing never-ending growth is plausible and desirable may make this new prospect shocking for some. However, there is now overwhelming evidence that **decoupling GDP growth from increases in natural resource and energy use is impossible**. And our plundering of Earth’s bounty has **already reached unsustainable levels** with the overshot of several planetary boundaries.

It is, therefore, time for a bold public debate about whether it is desirable to continue our relentless pursuit of economic growth, with the associated dire consequences for the health of the planet, simply to keep people employed. Adopting an economic policy proposal known as the job guarantee could ensure full employment while our society transitions towards an economy that no longer grows. All this, without sacrificing the goods and services needed for just and sustainable prosperity.

The need for planned economic degrowth

The idea of ‘degrowth’ takes aim at the **irreconcilable contradiction** between the growth imperative of capitalism and sustainability on a finite planet. Degrowth is defined as an equitable downscaling of production and consumption that will reduce society’s extraction of energy and raw materials and generation of waste. More broadly, **degrowth means the abolition of economic growth as a social objective**. Instead, degrowth implies a new direction for society, one in which we live and work differently from today by giving priority to a sustainable level of wellbeing for all citizens rather than to maximising wealth.

**Aggregate data from the recession refutes all of their warrants**

Daniel **Drezner 14**, professor of international politics at the Fletcher School of Law and Diplomacy at Tufts University, “The System Worked: Global Economic Governance during the Great Recession,” World Politics 66, No 1 (January 2014), 123-64

The final significant outcome addresses a dog that hasn’t barked: the effect of the Great Recession on cross-border conflict and violence. During the initial stages of the crisis, multiple analysts asserted that the financial crisis would lead states to increase their **use of force as a tool for staying in power**.42 They voiced genuine concern that the global economic downturn would lead to an increase in conflict—whether through greater **internal repression, diversionary wars, arms races, or a ratcheting up of great power conflict.** Violence in the Middle East, border disputes in the South China Sea, and even the disruptions of the Occupy movement fueled impressions of a surge in global public disorder.

The **aggregate data suggest otherwise**, however. The Institute for Economics and Peace has concluded that “the average level of peacefulness in 2012 is **approximately the same as** it was in 20**07**.”43 **Interstate violence** in particular **has declined** since the start of the financial crisis, as have military expenditures in most sampled countries. Other studies confirm that the Great Recession has not triggered **any increase in violent conflict,** as Lotta Themnér and Peter Wallensteen conclude: “[T]he pattern is one of relative stability when we consider the trend for the past five years.”44 The secular decline in violence that started with the end of the Cold War has not been reversed. Rogers Brubaker observes that “the crisis has not to date generated the surge in protectionist nationalism or ethnic exclusion that might have been expected.”45

**Instability from economic decline doesn’t translate into conflict**

Robert **Jervis 11**, Professor in the Department of Political Science and School of International and Public Affairs at Columbia University, December 2011, “Force in Our Times,” Survival, Vol. 25, No. 4, p. 403-425

Even if war is still seen as evil, the security community could be dissolved if severe conflicts of interest were to arise. Could the more peaceful world generate new interests that would bring the members of the community into sharp disputes? 45 A zero-sum sense of status would be one example, perhaps linked to a steep rise in nationalism. More likely would be a worsening of the current economic difficulties, which could itself produce greater nationalism, undermine democracy and bring back old-fashioned beggar-my-neighbor economic policies. While these dangers are real, **it is hard to believe that the conflicts could be great enough** to lead the members of the community to contemplate fighting each other. It is not so much that economic interdependence has proceeded to the point where it could not be reversed – states that were more internally interdependent than anything seen internationally have fought bloody civil wars. Rather it is that **even if the more extreme versions of free trade and economic liberalism become discredited**, it is hard to see how without building on a preexisting high level of political conflict leaders and mass opinion would come to believe that their countries could prosper by impoverishing or even attacking others. Is it possible that problems will not only become severe, but that people will entertain the thought that they have to be solved by war? While a pessimist could note that this argument does not appear as outlandish as it did before the financial crisis, an optimist could reply (correctly, in my view) that the very fact that we have seen **such a sharp economic down-turn** without **anyone** suggesting that force of arms is the solution shows that **even if bad times bring about greater economic conflict**, **it will not make war thinkable**.

**No trade conflict – longer downturns make lobbying for protectionism too costly and spark counter-lobbies**

Cameron **Ballard-Rosa 18**, Ph.D. in Political Science from Yale University, Assistant Professor of Political Science at the University of North Carolina, et al., July 2018, “Economic Crisis and Trade Policy Competition,” British Journal of Political Science, Vol. 48, Issue 3, p. 736-738

CONCLUSION

Existing research on the effects of crises on trade policy offers conflicting accounts, arguing at the same time that shocks make autarky more likely, that economic distress leads to less protectionism and that there is no systematic relationship linking crises to policy reform. Our novel theoretical account reconciles these diverging perspectives by distinguishing between the intensity and duration of economic shocks, and by explicating the differential effects of crises on industries’ lobbying resources and strategies. We demonstrate that as crises increase in severity, industries clamor for more protection, but when crises become dire, industries can no longer afford to secure protection because they must compete in the policy domain with other players seeking **lower tariffs**. Similarly, following the onset of a crisis, affected industries demand protection, but as the crisis persists over time, **lobbying resources run dry** and counter lobbies mobilize to **demand greater liberalization**. We investigate our theory’s claims using formal modeling, illustrative examples, and both sub-national and cross-national empirical evidence, finding **strong support** for our argument.

Our results have several policy implications. For example, we find that when the cost of organizing a counter-lobby – a key parameter in our model – is lower, it is easier for firms to engage in counter-lobbying activities. These expenditures have a significant **offsetting effect** on the demand for trade protection, lowering tariff levels as shocks increase in size. To the extent that lower tariffs are desirable, then, reducing the organizational costs of counter-lobbying can result in more socially beneficial policy outcomes. More broadly, institutional designs that promote the broader representation of interest groups can achieve greater policy-making stability during crisis periods, as lobbying for policy adjustments can spark counter-lobbying that drives policy back toward the status quo. While our article does not speak directly to these implications, it raises a constructive set of research questions about the role of policy competition, institutional design and representation in shaping distributional politics.

Future work should examine how our theory pertains to other policy-making domains. While we focus on trade policy reactions to crises, our theory and research design could be used productively to investigate a variety of policy responses. For instance, previous work has explored the impact of lobbying expenditures on immigration, climate change, mortgage lending, tourism and university earmarks, to name just a few policy-making domains – yet these studies tend to focus only on lobbying activities that either promote or protect particular policies. Our study suggests, by contrast, that incorporating the role of offsetting special interests can result in very different theoretical predictions about how policies with distributional dimensions are contested in the political arena.

Furthermore, future research should also explore the heterogeneous treatment effects suggested by our theory. The strength of the U-shaped curve that we uncover may vary by institutional structures, for instance. Previous work has shown that countries with more veto points have a diminished ability to change pre-existing policies. Therefore, we might expect that these countries typically alter tariffs more slowly in response to crises. Conversely, countries with more access points might change policy more quickly, yet might also react more abruptly to countervailing pressures. By exploring these empirical implications systematically, scholars can shed new light on the dynamics of policy competition in diverse institutional domains.

We conclude by noting that our article suggests important extensions for the large body of work investigating crisis politics more generally. Understanding the conditions under which governments impose protection can shed light on the distributional consequences of a given crisis for different firms and industries in the economy, on shifts in public opinion over policy instruments and political representation, and on the strategies employed by industries in the midst of dynamic international and domestic economic changes. Our study implies that each of these processes is likely influenced by the **duration** and **intensity** of crises. By specifying the conditions under which crises spark lobbying and **counter-lobbying**, we offer a simple and parsimonious account that explains when and why industries lobby the government and attain their desired policy goals. In an era of repeated economic crises, our investigation of the political dynamics surrounding protection and reform is of particular importance, and is likely to remain of interest for the foreseeable future.

**Economic interdependence as a theory oversimplifies why states go to war and ignores counter-examples**

Joel **Einstein 17**, Masters of Strategic Studies at the Strategic & Defence Studies Centre (SDSC) at Australian National University, reviewed by Charles Miller, Ph.D. in Political Science from Duke University, Professor at Australian National University, 1/17/17, “Economic Interdependence and Conflict – The Case of the US and China,” https://www.e-ir.info/2017/01/17/economic-interdependence-and-conflict-the-case-of-the-us-and-china/

Economic Interdependence and Conflict

The theory that increased economic interdependence reduces conflict rests on three observations: trade benefits states in a manner that **decision-makers value**; conflict will reduce or **completely cut-off trade**; and that decision-makers will take the previous two observations into account before choosing to go to war. Based on these observations, one should expect that the higher the benefit of trade, the higher the cost of a potential conflict. After a certain point, the value of trade may become so high that the state in question has become economically dependent on another. Proponents of this theory argue that if two states have reached this point of mutual dependence (interdependence), their decision-makers will value the continuation of trade relations higher than any potential gains to be made through war.[3] It is on this argument that Pinker rests his statement that the economic relationship between the US and China precludes war. One can see evidence of this when analysing US views on China as trade rises. A 2014 Chicago Council on Global Affairs survey indicates that only a minority of Americans see China as a critical threat, compared to a majority in the mid-1990s. This number is even higher when analysing Americans who directly benefit from trade with China.[4]

As compelling as this argument may be, **high levels of economic interdependence have not always resulted in peace**. The decades preceding WW1 saw an unprecedented growth in international trade, communication, and interconnectivity but needless to say, **war broke out**.[5] This instance alone is not enough to disprove Pinker’s logic. War may become very unlikely but began nonetheless.[6] Let us take two hypothetical scenarios, one in which the chances of war is 80% and the other in which trade has reduced the likelihood of war to 10%. Just knowing that war did indeed take place does not tell us which scenario was in play. Similarly, the fact that WW1 took place gives us no information about whether economic interdependence made war unlikely or not. In fact, evidence even exists to suggest that economic linkages prevented a war from breaking out during the sequence of crises that led up to WW1.[7] However, the fact that a war as detrimental as WW1 could break out despite a supposed reduction of the likelihood of conflict gives us an impetus to examine whether this reduction does take place. Additionally, if this is the case, what variables can weaken this pacifying effect?

Does Conflict Cut off Trade?

Economic interdependence theory makes the assumption that conflict will reduce or cut-off trade. This assumption appears to be logical, as one would expect that the moment two states are officially adversaries, fear of relative gains would ensure that policy makers want to completely cut-off trade. However, there are many historical **examples of trade between warring states carrying on during wartime**, including strategic goods that directly affect the ability of the enemy to carry out the war.[8] For example, in the Anglo-Dutch Wars, British insurance companies continued to insure enemy ships and paid to replace ships that were being destroyed by their own army.[9] Even during WW2, there are numerous examples of American firms continuing to trade strategic goods with Nazi Germany.[10] Barbieri and Levy argue that these examples and their own statistical analysis suggest that the outbreak of war does not radically reduce trade between enemies, and when it does, it often **quickly returns to pre-war levels** after the war has concluded.[11]

In response to this result, Anderton and Carter conducted an interrupted time-series study on the effect war has on trade in which they analysed 14 major power wars and 13 non-major power wars. Seven of the non-major power wars negatively impacted trade (although only four of these reductions were significant), but in the major war category, all results bar one showed a reduction of trade during wartime and a quick return to pre-war levels at its conclusion.[12] Accompanying this contradictory finding one must take into account that even if war does not radically reduce trade, if a state believes that it does then potential opportunity cost would still figure in their calculations.

Variables that Impact the Pacifying Effect of Economic Interdependence

The purpose of this section is to demonstrate that the pacifying effect of economic interdependence is **not constant**. It achieves this via a discussion of the effect of changes in a number of variables pertaining to how and what a state trades. Once it is established that changes in such variables may alter the effect of economic interdependence on the likelihood of conflict, Pinker’s statement (that the level of trade between the US and China makes conflict unlikely) can be considered to be an **over-simplification**.

### 1NC – Biod

#### No tipping point and biod impacts

* Permian-Triassic extinction proves resiliency
* No data on tipping points
* Ecosystems never outright collapse
* 600 models prove no ecosystem collapse

Hance 18 [Jeremy Hance, wildlife blogger for the Guardian and a journalist with Mongabay focusing on forests, indigenous people, climate change and more. He is also the author of Life is Good: Conservation in an Age of Mass Extinction. Could biodiversity destruction lead to a global tipping point? Jan 16, 2018. https://www.theguardian.com/environment/radical-conservation/2018/jan/16/biodiversity-extinction-tipping-point-planetary-boundary]

Just over 250 million years ago, the planet suffered what may be described as its greatest holocaust: ninety-six percent of marine genera (plural of genus) and seventy percent of land vertebrate vanished for good. Even insects suffered a mass extinction – the only time before or since. Entire classes of animals – like trilobites – went out like a match in the wind.

But what’s arguably most fascinating about this event – known as the Permian-Triassic extinction or more poetically, the Great Dying – is the fact that anything survived at all. Life, it seems, is so ridiculously adaptable that not only did thousands of species make it through whatever killed off nearly everything (no one knows for certain though theories abound) but, somehow, after millions of years life even recovered and went on to write new tales.

Even as the Permian-Triassic extinction event shows the fragility of life, it also proves its resilience in the long-term. The lessons of such mass extinctions – five to date and arguably a sixth happening as I write – inform science today. Given that extinction levels are currently 1,000 (some even say 10,000) times the background rate, researchers have long worried about our current destruction of biodiversity – and what that may mean for our future Earth and ourselves.

In 2009, a group of researchers identified nine global boundaries for the planet that if passed could theoretically push the Earth into an uninhabitable state for our species. These global boundaries include climate change, freshwater use, ocean acidification and, yes, biodiversity loss (among others). The group has since updated the terminology surrounding biodiversity, now calling it “biosphere integrity,” but that hasn’t spared it from critique.

A paper last year in Trends in Ecology & Evolution scathingly attacked the idea of any global biodiversity boundary.

“It makes no sense that there exists a tipping point of biodiversity loss beyond which the Earth will collapse,” said co-author and ecologist, José Montoya, with Paul Sabatier Univeristy in France. “There is no rationale for this.”

Montoya wrote the paper along with Ian Donohue, an ecologist at Trinity College in Ireland and Stuart Pimm, one of the world’s leading experts on extinctions, with Duke University in the US.

Montoya, Donohue and Pimm argue that there isn’t evidence of a point at which loss of species leads to ecosystem collapse, globally or even locally. If the planet didn’t collapse after the Permian-Triassic extinction event, it won’t collapse now – though our descendants may well curse us for the damage we’ve done.

Instead, according to the researchers, every loss of species counts. But the damage is gradual and incremental, not a sudden plunge. Ecosystems, according to them, slowly degrade but never fail outright.

“Of more than 600 experiments of biodiversity effects on various functions, none showed a collapse,” Montoya said. “In general, the loss of species has a detrimental effect on ecosystem functions...We progressively lose pollination services, water quality, plant biomass, and many other important functions as we lose species. But we never observe a critical level of biodiversity over which functions collapse.”

#### No impact to biod

Hance 13 [Jeremy Hance, senior writer at Mongabay citing Barry Brook, Sir Hubert Wilkins Chair of Climate Change at the School of Earth and Environmental Sciences at the University of Adelaide, and Director of Climate Science at the University of Adelaide’s Environment Institute. Warnings of Global Ecological Tipping Points May Be Overstated. 3-5-2013. http://news.mongabay.com/2013/0305-hance-tipping-points.html#r2IbUBDMyux2eU7i.99]

There's little evidence that the Earth is nearing a global ecological tipping point, according to a new Trends in Ecology and Evolution paper that is bound to be controversial. The authors argue that despite numerous warnings that the Earth is headed toward an ecological tipping point due to environmental stressors, such as habitat loss or climate change, it's unlikely this will occur anytime soon—at least not on land. The paper comes with a number of caveats, including that a global tipping point could occur in marine ecosystems due to ocean acidification from burning fossil fuels. In addition, regional tipping points, such as the Arctic ice melt or the Amazon rainforest drying out, are still of great concern.

"When others have said that a planetary critical transition is possible/likely, they've done so without any underlying model (or past/present examples, apart from catastrophic drivers like asteroid strikes)," lead author Barry Brook and Director of Climate Science at the University of Adelaide told mongabay.com. "It’s just speculation and we’ve argued [...] that this conjecture is not logically grounded. No one has found the opposite of what we suggested—they’ve just proposed it."

According to Brook and his team, a truly global tipping point must include an impact large enough to spread across the entire world, hitting various continents, in addition to causing some uniform response.

"These criteria, however, are very unlikely to be met in the real world," says Brook.

The idea of such a tipping point comes from ecological research, which has shown that some ecosystems will flip to a new state after becoming heavily degraded. But Brook and his team say that tipping points in individual ecosystems should not be conflated with impacts across the Earth as a whole.

Even climate change, which some scientists might consider the ultimate tipping point, does not fit the bill, according to the paper. Impacts from climate change, while global, will not be uniform and hence not a "tipping point" as such.

"Local and regional ecosystems vary considerably in their responses to climate change, and their regime shifts are therefore likely to vary considerably across the terrestrial biosphere," the authors write.

Barry adds that, "from a planetary perspective, this diversity in ecosystem responses creates an essentially gradual pattern of change, without any identifiable tipping points."

The paper further argues that biodiversity loss on land may not have the large-scale impacts that some ecologists argue, since invasive species could potentially take the role of vanishing ones.

"So we can lose the unique evolutionary history (bad, from an intrinsic viewpoint) but not necessarily the role they impart in terms of ecosystem stability or provision of services," explains Brook. The controversial argument goes against many scientists' view that decreased biodiversity will ultimately lessen ecological services, such as pollination, water purification, and carbon sequestration.

#### ecosystems are resilient to everything

Nield 17 [David Nield, freelance journalist who has been writing about technology, science, apps, gadgets and the web since 2002. Extensively citing "Impact of the Late Triassic mass extinction on functional diversity and composition of marine ecosystems," written by Alexander M. Dunhill, William J. Foster, James Sciberras, and Richard J. Twitchett. Marine Ecosystems Can Survive The Worst Mass Extinction Events, Study Shows. October 23, 2017. <https://www.sciencealert.com/marine-ecosystems-cling-on-to-life-through-some-of-the-worst-mass-extinction-events>]

Researchers have studied fossil records from the Late Triassic mass extinction, which happened around 201.3 million years ago, and found that marine life did not fundamentally change, even though the vast proportion of species were killed off.

The international team of researchers says that while marine species were still badly affected by the event, enough life survived underwater to keep the ecosystems functioning. The findings could help us understand more about how the changing climate of today could affect the planet.

"While the Late Triassic mass extinction had a big impact on the overall number of marine species, there was still enough diversity among the remaining species that the marine ecosystem was able to function in the same way it had before," says lead researcher Alex Dunhill from the University of Leeds in the UK.

It's thought that huge volcanic eruptions, and the subsequent warming of the planet caused by the greenhouse gases produced, was behind the Late Triassic extinction event.

At least half the species on Earth at that time were wiped out by the rise in temperatures, and in the event's aftermath, dinosaurs came to dominate life on our planet.

The researchers analysed fossils dated between the Middle Triassic to the Middle Jurassic periods, a time span of around 70 million years, covering life before and after the mass extinction event.

Ocean-dwelling animals were classified by how they moved, where they lived, and how they fed, and the study showed that none of these categories of life completely disappeared after the extinction event.

That said, there were major impacts on different regions and the environment as a whole, and some specific marine ecosystems were badly damaged.

"We're not saying nothing happened," says one of the researchers, palaeontologist William Foster from the University of Texas at Austin. "Rather, global oceans in the extinction's aftermath were a bit like a ship manned by a skeleton crew – all stations were operational, but manned by relatively few species."

The idea of a skeleton crew of lifeforms keeping the lights on in an ecosystem was first raised by Foster and his colleague Richard J. Twitchett in 2014, after another study focussed on the Late Permian mass extinction event about 252 million years ago.

The current study found one of the hardest-hit underwater organisms were corals, and the fossil record shows it took some 20 million years before tropical reef ecosystems recovered from the Late Triassic extinction, even though the ecosystem as a whole carried on functioning.

With corals again under threat from rising temperatures in the modern day, the new research could provide a blueprint for the potential damage we're going to see – and perhaps give us some clues for how to prevent it.

On a more positive note, it shows life underwater is incredibly resilient, and capable of surviving through even the worst times of environmental upheaval on our planet.

### 1NC – Warming

#### Process already started and alt causes they can’t solve -- blue

World Bank 19 [(World Bank, is one of the world’s largest sources of funding and knowledge for developing countries. Its five institutions share a commitment to reducing poverty, increasing shared prosperity, and promoting sustainable development.) “Why the Amazon’s Biodiversity is Critical for the Globe: An Interview with Thomas Lovejoy” The World Bank, 5/22/19. <https://www.worldbank.org/en/news/feature/2019/05/22/why-the-amazons-biodiversity-is-critical-for-the-globe>] RR

Nature is declining at a rate unprecedented in human history, confirmed by the landmark new report from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)—the most comprehensive report of its kind. The massive rate of extinction of plant and animal species will likely have grave impacts on people around the world.

IPBES Chair, Sir Robert Watson, said at the report launch: “It is not too late to make a difference, but only if we start now at every level from local to global.” That is what the World Bank-led, Global Environment Facility-funded Amazon Sustainable Landscapes (ASL) Program is working to do in the Amazon, a region that hosts 40% of the world’s remaining rainforest, 25% of its terrestrial biodiversity, and more fish species than in any other river system. Through its integrated regional approach, the ASL will improve management of 82 million hectares of forest across Brazil, Colombia and Peru.

Often called the ‘Godfather of Biodiversity’, prominent ecologist Thomas Lovejoy has been working in the Amazon for more than 50 years. He shares with us pressures currently facing the Amazon, why we must protect the Amazon, and some solutions —including why it needs to be managed as an integrated system with incremental decisions.

The Amazon is one of the few remaining wilderness areas and is home to possibly one-fourth of the world's terrestrial species. Why is this biodiversity so important?

The Amazon’s forest and rivers host an extraordinary variety of species, some endemic, others endangered, and many of which are still unknown.

This biodiversity is important globally. Every species in this incredibly biodiverse system represents solutions to a set of biological challenges -- any one of which has transformative potential and could generate global human benefits. For example, the discovery of ACE (Angiotensin Converting Enzyme) inhibitors, inspired by studies of Fer de Lance venom (a tropical viper found in the Amazon), help hundreds of millions of people control hypertension around the world. This rich wealth of species brims with promise, awaiting discovery. Leaf cutting ants, are an example. These ants collect leaves as mulch for their fungus farms, deliberately avoiding those with natural fungicides. Studying the species they avoid might be a shortcut to identifying new natural fungicides. Knowledge of indigenous populations have a large role to play in uncovering this potential. Biodiversity is also important locally, constituting a natural capital underpinning many human activities, in particular livelihoods of the world’s poor. For example, the giant catfish is an important local staple.

Amazon biodiversity also plays a critical role as part of global systems, influencing the global carbon cycle and thus climate change, as well as hemispheric hydrological systems, serving as an important anchor for South American climate and rainfall.

While most people are familiar with the fact that the Amazon stores large amounts of carbon and hence its importance for climate change, can you tell us more about hydrological cycles?

Few people are aware that the Amazon makes about half of its own rainfall, as well as delivering rainfall as far south as Argentina, supporting agricultural production. Failing to maintain this hydrological cycle could lead to a tipping point converting parts of the tropical forest to dry savannah and maybe caatinga, a semi-arid scrubland formation, as well as negatively affecting rainfall and agriculture throughout South America. Climate scientist Carlos Nobre and I believe we are actually close to this tipping point, with the 2005, 2010, and 2016 droughts being its first signs. There is good news, however, as recognizing this possibility and engaging in reforestation can build back a margin of safety.

What do you see as the main threats to the Amazon and solutions to address them?

Unfortunately, the Amazon is increasingly under pressure. While the places most at risk are in the south and south-east (parts of Pará, Mato Grosso and Rondonia), pressures are beginning to emerge elsewhere.

One of the biggest problems is deforestation for cattle ranching or other agriculture. Infrastructure development also poses a large threat, especially if some developments proceed as currently conceived. We need to think about alternatives and engage with state governments to create sustainable development models that conserve the forest.

**Renewables cause massive environmental damage from mining and only offshore emissions**

Guillaume **Pitron 18**, M.A. in International Law from the University of Georgetown, French journalist and documentary maker for France's Leading Television Channels, 10/30/18, “The energy transition will be a metallic one,” https://www.linkedin.com/pulse/energy-transition-metallic-one-guillaume-pitron?articleId=6463071096034983936#comments-6463071096034983936&trk=prof-post

From December 3rd to 14th, the world will have its eyes set on Katowice. The 24th United Nations Climate Change Conference (COP 24) will take place in this southern Polish city. Green Climate Fund (GCF) subsidies, carbon trading mechanisms, precise deadlines setting... 196 delegations will work for "the practical fulfillment of the Paris climate agreement," signed in 2015 during the COP 21. As laudable as these goals might be, a significant stake risks to go unreported in Katowice: the vast amounts of **mining resources** necessary for the achievement of the energy transition.

Electric cars, windmills, solar panels, cities and intelligent network... All these "green" and digital technologies share the specificity of being **highly metal-consuming**. Technology minerals include basic metals such as iron, copper or zinc as well as less abundant ones. Cobalt, tungsten, Rare Earth elements, tantalum, vanadium, indium, or gallium are sought after for their great optical, catalytic or magnetic properties. These "small metals" are the lesser known base of digital and green tech, presented as environment-friendly.

We already consume over two billion tons of mineral resources each year, i.e., about **500 Eiffel Towers daily**. Given these new needs, the German agency for mineral resources predicts that the demand for metals such as germanium could double up around 2035, that for dysprosium and tantalum could quadruple and needs for cobalt could be multiplied by 24. In a 2017 report, the World Bank estimated that lithium extraction, could, on the medium term, grow by 1000% because of the demand for batteries.

**The energy transition is a metallic** one. And yet, the 2015 Paris agreement on climate doesn't say a word on environmental, economic and geopolitical challenges surrounding this new dependency. Words such as "metals," "minerals" or "raw materials" aren't even mentioned. Will we avoid this fatal mistake in Katowice?

The question is all the more crucial given that the **environmental impact** of rare metals' extraction and refining contradict the incantatory spells on the coming of a greener world. In Chile, the Democratic Republic of Congo or even Kazakhstan, copper, cobalt and chrome extraction and refining go hand in hand with **ecosystems' pollution** and **massive sanitary consequences**. China has paid a very hefty price. We visited the mining areas of the southern Jiangxi province and the Inner Mongolia Autonomous Region. We can testify about the **paradox** of green energies. So-called clean technologies require **metals** which extraction is **particularly damaging**. Likewise for "renewable" energies: they do not function without non-renewable ones. As for digital technologies meant to dematerialize our lifestyles, they benefit from phenomenal amounts of solid materials.

Which ones among these thirty heads of State expected in Katowice know about this darker side of green energies? In the West, the question was concealed from the beginning of the 1990's. At the time, many States closed their mines and refining factories, deemed as too polluting, while less industrialized countries would take on this burden to catch up with their industrial delay. In other words, the westerners have delocalized green technologies' pollution, and these political choices lead the world to a binarism between the dirty ones and those **pretending to be clean**.

The parenthesis of the "happy globalization," with every resource handy, anywhere and at any cost, shuts down little by little. The "markets' invisible hand" is not sufficient to smooth the new tensions around rare metals' supply. We expect the first mineral resource shortages to happen long before petroleum ones! A question arises, incongruous yet essential. Could we fail in leading the energetic transition achievement, not due to a lack of agreement on either GCF or carbon finance in Katowice, on December 14th, instead because **we will lack minerals and energies to industrialize them**?

The COP24 could be the occasion to shut up the doom-mongers while engaging a courageous and practical dialogue on the necessary rationalization of mineral resources. A robust circular economy of metals implies tackling waste ending up in electric discharges on the African continent. This goal also means that we eco-design technological products, an essential condition for better recycling of rare metals (the recycling rate of some doesn't go beyond 1%). The fight against planned obsolescence should as well be systematized.

A successful, energetic transition implies to **rethink our economic models**, that are too focused on short-term benefit and a religious seeking of the lower cost. The deployment of an economy based on functionality that gets most of its profits not from its products but its related-services is an inspiring track. The question of the frugality of our consumption habits is central because without adequate resource management, as the World Banks reminds, "a future founded on green technologies [...] could ruin [...] sustainable development goals".

**Absolute decoupling is impossible because of efficiency limitations – collapse now is better than waiting for nature to force transition**

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The perpetually growing economy is generally regarded as a viable and desirable societal objective [1–4]. Whilst ‘**infinite growth’** may not be the words used to characterize and exhort a perpetually growing economy, they are nonetheless an accurate characterization of the objective. The words in current fashion for defending the viability of a perpetually growing economy are phrases such as ‘**green growth**’, ‘**dematerialization**’, and ‘**decoupling**’ [5–9]. The decades old question ‘Is economic growth environmentally sustainable?’ remains contested despite its apparent simplicity. The Limits to Growth [10] was a seminal work that warned of the consequences of exponential growth with finite resources. The World3 models underpinning the Limits to Growth analysis were validated using actual data after twenty and thirty years [11,12]. A further independent evaluation of the projections of the World3 models showed that our actual trajectory since 1972 has closely matched the ‘Business as Usual’ scenario [13]. Increasing recognition of the causes and consequences of climate change have generated a great deal of doubt regarding the feasibility of simultaneously pursing economic growth and preventing and/or mitigating climate change [14–18]. Contemporary work in this broad area of assessing **anthropogenic impact** on the planet suggests that several ‘Planetary Boundaries’ have been crossed [19].

The question as to whether human society can decouple economic growth–defined as growth in Gross Domestic Product (GDP)–from environmental impacts has not been settled. The decoupling debate itself is polarized with a preponderance of neo-classical economists on one side (decoupling is viable) and ecological economists on the other (decoupling is not viable) [20]. The divide over the compatibility of economic growth and environms sental limits extends into the general public [2] with substantial polarization in ideas of decoupling, dematerialization, and limits to growth.

Settling the debate has far reaching policy implications. Decoupling is increasingly being described in popular press as a viable policy objective [21,22]. Decoupling has been incorporated into international indicators of sustainable development [23] and policy objectives such as the United Nations’ ‘Sustainable Development Goals’ [24]. If decoupling is possible, then these policies are valid sustainable goals; however, if decoupling is shown to be **nonviable** then society will need to shift away from the current ‘infinite growth’ model.

Decoupling is defined as either ‘relative’ (aka ‘weak’) or ‘absolute’ (aka ‘strong’). Relative decoupling refers to higher rates of economic growth than rates of growth in material and energy consumption and environmental impact. As a result, relative decoupling implies a gain in efficiency rather than removal of the link between impact and GDP. Recent trends (1990 to 2012) for GDP [25], material use [26] and energy use [27] in different countries and regions exhibit different behavior (Fig 1). In China, relative decoupling has occurred as GDP (market prices, in current US$) increased by a factor of more than 20 over the 22-year period, while energy use rose by a factor of slightly more than four and material use by almost five. Germany, meanwhile, exhibited slower GDP growth than China, but at the same time reduced energy use by 10% and total material use by 40%. The OECD follows a similar story to Germany, albeit with flat rather than falling energy and material consumption. Although Germany and the OECD give hope that absolute decoupling may be achievable, at the global level we see only relative decoupling with energy and material use increasing by 54% and 66% over the 22 years, respectively.

Similar evidence to that in Fig 1, showing apparent decoupling of GDP from specific resources, has been shown throughout much of the OECD [28]. However, there are several limitations to the inference of decoupling from national or regional data. There are three distinct mechanisms by which the illusion of decoupling may be presented as a reality when in fact it is not actually taking place at all: 1) **substitution of one resource for another**; 2) the **financialization** of one or more components of GDP that involves increasing monetary flows without a concomitant rise in material and/or energy throughput, and 3) the **exporting of environmental impact** to another nation or region of the world (i.e. the separation of production and consumption). These illusory forms of decoupling are described with respect to energy by our colleague [29].

An additional mechanism of decoupling is associated with growing inequality of income and wealth, which can allow GDP to grow overall while the majority of workers do not see a real gain in income [30]. This growth in inequality can manifest as higher GDP without a proportional increase in material and energy flow (i.e. relative decoupling) when a wealthy minority of the population derives the largest fraction of GDP growth but does not necessarily increase their level of consumption with as much demand for energy and materials [31]. In such cases, at the aggregate level decoupling would be observed, but it is doubtful that such unequal sharing of growth in GDP represents an improvement in wellbeing.

At the World aggregate level, Fig 1 shows relative decoupling with a growing gap between GDP and resource consumption. In the context of reaching **planetary boundaries** and **global environmental limits**, however, relative decoupling will be **insufficient to maintain a GDP growth-oriented human civilization**. The only way to achieve truly sustainable growth would be via permanent absolute decoupling. Absolute decoupling theoretically occurs when environmental impacts are reduced while economic growth continues. While relative decoupling has been observed in multiple countries, **absolute decoupling remains elusive** [32–34]. According to one study [35] no country has achieved absolute decoupling during the past 50 years. Another study [36] reports that population growth and increases in affluence are overwhelming efficiency improvements at the global scale. They find no evidence for absolute reductions in environmental impacts, and little evidence to date even for significant relative decoupling.

It should be noted that technological advances can lead to absolute decoupling for specific types of impact [37]. It is possible, for instance, to substitute a polluting activity with a non-polluting activity, and notable examples have included the removal of tetraethyl lead from automotive fuel and CFCs from refrigerants and propellants. It is also possible to envisage a scenario in which GDP growth is decoupled from the use of fossil fuels and related CO2 emissions by switching to 100% renewable energy, but this is not the same as decoupling GDP growth from energy use. In the context of this study, we are primarily interested in fundamental resources (matter and energy) as the foundations of economic activity.

In the current paper, we show that decoupling scenarios can be interpreted using an easily understood model of economic growth and environmental impact. The simple model was calibrated against published data derived from sophisticated predictive studies of decoupling, and used to develop a long-term prognosis of environmental impact under continued GDP growth. The results are then used to draw conclusions about the long-term viability of GDP growth as a societal goal.

Model Derivation

We use a simple mathematical model to develop insights into decoupling behavior. We start with the IPAT equation [38–40], which is a basic formulation of environmental impact I as a function of economic activity:

(1)

where P is population, A is affluence (GDP per capita in $/person/year) and T, as originally formulated, represents “technology”. More precisely, however, T should be viewed as the economic intensity of a particular resource or pollutant, and therefore both T and I will have different units depending on which resource or pollutant is considered. For energy, appropriate units for T may be joules per $ of GDP; for material use T may be kilograms per $ of GDP. The terms T and I can–and should–thus be evaluated separately, with appropriate units, for individual resources such as farming land, fresh water and energy resources, and/or pollutant emissions such as sulphur dioxide, lead, or carbon dioxide.

To test the hypothesis that continual GDP growth can be sustained, we only require a scenario in which GDP increases exponentially. The economy (as GDP) can thus be simplified to G = PA, leading to Ij = GTj where Ij and Tj are the impact and economic intensity, respectively, of resource or pollutant j. A simple case is one in which both population (P) and affluence (A) are increasing exponentially, but other combinations (e.g. stationary population with rising affluence) could achieve the same result of rising GDP. There are, of course, scenarios that could lead to falling GDP (e.g. declining population with constant affluence, or both falling) but our investigation is directed explicitly at testing the sustainability of continual economic growth as a societal goal. As such, we assume G at time t is given by:

(2)

where G0 is the initial GDP at time t = 0, and k is the growth rate per year. Hence, impact (for resource or pollutant j) over time is given as:

(3)

If there is no technological change to reduce a particular impact (i.e. Tj = constant; no decoupling), the use of resources or pollutant emissions will rise exponentially, in keeping with GDP growth. For absolute decoupling from resource or pollutant j, Tj must decrease exponentially at the same rate as GDP growth such that Ij remains constant in time, i.e.:

(4)

where Tj,0 is the initial level of economic intensity of resource or pollutant j.

Put simply, absolute decoupling from resource or pollutant j requires Tj to decrease by at least the same annual percentage as the economy is growing. For example, if k = 0.03 (steady 3% p.a. economic growth), Tj must reduce 20-fold over 100 years, 100-fold over 150 years, and 500-fold over 200 years, and continue this trend of exponential reduction as long as the economy is growing. If Tj were to decrease at a faster rate than GDP growth, the impact Ij would decline.

For non-substitutable resources such as land, water, raw materials and energy, we argue that whilst efficiency gains may be possible, there are minimum requirements for these resources that are ultimately governed by physical realities: for instance the photosynthetic limit to plant productivity and maximum trophic conversion efficiencies for animal production govern the minimum land required for agricultural output; physiological limits to crop water use efficiency govern minimum agricultural water use, and the upper limits to energy and material efficiencies govern minimum resource throughput required for economic production. Therefore a more appropriate formulation of Eq (4) is to allow Tj to decrease to an ultimate value, Tult ≥ 0, as follows:

(5)

where Tj,ult is the ultimate resource use intensity, and rj is the rate of exponential decline, for resource or pollutant j. In cases where decoupling is occurring, Tj,ult < Tj,0. However, cases where resource use intensity is increasing towards an upper limit can be accommodated with Tj,ult > Tj,0.

The nature of decoupling behavior for different types of resource can be readily predicted from the relationships between rj, k, Tj,ult and Tj,0 as summarized in Table 1. It is only those resources or pollutants for which rj > k and Tj,ult < Tj,0 (i.e. efficiency gains are possible and can be achieved faster than the economy is growing) that a period of decoupling can be expected.

Model Application

A recent predictive study [41] concluded that Australia could–through adoption of specific policies–“achieve strong economic growth to 2050 … in scenarios where environmental pressures fall or are stable” (this study is referred to as “H-D” hereafter). That paper summarized the results of a significant project, the 2015 Australian National Outlook [42] published by the Commonwealth Science and Industrial Research Organisation (CSIRO), and represents a high-profile, contemporary study in decoupling. In all of their modelled scenarios, both population and gross national income per capita increased. In their strong abatement scenario (called “Stretch”), various forms of decoupling behavior were predicted. We will use the Stretch scenario from H-D as a case study in decoupling, and will use Eq (5) to further explore the behavior of energy and material use and implications for longer-term impact. The data used in H-D’s historical and projected scenarios are all available in their Supplementary Information files that accompanied their original publication. Likewise, the data and model results for the following analysis can all be found in the S1 File accompanying this paper.

We begin by calibrating the decline rate rj from Eq (5) against H-D’s historical energy use (j = 1) and material extraction (j = 2). The term Tj for each resource is found by dividing GDP (G) by resource use (Ij) on a yearly timestep. For energy, units are MJ per thousand $AUD (2010). T1,0 = 3.783, equal to the value of T1 in the year 1980. The ultimate resource use intensity T1,ult is unknown, and depends on future technological advances. To account for this uncertainty, three scenarios are adopted: high decoupling (T1,ult = 0.25 T1(2010) = 0.704), medium decoupling (Tult = 0.5T1(2010) = 1.408) and low decoupling (Tult = 0.75 T1(2010) = 2.113). Under each of the three T1,ult scenarios, Eq (5) is used to predict T1, and is calibrated by varying the single unknown parameter (the decline rate, r1) to give the best fit between our T1 (predicted) and T1 (historical) derived from H-D’s data. The calibration was performed using the free statistical package “R” (https://www.r-project.org) with the in-built Non-Linear Least Squares function.

All three scenarios reproduce the observed downward trend in T1. Calibrated declines rates with standard error (in brackets) were 1.24% (± 0.05%), 1.70% (± 0.07%) and 2.66% (± 0.13%) for high, medium and low respectively. The result is a simple calibrated model that can be used to project forward based on recent trends, for the purpose of comparing against the more complex modelling scenarios from H-D. The results are shown in Fig 2(A), with the modelled T1 values projected to 2050. The decoupling predicted by H-D is also shown (taking T1 as their predicted impact divided by their predicted GDP). Clearly H-D predict stronger decoupling than our strongest case. In terms of the simplified IPAT model, even for our most optimistic T1,ult scenario, this implies a change to a greater decline rate than can be obtained merely by calibrating against historical trends.

In the case of material extraction, T2 has been increasing over recent years; in other words, according to H-D’s historical data, material use has not been on a decoupling trajectory in Australia. This is not unexpected, reflecting Australia’s strong dependence on its extractive industries. However, it means that in order to obtain a good fit to historical data, T2,ult must be greater than T2,0. The units of T2 are tonnes of material extracted per thousand $AUD (2010), and T2,0 = 1.091 in the year 1980. Three scenarios are adopted as an upper bound to future material intensity: low (T2,ult = 1.25T2(2010) = 1.513), medium (T2,ult = 1.50T2(2010) = 1.815) and high (T2,ult = 2.00T2(2010) = 2.420). As before, the model is calibrated by finding the decline rate r2 for each T2,ult scenario. The scenarios calibrate well in all three scenarios with r2 = 2.75% (± 0.47%), 1.36% (± 0.22%) and 0.68% (± 0.11%) for low, medium and high T2,ult scenarios respectively. Fig 2(B) shows the historical and modelled T2 values, plus H-D’s projection to 2050. The profound deviation from long-term trends reflects the assumptions embedded within H-D’s Stretch scenario, which anticipates major policy changes and a shift toward very different forms of production.

The results of calibrating Eq (5) to historical data are inconclusive; uncertainty in T1,ult and T2,ult makes long-term projections unreliable. In any case, historical observations of decoupling at national levels are fraught, for the reasons articulated earlier. We conclude that simplistically extrapolating historical trends is not a reliable technique for projecting future decoupling behavior. Moreover, the sophisticated analysis of H-D suggests that deviations from historical trends in Tj may be plausible, as shown in Figs 2 and 3. Hence from here onward we will focus on the Stretch scenario from H-D and assume it is a plausible future of rapid technological development and proactive policy settings, which could lead to rapid decoupling from energy and material use.

In order to re-calibrate Eq (5) to create a more useful long-term projection, we use the period 2015–2050 in H-D’s Stretch scenario. The scenario already contains embedded assumptions regarding strong efficiency gains (30% drop in energy intensity and almost 70% drop in material intensity by 2050). As with the historical calibration, T1 and T2 are taken as H-D’s predicted energy and material use, I1 and I2 respectively, divided by their predicted GDP. We adopt a single Tj,ult scenario for each resource, and arbitrarily assume resource use intensity can be reduced to 50% of the Tj attained by H-D’s model in 2050, giving values of T1,ult = 0.881 MJ per thousand $AUD and T2,ult = 0.139 tonnes per thousand $AUD. The decline rates rj are calibrated in the same manner as above.

Fig 3 shows the calibrated model runs, with a projection to 2100. Calibrated decline rates are r1 = 2.06% (± 0.12%) and r2 = 5.59% (± 0.11%) for final energy demand and material extraction, respectively. A 95% confidence interval on each Tj prediction is obtained by performing additional model runs using upper and lower values for rj (mean ± 1.96 × SE); this is included as a coloured band around each solid coloured line in Fig 3, but is only clearly visible on T1, being too narrow to see on T2. Finally, to check the appropriateness of our Tj,ult scenarios, a further calibration is performed by varying both rj and Tj,ult. This allows us to estimate the ultimate resource intensity if technology followed the trend projected by H-D, giving calibrated values T1,ult = 1.64 (± 0.05) and T2,ult = 0.19 (± 0.01). From this we can see that our projection is more optimistic than the Stretch scenario of H-D (which was their most optimistic scenario), and we proceed on the basis that our modelled conditions must be considered extremely favorable to decoupling.

Fig 4 shows values of Tj inferred for current energy and total material use across a range of countries, in order to provide some context to the future decoupling scenarios being modelled. It is clear that by this measure, Australia is already one of the most energy-efficient economies in the world. H-D project that by 2050 Australia will improve further, to be on par with Denmark and Sweden today, and our chosen T1,ult value assumes Australia can ultimately become more energy-efficient (per unit GDP) than any country on the planet today. With respect to material use, H-D project that by 2050 Australia will have completely transformed from being one of the most materially intensive economies today, to being one of mid-range material intensity (by current measures). Our assumption of a 50% further reduction in T2,ult would place Australia's ultimate material efficiency at a level equivalent to high-income countries today that have relatively low dependence on extractive industries, such as New Zealand. These assumptions can indeed be viewed as an extremely optimistic scenario of future technological improvement.

The calibrated model can now be used to explore the potential future evolution of resource use under continued economic growth. For this projection, the growth rate k = 2.41%, which is the average GDP growth rate from 2015 to 2050 in H-D’s Stretch scenario. Fig 5 shows the modelled projection of impact Ij to 2100. Projected GDP at the end of the century is 7.7 times its 2015 level. Material extractions and final energy demand in 2100 are up 29% (95% confidence interval 28.4–30.7%) and 256% (95% confidence interval 241–273%) respectively, relative to 2015 levels. Considering the embedded optimistic assumptions for Tj,ult, this result is a robust rebuttal to the claim of absolute decoupling. Fig 5 also includes the projections for Ij using the model in which both rj and Tult were calibrated (i.e. most closely reproducing the trends in H-D’s projections). Using that model, energy demand in 2100 would be five times higher than in 2015, and material extraction would rise by 71%.

Importantly, as Tj moves towards a constant value (Tj,ult), the growth rate of Ij approaches the economic growth rate k. Thus, whilst in 2015 the growth rates for material extraction and final energy demand (-1.87% and +1.47% respectively) are all less than the 2.41% economic growth rate, by 2100 these have changed to +2.16% and +1.89% and by 2150, both I1 and I2 exhibit growth rates close to the economic growth rate (2.42% and 2.21% respectively).

On the basis of this simple modeling, we conclude that decoupling of GDP growth from resource use, whether relative or absolute, is **at best only temporary**. Permanent decoupling (absolute or relative) is **impossible** for essential, non-substitutable resources because the efficiency gains are ultimately governed by physical limits.

Discussion & Conclusions

Our model demonstrates that growth in GDP ultimately cannot plausibly be decoupled from growth in material and energy use, demonstrating categorically that GDP **growth cannot be sustained indefinitely**. It is therefore misleading to develop growth-oriented policy around the expectation that decoupling is possible. However, we also note that GDP has been shown to be a poor proxy for societal wellbeing, something it was never designed to measure, and GDP growth is therefore a questionable long-term societal goal in any case. The mounting costs of “uneconomic growth” [43] suggest that the pursuit of decoupling–if it were possible–in order to sustain GDP growth would be a misguided effort.

Society can sustainably improve wellbeing, including the wellbeing of its natural assets, but only by discarding the goal of GDP growth in favor of more comprehensive measures of societal wellbeing [44]. The 17 UN Sustainable Development Goals (SDGs), recently agreed to by all UN countries, represent a much broader conception of the goals of society. These goals include eliminating poverty and hunger, reducing inequality, protecting and restoring the climate, and terrestrial and marine ecosystems. Only one of the 17 goals mentions GDP growth, but it is qualified as “inclusive and sustainable growth”. Certainly, GDP growth over the last several decades has not been inclusive–inequality is getting worse in most countries. For GDP growth to be sustainable it would have to be decoupled from energy and material use and environmental impacts. We have shown that there is little evidence that GDP growth can be decoupled in the long-term (i.e. it is not sustainable).

If GDP growth as a societal goal is unsustainable, then it is ultimately necessary for nations and the world to transition to a steady or declining GDP scenario. We contend that it will be easier to start this **transition now** while there is still capacity for technological gains, rather than go down the path of decoupling and be forced to make a transition post 2050 when we are closer to the theoretical limits to technological efficiency gains. We argue that **now is the time to recognize the biophysical limits**, and to begin the overdue task of re-orienting society around a more achievable and satisfying set of goals than simply growing forever [44,45].