## 1

#### Megaconstellations solve rural broadband---Starlink alone solves.

Weinschenk ‘21 [Carl; February 21; Freelance Editor, Freelance. Contributor, Telecompetitor, Technology, U.S. “Report: Starlink Looks Very Promising for Rural Broadband,” <https://www.telecompetitor.com/report-starlink-looks-very-promising-for-rural-broadband/>] brett

SpaceX’s Starlink satellite broadband service has the potential to be a game changer for rural broadband, according to an analysis by PCMag of Starlink speeds. The analysis is based on beta tester data exclusively provided to it by Ookla Speedtest.

The site looked at data from rural, suburban and urban areas. Among its more than 10,000 users in its semi-public beta were “a perplexing” number in urban and suburban areas where a variety of high-speed options already are available. The story cites Chicago, Seattle and Minneapolis as places where there were testers, despite readily available alternatives.

The site compared download speeds against other fixed service providers in 30 counties with at least 30 samples in any month from December 30 to February 24. The counties in which the fixed providers had the biggest speed advantage over Spacelink were urban or suburban: Los Angeles and Santa Clara counties, CA; Cook County, IL; King County, WA and Washington County, MN.

It is in rural areas that Starlink shines, according to the research. The five counties in which Starlink had the biggest download speed advantage over the fixed group were rural: Vilas County, WI; Ravali County, MT; Waldo County, ME; Okanogan County, WA and Lamoile County, VT.

Source: PCMag

The number of counties in which Starlink beat the fixed providers and those in which the fixed providers beat Starlink appeared to be about equal, as was the speed differential.

“Our own analysis shows that Starlink will make the biggest difference in rural, low-density, low-population counties with few options other than lower-quality satellite services,” wrote Sascha Segan, author of the PCMag article about Startlink rural speeds.

There is some skepticism about Starlink and its ability to serve rural broadband at scale, especially considering it has committed to serve 642K locations through the FCC RDOF program. Detractors have argued the service will struggle to provide adequate broadband speeds to that many rural customers.

At this point, Starlink is geographically constrained. The story says that reports put its current constellation most effectively covering areas ” between either 44 degrees or 45 degrees north, and either 52 degrees or 53 degrees north.” This region is in the northern third of the country and extends into Canada. A distribution map shows most beta testers in the northwest, with some in the upper Midwest and a smattering in the northeast and central and southern California.

Beta users report download speeds of as much as 170 Mbps with no data caps.

Starlink may be getting a speed boost. Last week, Space X CEO Elon Musk tweeted that he expects download speeds to hit 300 Mbps later this year. He added that latency will be 20 milliseconds.

#### Rural broadband is key to precision ag---solves supply which turns FDI 12.

USDA ‘19 [US department of agriculture, April 2019, A Case For Rural Broadband, accessed 8/12/21, <https://mobroadband.org/wp-content/uploads/sites/44/2020/07/case-for-rural-broadband.pdf>] brett

Across the agricultural production cycle, farmers and ranchers can implement digital technologies as other modern businesses are doing, enhancing agriculture by driving decision-making based on integrated data, automating processes to increase operational efficiency, improving productivity with tasks driven by real-time insights, augmenting the role of management in the business of farming, and creating new markets with extended geographic reach. These patterns of digital transformation create fundamental shifts in agricultural production, developing new ways of working that make the industry more productive, attractive, and financially sustainable for farmers and ranchers. Tech companies which stand to benefit from industry transformation continue to capitalize on these shifts by developing new technologies, which according to one recent study, may help position themselves to capture a portion of an estimated $254 billion to $340 billion in global addressable digital agriculture market.13 Business Management shifts decision making from instinct to integrated data Precision Agriculture is transforming the way producers collect, organize, and rely on information to make key decisions. Traditionally, producers’ long-term experiences have created a competitive advantage: years of experiments have produced insights and instincts about the land they have farmed and the animals they have raised. But the volume of data that is possible to collect today can accelerate that learning curve, helping producers learn faster and more rapidly adapt to market shifts—particularly on new fields and with new animals—and creating more nuanced insights, enabling them to act on leading indicators. This creates a disparity between producers who can utilize high-speed Internet service and those who cannot. Examples include the ability to do the following: • create decision tools to help farmers and ranchers estimate the potential profit and economic risks associated with growing one particular crop over another • decide which fertilizer is best for current soil conditions • apply pesticides in targeted areas of the field, to control pests rather than applying pesticides over the entire field • use limited water resources more effectively • respond to findings of sensors that monitor animal health and nutrition Better choices about what, where, and when to plant, fertilize, and harvest—or breed, feed, and slaughter—can drive above-average returns by removing unrecognized inefficiencies and scaling insights. Digitization shifts supply chain management and resource allocation from generic to precise. Precision Agriculture helps make the business of farming more efficient by minimizing inputs— such as raw materials and labor—and maximizing outputs. For example, previous research has found that 40 percent of fields are over-fertilized, which not only inflates the cost of inputs but also results in 15 percent–20 percent yield loss suffered from improper fertilizer application.14 Precise application of inputs, such as fertilizer, herbicides, and pesticides, allows farmers to adjust inputs to location-based characteristics and use exact amounts needed, which saves money and increases sustainability due to more efficient resource stewardship. Improved fertilizer, soil, and water use can significantly improve water quality with less runoff and reduce climate gas emissions, which is important since agriculture accounts for 10-15 percent of worldwide emissions.15 Despite reductions in necessary inputs, Next Generation Precision Agriculture helps maintain or increase yields, leading to significant gains in efficiency14. Real-time insights also improve logistics. When growing melons, for instance, real-time data can help farmers overcome challenges in storing and shipping their products. Melons should be stored in an optimal refrigeration environment to minimize spoilage, and real-time precision sensors can reduce spoilage by alerting staff to suboptimal variations in temperature and humidity, allowing the execution of remedies before major losses occur. When refrigerated storage is full or the market price is at a peak, the “Internet of Things” can provide real-time information about where trucks are located and locating customers to market products to help make the sale. LABOR EFFICIENCY boosts productivity by automating routine processes and enabling real-time response Connected devices equip farmers with a clear picture of their operations at any moment, making it possible to prioritize tasks more effectively and triage the most pressing issues. While routine inspection and scouting has typically been a regular part of farm management and has increased farm profitability14, connected technologies can track, sense, and flag where a producer should focus their time and attention that day. Similarly, e-connectivity has allowed rural farms to access new training resources and high-skilled labor that has not been previously available. Real-time data and automation can radically improve a producer’s peace of mind and performance under time constraints, especially because of reduced physical and mental stress (no longer struggling to keep the machine on a row line between 6 and 10 hours in the field during harvest or planting). On dairy farms, for example, automated devices that milk and feed animals can also track each cow’s activity and alert producers to potential problems. Because these tasks are traditionally done by the producer and farm personnel, e-connectivity can substantially reduce the amount of time and effort necessary to run farms. This leads to dramatic increases in flexibility, enabling time and talent to be directed to more advanced tasks. Farmers can use newly found time to re-invest in more high-value tasks like long-term planning and management of the operation. This shift towards farm management opens new possibilities for the way that farms conduct business. GEOGRAPHIC ACCESS extends the reach of the supply chain and shifts marketing from standard to differentiated As explained in the previous section, as Precision Agriculture unlocks additional time and resources to explore new ways of doing business farmers are re-investing their time into identifying options to improve inputs, including better-trained labor and more effective types of inputs. New customers and markets can also be explored to increase sales volume and revenues.

#### Precision ag solves runoff.

Ling 17, Geoffrey Ling, a retired U.S. Army colonel, is an expert in technology development and commercial transition. He is a professor of neurology at Johns Hopkins University and the Uniformed Services University of the Health Sciences and a partner of Ling and Associates. Scientific American, June 26, 2017. “Precision Farming Increases Crop Yields” <https://www.scientificamerican.com/article/precision-farming/> brett

As the world’s population grows, farmers will need to produce more and more food. Yet arable acreage cannot keep pace, and the looming food security threat could easily devolve into regional or even global instability. To adapt, large farms are increasingly exploiting precision farming to increase yields, reduce waste, and mitigate the economic and security risks that inevitably accompany agricultural uncertainty.

Traditional farming relies on managing entire fields—making decisions related to planting, harvesting, irrigating, and applying pesticides and fertilizer—based on regional conditions and historical data. Precision farming, by contrast, combines sensors, robots, GPS, mapping tools and data-analytics software to customize the care that plants receive without increasing labor. Stationary or robot-mounted sensors and camera-equipped drones wirelessly send images and data on individual plants—say, information about stem size, leaf shape and the moisture of the soil around a plant—to a computer, which looks for signs of health and stress. Farmers receive the feedback in real time and then deliver water, pesticide or fertilizer in calibrated doses to only the areas that need it. The technology can also help farmers decide when to plant and harvest crops.

As a result, precision farming can improve time management, reduce water and chemical use, and produce healthier crops and higher yields—all of which benefit farmers’ bottom lines and conserve resources while reducing chemical runoff.

Many start-ups are developing new software, sensors, aerial-based data and other tools for precision farming, as are large companies such as Monsanto, John Deere, Bayer, Dow and DuPont. The U.S. Department of Agriculture, NASA and the National Oceanic and Atmospheric Administration all support precision farming, and many colleges now offer course work on the topic.

In a related development, seed producers are applying technology to improve plant “phenotyping.” By following individual plants over time and analyzing which ones flourish in different conditions, companies can correlate the plants’ response to their environments with their genomics. That information, in turn, allows the companies to produce seed varieties that will thrive in specific soil and weather conditions. Advanced phenotyping may also help to generate crops with enhanced nutrition.

Growers are not universally embracing precision agriculture for various reasons. The up-front equipment costs—especially the expense of scaling the technology to large row-crop production systems—pose a barrier. Lack of broadband can be an obstacle in some places, although the USDA is trying to ameliorate that problem. Seasoned producers who are less computer-literate may be wary of the technology. And large systems will also be beyond the reach of many small farming operations in developing nations. But less expensive, simpler systems could potentially be applied. Salah Sukkarieh of the University of Sydney, for instance, has demonstrated a streamlined, low-cost monitoring system in Indonesia that relies on solar power and cell phones. For others, though, cost savings down the road may offset the financial concerns. And however reticent some veteran farmers may be to adopt new technology, the next generation of tech-savvy farmers are likely to warm to the approach.

#### Gulf hypoxia is growing because of ag runoff---it’ll collapse whole oceans---extinction

Dr. Ian Hendy 17, PhD in Trophic Marine Biology, Research and Communication Officer and Senior Scientific Researcher in Marine Ecology at the University of Portsmouth, Institute of Marine Sciences Laboratories, Gulf of Mexico 'Dead Zone' Is Already A Disaster – But It Could Get Worse, Phys Org, 8-14, https://phys.org/news/2017-08-gulf-mexico-dead-zone-disaster.html

Each summer, a large part of the Gulf of Mexico "dies". This year, the Gulf's "dead zone" is the largest on record, stretching from the mouth of the Mississippi, along the coast of Louisiana to waters off Texas, hundreds of miles away. Around 8,776 square miles of ocean, an area the size of New Jersey or Wales, is almost lifeless.

John Muir, the famed naturalist and early conservation campaigner, once said that: "When we try to pick out anything by itself, we find it hitched to everything else in the Universe." His point was that everything in nature is connected, and that no part of our ecosystem exists entirely independently from any other.

It is perhaps no surprise then that ultimate cause of the Gulf of Mexico's dead zone can be found many miles inland. Fertilisers used by farmers then wash into the Mississippi River and eventually into the sea, where nutrients such as nitrogen and phosphorus stimulate an explosion in microscopic algae, creating huge "algal blooms". The algae then die and sink to the bottom, where they decompose. But the same bacteria which decompose the algae also use the sea's oxygen during the process, leaving an "anoxic" ocean.

Fish and other mobile sea creatures are able to escape the suffocating dead zone. Less lucky however are the sponges, corals, sea squirts and other animals who live their lives fixed in one place on the sea bed. Low oxygen levels place them under great stress and we have seen huge mortalities. Such losses will of course ripple up the food web, creating a negative chain reaction of increasing mortality rates in larger and larger animals.

The "dead zone" has grown this year due to increased rainfall in America's Midwest washing ever greater amounts of nutrients into the Mississippi, which ultimately end up in the Gulf. Not only is this a huge conservation issue – the Gulf contains key nursery habitats such as mangrove forests, sea grass beds and coral reefs that benefit adjacent fisheries – but it also has huge consequences for the local fishing economy, particularly the shrimp industry.

Steps are under way to slow down the ecological disaster. Some farmers in the Mississippi basin are using large grassy zones along waterways in order to soak up the agricultural fertilisers and filter out many of the nutrients before they make their way down the Mississippi to pollute the Gulf. However, it remains to be seen whether such measures are effective – and US farmers certainly need to greatly reduce the nitrogen and phosphates they use.

In the century since Muir's death, things have sped up. A larger population demands more food which means more deforestation, more farmland and more fertiliser. The increase demand placed on our land is ultimately affecting the marine environment.

These losses are unsustainable. The marine environment is integral for all life on earth, from an ecological and economic point of view. If we keep losing ecosystem services such as coastal nursery habitats and spawning grounds at this current rate, it will not just be an area the size of a state that is a dead zone, but the whole Gulf, or even whole oceans.

## 2

#### States ought to establish a regulatory framework regarding private entities in Low Earth Orbit:

#### ---that mandates the incorporation of Space Sustainability Ratings;

#### ---that mandates Space Traffic Management for all entities in space, including Active Debris Removal;

#### ---that facilitates the creation of Public Private Partnerships between States and private entities creating megaconstellations.

#### Solves tracking satellites, norms, co-operation, info, collisions, and access---empirics prove.

Bhakare 21 [Nikita; IV B.A. LL.B. student, ILS Law College, Pune (India) “THE NEED FOR EVOLVING LEGAL FRAMEWORK FOR REGULATION OF SPACE DEBRIS CAUSED BY SATELLITE CONSTELLATIONS” <https://conference.sdo.esoc.esa.int/proceedings/sdc8/paper/310/SDC8-paper310.pdf>] brett

In view of all the grey areas of Law and Policies in order to regulate satellite constellations, it has been clear that since the law is not always binding, it tends to leave much scope for ruthless exploitation of the legislative frameworks. Hence, it could prove to be valuable by incorporating the following concepts while allowing large sat-structures up in the skies.

7.1 Space Sustainability Ratings (SSR) and Space-Traffic Management (STM)

Space Sustainability Ratings is a novel concept that implores companies to inculcate the Long-Term Sustainability Principles while tracking the satellite activity, in this case, in corporate and commercial ventures, an initiative by MIT and Bryce Space.

Space-Traffic Management is a highly essential technique that should be made non-negotiable and mandatory for every entity present in space. It may include methods such as Active Debris Removal (ADR). “Rules of the road, including right of way and similar behavioural norms, are in their infancy today for space in the way of practice, domestic policy or international guidelines” and the Space Data Association (SDA) is working on co-operation for international mutual benefit via formal rules of distributing information, coordinating manoeuvres, etc, also applied at high seas and international airspaces as well. [29]

7.2 Newspace & Public-Private Partnerships

In an era of Privatisation, it only makes sense to resort to Public-private partnerships in order to facilitate ease of legal access besides financial and business relationships. The concept of NewSpace must be inculcated in the traditional Space Code and Policies, in order to not restrict the growth of human endeavours. There are several ways where the outcome of Government and private companies interacting is advantageous. For eg, CleanSpace, engaging in ADR mentioned above.

## Case

### NC – Overview

#### Overview to their impact—have a high threshold for 1AR extrapolations for impacts. Their card is under warranted and causally asserts claims without delineated warrants. Don’t fill in gaps for them. Reject new 1ar ‘yes extinction’ evidence—we premised our 1nc strategy off of a horrible 1ac piece of impact evidence. Study indicts and answers to our impacts/transition solves but discourages sandbagging good ev until after we read the 1nc.

### Adv

#### Growth is unsustainable and innovation doesn’t solve---shifting away from production is key.

Büchs and Koch 17 [Milena Büchs & Max Koch 17. Milena Büchs is Associate Professor in Sustainability, Economics and Low Carbon Transitions at the University of Leeds, UK. Max Koch is Professor of Social Policy at Lund University (School of Social Work), Sweden. 2017. Postgrowth and Wellbeing. Springer International Publishing. CrossRef, doi:10.1007/978-3-319-59903-8.] // Re-Cut Justin

As the previous chapters have shown, economic growth is regarded as a prime policy aim by policy makers and economists because it is thought to be essential for reducing poverty and generating rising living standards and stable levels of employment (Ben-Ami 2010: 19–20). More generally, support for economic growth is usually intertwined with advocating social progress based on scientific rationality and reason and hence with an optimistic view of humans’ ingenuity to solve problems (ibid.: 17, 20, Chap. 5). Growth criticism thus tends to be portrayed as anti-progress and inherently conservative (ibid.: Chap. 8). While it is important to acknowledge and discuss this view, it needs to be emphasised that growth criticism is formulated with long-term human welfare in mind which advocates alternative types of social progress (Barry 1998). This chapter first outlines ecological and social strands of growth critiques and then introduces relevant concepts of and positions within the postgrowth debate. Ecological Critiques of G rowth Generally speaking, two types of growth criticism can be distinguished: the first focuses on limitations of GDP as a measure of economic performance; the second goes beyond this by highlighting the inappropriateness of growth as the ultimate goal of economic activity and its negative implications for environment and society. Since GDP measures the monetary value of all final goods and services in an economy, it excludes the environmental costs generated by production. For instance, as long as there is no cost associated with emitting greenhouse gases , the cost for the environmental and social damage following from this is not reflected in GDP figures. Worse even, GDP increases as a consequence of some types of environmental damage: if deforestation and timber trade increase or if natural disasters or industrial accidents require expenditures for clean-up and reconstruction, GDP figures will rise (Douthwaite 1999: 18; Leipert 1986). Several critics of GDP as a measure of progress have proposed alternative indicators of welfare such as the Genuine Progress Indicator, Green GDPs or other approaches which factor in environmental costs (see Chap. 5 for more details), but they do not necessarily object to economic growth being the primary goal of economic activity (van den Bergh 2011). In contrast, the idea of ecological limits to growth goes beyond the critique of GDP as a measure of economic performance. Instead, it maintains that economic growth should not, and probably cannot, be the main goal of economic activity because it requires increasing resource inputs, some of which are non-renewable, and generates wastes, including greenhouse gases, that disturb various ecosystems, severely threatening human and planetary functioning in the short and long term. 4 CRITIQUES OF GROWTH 41 Resources are regarded as non-renewable if they cannot be naturally replaced at the rate of consumption (Daly and Farley 2011: 75–76). Examples include fossil fuels, earth minerals and metals, and some nuclear materials like uranium (Daly and Farley 2011: 77; Meadows et al. 2004: 87–107). Based on work by Georgescu-Roegen (1971), many ecological economists also assume that non-renewable resources cannot be fully recycled because they become degraded in the process of economic activity. Historically speaking, economic growth is a fairly recent phenomenon (Fig. 2.1). Since its onset in the late seventeenth century in Europe and mid-eighteenth century in the US (Gordon 2012), it has gone hand in hand with an exponentially increasing use of non-renewable resources such as fossil fuels (Fig. 4.1). While we are not yet close to running out of non-renewable resources, over time they will become more difficult and hence more expensive to recover. This idea is captured by the concept of “energy returned on energy invested” (EROEI). In relation to oil for instance, it has been shown that the easily recoverable fields have been targeted first and that therefore greater energy (and hence financial) inputs will be required to produce more oil. Over time, the ratio of energy returned on energy invested will decrease, reducing the financial incentive to invest further in the recovery of these non-renewable resources (Dale et al. 2011; Brandt et al. 2015: 2). Relevant to this is also the debate about peak oil—a concept coined by Shell Oil geologist Marion King Hubbert in the 1950s—the point at which the rate of global conventional oil production reaches its maximum which is expected to take place roughly once half of global oil reserves have been produced. There is still controversy about whether global peak oil will occur, and if so when, as it is difficult to predict, or get reliable data on, the rate at which alternative types of energy will replace oil (if this was to happen fast enough, peak oil might not be reached, if it has not yet occurred), the size of remaining oil reserves and the future efficiency of oil extraction technologies (Chapman 2014). However, it is plausible to assume that oil prices will rise in the long term if conventional oil availability diminishes, while global demand for oil increases with continuing economic and population growth. Since economic growth in the second half of the twentieth century required increasing inputs of conventional oil, higher oil prices would have a negative impact on growth unless alternative technologies are developed that can generate equivalent liquid fuels at lower prices (Murphy and Hall 2011). Some scholars have criticised the focus on physical/energy resource limitations as initially highlighted in the “limits to growth” debate (Meadows et al. 1972) and state that instead catastrophic climate change is likely to be a more serious and immanent threat to humanity (Schwartzman 2012). The main arguments here are first that much uncertainty remains about the potential and timing of peak oil, future availability of other fossil fuels and development of alternative low energy resources, while the impacts of climate change are already immanent and may accelerate within the very near future. Second, even if peaks in fossil fuel production occurred in the near future, remaining resources could still be exploited to their maximum. However, this would be devastating from a climate change perspective as, according to the latest IPCC scenarios, greenhouse gas emissions need to turn net-zero by the second half of this century for there to be a good chance to limit global warming to 2° Celsius (and ideally, below that) (Anderson and Peters 2016). It is telling that some of the more recent debates about ecological limits to growth put much more emphasis on environmental impacts of growth, rather than on peak oil or other resource limitations (Dietz and O’Neill 2013). Differently put, limits of sinks, especially to absorb greenhouse gases, and to the regeneration of vital ecosystems are now attracting greater concern, compared to limits of resources. Growing economic production generates increasing pressures on the environment due to pollution of air, water and soil, the destruction of natural habitats and landscapes, for instance, through deforestation and the extraction of natural resources. Therefore, growth often also threatens the regeneration of renewable resources such as healthy soil, freshwater and forests, as well as the functioning of vital ecosystems and ecosystems services such as the purification of air and water, water absorption and storage and the related mitigation of droughts and floods, decomposition and detoxification and absorption of wastes, pollination and pest control (Meadows et al. 2004: 83–84). Recent research on planetary boundaries has started to identify thresholds of environmental pollution or disturbance of a range of ecosystems services beyond which the functioning of human life on earth will be put at risk. Rockström and colleagues have identified nine such “planetary boundaries”—“climate change; rate of biodiversity loss (terrestrial and marine); interference with the nitrogen and phosphorus cycles; stratospheric ozone depletion; ocean acidification; global freshwater use; change in land use; chemical pollution; and atmospheric aerosol loading” (Rockström et al. 2009: 472). They also present evidence according to which three of these boundaries—climate change, rate of biodiversity loss and the nitrogen cycle—have already reached their limits (Rockström et al. 2009). Of those three thresholds, climate change has received most attention. The 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2014) concluded that global temperatures have risen by an average of 0.85° since the 1880s (while local temperature increases can be much higher than that) and that the concentration of greenhouse gases in the atmosphere has reached unprecedented levels over the last 800,000 years—that of CO2 has now reached 405.6 parts per million (NASA, January 2017, Fig. 4.2), far surpassing the level of 350 ppm which is considered safe by many scientists (Rockström et al. 2009). The IPCC report also maintained that humans very likely contributed to at least 50% of global warming that occurred since the 1950s (IPCC 2014: 5). A range of climate change impacts can already be observed, including a 26% increase of ocean acidification since industrialisation; shrinking of glaciers, Greenland and Antarctic ice sheets, as well as arctic sea ice; and the rise of sea levels of 19 cm since 1901. This is projected to increase by an additional 82 cm by the end of this century at current levels of greenhouse gas emissions (ibid.: 13). Climate change impacts are already felt with increased occurrences of heat waves, heavy rain fall, increased risk of flooding and impacts on food and water security in a number of regions around the world. It is projected that with a rise of 2° of global temperatures, 280 million people worldwide (with greatest numbers in China, India and Bangladesh) would be affected by sea level rise, escalating to a projected 627 million people under a 4° scenario (Strauss et al. 2015: 10). At the 21st Conference of Parties of the United Nations Framework Convention on Climate Change in Paris in 2015, representatives agreed that action should be taken to limit rise of global temperatures to 2° and Fig. 4.2 Concentration of CO2 in the atmosphere. Source NASA, available from https://climate.nasa.gov/vital-signs/carbon-dioxide/. The CO2 levels have been reconstructed from measures of trapped air in polar cap ice cores 4 CRITIQUES OF GROWTH 45 to “pursue efforts” to limit it to 1.5°. This has been adopted by 196 countries, but immense efforts and very radical reductions of greenhouse gas emissions will be required to comply with the agreement. Even if net greenhouse gas emissions were reduced to zero, surface temperatures would remain constant at their increased levels for hundreds of years to come and climate change impacts such as ocean acidification and rising sea levels would continue for hundreds or even thousands of years once global temperatures are stabilised; moreover, a range of climate change impacts are deemed irreversible (IPCC 2014: 16). One controversial question in the debate about economic growth and environmental impacts has been whether growth can be decoupled from the damage it causes. Important to this debate is the theory of the Environmental Kuznets Curve which applies Simon Kuznets’ hypothesised inverted u-shaped relationship between economic development and income inequality to the relationship between economic development and environmental degradation. According to this theory, environmental degradation is low in the early phases of economic development, then rises with increasing development up to a certain point, beyond which it falls again with advancing development because more resources can be invested to render production and consumption more efficient and less polluting. Therefore, this theory suggests that it is possible to decouple economic growth (measured in GDP) from its environmental implications. The counter-argument to this theory is that it does not take into account the difference between relative and absolute decoupling. Relative decoupling refers to the environmental impacts generated over time per unit of economic output, for instance CO2 emissions per million of US$. In contrast, absolute decoupling would examine aggregate environmental impact, compared to total economic output over time. Here it has been argued that while relative decoupling may be possible as the environmental impact per unit of economic output decreases over time due to efficiency gains, absolute decoupling is much harder to achieve while growth continues. Indeed, there is no evidence for absolute decoupling as total environmental impacts, for instance total global CO2 emissions, are still rising with rising global GDP (Jackson 2011: 67–86). This is partly due to rebound effects which we discussed in Chap. 2: rising consumption because the increase in efficiency has made it cheaper to produce/consume (Jackson 2011: 67–86; see also Czech 2013: Chap. 8 criticising “green growth”). Furthermore, if decoupling is examined at the country level, one would need to take consumptionbased resource use/emissions into account rather than productionbased impacts. Substantial environmental impacts related to everything that is consumed in rich countries occur in developing countries from which goods are imported. A focus on production-based environmental impacts would hence be misleading as it ignores the [and] environmental impacts that relate to a country’s living standards and that occur outside of that country. Social Critiques of Growth Economic growth has not only been criticised from an ecological perspective, but also from an individual and social wellbeing point of view. Here, we can again distinguish a critique of GDP as a measure of wellbeing and a wider critique which highlights potential negative consequences of economic growth for human wellbeing. Several scholars have argued that GDP is an inadequate measure of prosperity or wellbeing because it only includes market transactions and ignores activities of the informal economy in households and the volunteering sector which make an important contribution to individual and social wellbeing (Stiglitz et al. 2011; van den Bergh 2009; Jackson 2011). It also excludes the contribution of certain government services that are provided for free (Douthwaite 1999: 14; Stiglitz et al. 2011: 23), and the roles of capital stocks and of leisure in generating welfare (Costanza et al. 2015: 137). Furthermore, all market transactions make a positive contribution to GDP, regardless of whether expenditures increase or decrease welfare. Similar to the way in which environmental costs of growth are either excluded from GDP or even increase it, expenditures that arise from road accidents, divorces, crime, etc., contribute positively to GDP (ibid.: 133). The focus on market transactions also means that an increasing marketisation (or “commodification”) of an economy will be reflected in a rise of GDP, which may or may not be related to actual “welfare” outcomes (Stiglitz et al. 2011: 49). It also implies that GDP is an insufficient cross-national comparator for the quality of life, as it does not take into account the different sizes of the informal economy across countries (ibid.: 15). Furthermore, GDP does not indicate how income and consumption are distributed in society (Stiglitz et al. 2011: 44). This implies that a rise of GDP can be consistent with a rise of inequality of income and wealth. 4 CRITIQUES OF GROWTH 47 However, if greater inequality has negative impacts on social wellbeing (Wilkinson and Pickett 2009), this would be masked by rising GDP figures (Douthwaite 1999: 17). An even more fundamental criticism of GDP as a measure of wellbeing is that it focuses on the accumulation of money or wealth and thus on the material aspects of wellbeing. Such a narrow conception of the goals of economic activity and wellbeing has been criticised early on in the history of economic thought, e.g. by Aristotle’s distinction between oikonomia and chrematistics. The latter refers to the accumulation of wealth and was regarded by him as an “unnatural” activity which did not contribute to the generation of use value and wellbeing (Cruz et al. 2009: 2021). The argument that wider conceptions of wellbeing and prosperity are required has also become relevant for contemporary critiques of economic growth (Jackson 2011; Paech 2013; Schneider et al. 2010) as we will discuss this in more detail in Chap. 5. Arguments About the Psychological and S ocial Costs of G rowth The broader social critique of economic growth highlights potential “social limits” to or even negative consequences of economic growth for individual and collective wellbeing. The term “social limits to growth” was coined by Fred Hirsch (1976). He argued that the benefits of growth are initially exclusive to small elites and that these benefits disappear as soon as they spread more widely through mass consumption. For instance, only few people can own a Rembrandt painting; holiday destinations are more enjoyable when they are not overrun by hordes of other tourists; there are only few leadership positions, etc. From this perspective, there are “social limits” to the extent to which the benefits of growth can be socially expanded and equally shared. Other scholars have expressed concern about individual and collective social costs of economic growth. First, there is the argument that the need to keep up with ever-rising living standards and new consumer habits, “keeping up with the Joneses”—a lot of which is seen to be driven by advertisement and social pressure rather than real needs, for instance fashionable clothing or gadgets—can generate stress and increase the occurrence of mental disorders (James 2007; Offer 2006; Kasser 2002). 48 M. BÜCHS AND M. KOCH Second, it has been argued that economic growth can imply wider social costs. For instance, with its emphasis on individual gain, market relations and competition, and the need that it generates for spatial mobility (e.g. for successful participation in education and labour markets), it is feared to undermine moral and social capital and put a strain on family and community relations, potentially even leading to increasing divorce and crime rates (Douthwaite 1999; Daly and Cobb 1989: 50–51; Hirsch 1976). Social costs of technological development and industrialisation also include industrial workplace and traffic accidents and time lost in traffic jams and for commuting (Czech 2013: Chap. 2; Stiglitz et al. 2011: 24). Technological innovation which arises from growth can also act as a factor for job losses and increasing job insecurity (Douthwaite 1999), especially if growth rates are not sufficiently high to compensate gains in productivity. It is often assumed that growth will benefit the many because of assumed “trickle-down” effects which promise to improve the lot of the poor simply because the “cake” of available wealth is growing. While progress has been made in reducing extreme global poverty and inequality (Sala-i-Martin 2006; Rougoor and van Marrewijk 2015), the number of people living in poverty across the globe remains high.1 At the same time, income inequality in a range of countries has been rising and the situation of many of the people living in extreme poverty is not improving which means the fruits of economic growth remain to be unequally distributed (Collier 2007; Piketty and Saez 2014). The post-development debate goes even further than that in arguing that not only may growth not have reached the global poor to the extent that had been predicted by neoclassical economists, but that it can also have negative impacts on indigenous communities in developing countries, especially those who rely on local natural resources for their livelihoods which often suffer exploitation, pollution or even destruction through the inclusion of local economies into global value chains (Rahnema and Bawtree 1997). While the distinction between critiques of growth that focus on its problematic ecological and social consequences is useful for analytic purposes, the two dimensions are of course closely linked. Ecological consequences of growth have the potential to severely impact or even undermine human wellbeing. Local livelihoods are already affected by current climate change impacts such as ocean acidification and its impact on marine organisms, draughts, floods and severe weather events, the 4 CRITIQUES OF GROWTH 49 frequency of which has been rising. Accordingly, it is estimated that crop and fish yields are already diminishing in several regions (Stern 2015; IPCC 2014) and that millions of people are already being displaced and forced to migrate due to climate change and other environmental impacts (Black et al. 2011). While the overall long-term impacts of climate change and the surpassing of other planetary boundaries are difficult to predict, they clearly have the potential to substantially undermine human wellbeing. Since greenhouse gas emissions are driven by economic growth, the development of alternative economic models that do not depend on growth is urgent since continued growth “threatens to alter the ability of the Earth to support life” (Daly and Farley 2011: 12).

#### Resources are finite – ensures collapse by 2050.

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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 United States’ 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 United States. 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).

#### Climate change destroys the world.

Specktor 19 [Brandon; writes about the science of everyday life for Live Science, and previously for Reader's Digest magazine, where he served as an editor for five years; "Human Civilization Will Crumble by 2050 If We Don't Stop Climate Change Now, New Paper Claims," livescience, 6/4/19; <https://www.livescience.com/65633-climate-change-dooms-humans-by-2050.html>] Justin

The current climate crisis, they say, is larger and more complex than any humans have ever dealt with before. General climate models — like the one that the [United Nations' Panel on Climate Change](https://www.ipcc.ch/sr15/) (IPCC) used in 2018 to predict that a global temperature increase of 3.6 degrees Fahrenheit (2 degrees Celsius) could put hundreds of millions of people at risk — fail to account for the **sheer complexity of Earth's many interlinked geological processes**; as such, they fail to adequately predict the scale of the potential consequences. The truth, the authors wrote, is probably far worse than any models can fathom. How the world ends What might an accurate worst-case picture of the planet's climate-addled future actually look like, then? The authors provide one particularly grim scenario that begins with world governments "politely ignoring" the advice of scientists and the will of the public to decarbonize the economy (finding alternative energy sources), resulting in a global temperature increase 5.4 F (3 C) by the year 2050. At this point, the world's ice sheets vanish; brutal droughts kill many of the trees in the [Amazon rainforest](https://www.livescience.com/57266-amazon-river.html) (removing one of the world's largest carbon offsets); and the planet plunges into a feedback loop of ever-hotter, ever-deadlier conditions. "Thirty-five percent of the global land area, and **55 percent of the global population, are subject to more than 20 days a year of** [**lethal heat conditions**](https://www.livescience.com/55129-how-heat-waves-kill-so-quickly.html), beyond the threshold of human survivability," the authors hypothesized. Meanwhile, droughts, floods and wildfires regularly ravage the land. Nearly **one-third of the world's land surface turns to desert**. Entire **ecosystems collapse**, beginning with the **planet's coral reefs**, the **rainforest and the Arctic ice sheets.** The world's tropics are hit hardest by these new climate extremes, destroying the region's agriculture and turning more than 1 billion people into refugees. This mass movement of refugees — coupled with [shrinking coastlines](https://www.livescience.com/51990-sea-level-rise-unknowns.html) and severe drops in food and water availability — begin to **stress the fabric of the world's largest nations**, including the United States. Armed conflicts over resources, perhaps culminating in **nuclear war, are likely**. The result, according to the new paper, is "outright chaos" and perhaps "the end of human global civilization as we know it."

#### Chemical emissions – extinction.

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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 civilisation, 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.

#### Plankton – Causes plankton to go extinct – they’re a keystone species – extinction.

Holthaus, 15 (Eric, reporter for the Rollilng Stone, citing data from/quoting Stephanie Dutkiewicz of MIT and Jacquelyn Gill, paleoecologist at the University of Maine, “The Point of No Return: Climate Change Nightmares Are Already Here”, Aug 5 2015 <http://www.rollingstone.com/politics/news/the-point-of-no-return-climate-change-nightmares-are-already-here-20150805> )

Attendant with this weird wildlife behavior is a stunning drop in the number of plankton — the basis of the ocean's food chain. In July, [another major study concluded](http://newsoffice.mit.edu/2015/ocean-acidification-phytoplankton-0720) that acidifying oceans are likely to have a "quite traumatic" impact on plankton diversity, with some species dying out while others flourish. As the oceans absorb carbon dioxide from the atmosphere, it's converted into carbonic acid — and the pH of seawater declines. According to lead author Stephanie Dutkiewicz of MIT, that trend means "the whole food chain is going to be different."¶ The Hansen study may have gotten more attention, but the Dutkiewicz study, and others like it, could have even more dire implications for our future. The rapid changes Dutkiewicz and her colleagues are observing have shocked some of their fellow scientists into thinking that yes, actually, we're heading toward the worst-case scenario. Unlike a prediction of massive sea-level rise just decades away, the warming and acidifying oceans represent a problem that seems to have kick-started a mass extinction on the same time scale.¶ Jacquelyn Gill is a paleoecologist at the University of Maine. She knows a lot about extinction, and her work is more relevant than ever. Essentially, she's trying to save the species that are alive right now by learning more about what killed off the ones that aren't. The ancient data she studies shows "really compelling evidence that there can be events of abrupt climate change that can happen well within human life spans. We're talking less than a decade."

#### Transition is possible---corona produces unique momentum.

Schiller-Merkens 20 [Senior Research Associate at the Faculty of Management and Economics at Witten/Herdecke University, Germany (Simone, MPIfG Discussion Paper 20/11 Scaling Up Alternatives to Capitalism A Social Movement Approach to Alternative Organizing (in) the Economy  Max Planck Institute for the Study of Societies] // Re-Cut Justin

Signs of hope Despite these two major obstacles that will most likely arise in processes of scaling up alternative organizing, there are also signs of hope that an upward scale shift can happen, and that a social transformation toward a democratic, egalitarian and sustainable economy will not remain an utopian dream but the “real utopia” that Wright (2013a) had envisioned. As just mentioned, the formation of new collective identities associated with alternative organizing will certainly allow its further diffusion, thereby increasingly institutionalizing the underlying moral values within the economy. Furthermore, in several capitalist countries, we witness an increasing politicization of the youth, most visibly in the mass protest of the Fridays for Future movement. While this movement does not directly mobilize against capitalism, it addresses issues that are seen as severe outcomes of the current economic system (and it has recently started to also target corporations). Its more confrontational tactics of capitalist critique – as well as the protest actions of other movements – complement the constructive tactics of alternative organizing initiatives as they raise the public interest in and awareness for alternatives, or at least underscore the urgency to act. While not ofering alternatives themselves, protest movements produce important cultural work on which prefgurative initiatives can build in their own activism for alternative organizing. Furthermore, the current pandemic crisis can provide a chance for a more fundamental transformation of our economy – although in the face of people’s sufering, it appears rather inappropriate to speak of a crisis as a sign of hope. As mentioned above, crises are destabilizing events that can alter the political opportunities for social change (McAdam and Tarrow 2019; Wright 2019). We currently see many initiatives that perceive the crisis as such – as a chance for change – and mobilize accordingly through online meetings and debates on, for instance, transformative responses to the crisis, the need for a social transformation of the economy, or responsible capitalism. Many of them point to the role of neoliberal austerity policies in the severeness of the crisis, and also question the rudimentary public engagement when it comes to issues around education, unemployment, and care work. Social scientists also raise their voice and call for a fundamental rethinking of the state’s functions and duties, asking for rediscovering its role for creating value for society.14 And indeed, the public spending and injections into the economy since the Covid-19 pandemic have risen to a scale that has been formerly unthinkable. Even strong supporters of capitalism nowadays favor state interventions. We currently also witness an increase of collective action based on principles of solidarity and mutuality which demonstrates the crucial role of civil society mobilization for coping with deep crises (della Porta 2020). It reflects what already happened in the aftermath of the financial crisis, namely an increase of organizing relationships in alternative ways through direct social action (Bosi and Zamponi 2015; della Porta 2015). While the current collective action mostly develops in the private sphere of neighborhood relations, there are also campaigns in the economic realm that focus on supporting local commerce that sufers from the lockdown. In the long run, these immediate reactions to the crisis can be a basis for reforming economic relations around ideas of local production and consumption, and therefore an opportunity for prefgurative organizations and communities to raise awareness for such ideas and practices. However, it remains to be seen whether these troubled times will provide the window of opportunity for a greater social transformation. At least, the people now perceive the future as more uncertain than before, and this has already made state actors to also listen to the alternative claims and ideas of actors who challenge the capitalist system or, more moderately, call for far-reaching socialist interventions into the economy. Whether this political opportunity will lead into a greater social change toward a more just economy will depend on the potential of the alternative organizing initiatives to mobilize a broader movement and to efectively counter any countermobilization by opposing actors in the economy.

#### Growth-oriented AI ensures extinction---degrowth solves.

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The challenges of sustainability and of superintelligence are not independent. The changing 84 fluxes of energy, matter, and information can be interpreted as different faces of a general acceleration2 85 . More directly, it is argued below that superintelligence would deeply affect 86 production technologies and also economic decisions, and could in turn be affected by the 87 socioeconomic and ecological context in which it develops. Along the lines of Pueyo (2014, p. 88 3454), this paper presents an approach that integrates these topics. It employs insights from a 89 variety of sources, such as ecological theory and several schools of economic theory. 90 The next section presents a thought experiment, in which superintelligence emerges after the 91 technical aspects of goal alignment have been resolved, and this occurs specifically in a neoliberal 92 scenario. Neoliberalism is a major force shaping current policies on a global level, which urges 93 governments to assume as their main role the creation and support of capitalist markets, and to 94 avoid interfering in their functioning (Mirowski, 2009). Neoliberal policies stand in sharp contrast 95 to degrowth views: the first are largely rationalized as a way to enhance efficiency and production 96 (Plehwe, 2009), and represent the maximum expression of capitalist values. 97 The thought experiment illustrates how superintelligence perfectly aligned with capitalist 98 markets could have very undesirable consequences for humanity and the whole biosphere. It also 99 suggests that there is little reason to expect that the wealthiest and most powerful people would be 100 exempt from these consequences, which, as argued below, gives reason for hope. Section 3 raises 101 the possibility of a broad social consensus to respond to this challenge along the lines of degrowth, 102 thus tackling major technological, environmental, and social problems simultaneously. The 103 uncertainty involved in these scenarios is vast, but, if a non-negligible probability is assigned to 104 these two futures, little room is left for either complacency or resignation. 105 106 2. Thought experiment: Superintelligence in a neoliberal scenario 107 108 Neoliberalism is creating a very special breeding ground for superintelligence, because it strives 109 to reduce the role of human agency in collective affairs. The neoliberal pioneer Friedrich Hayek 110 argued that the spontaneous order of markets was preferable over conscious plans, because markets, 111 he thought, have more capacity than humans to process information (Mirowski, 2009). Neoliberal 112 policies are actively transferring decisions to markets (Mirowski, 2009), while firms' automated 113 decision systems become an integral part of the market's information processing machinery 114 (Davenport and Harris, 2005). Neoliberal globalization is locking governments in the role of mere 115 players competing in the global market (Swank, 2016). Furthermore, automated governance is a 116 foundational tenet of neoliberal ideology (Plehwe, 2009, p. 23). 117 In the neoliberal scenario, most technological development can be expected to take place either in the context of firms or in support of firms3 118 . A number of institutionalist (Galbraith, 1985), post119 Keynesian (Lavoie, 2014; and references therein) and evolutionary (Metcalfe, 2008) economists 120 concur that, in capitalist markets, firms tend to maximize their growth rates (this principle is related 121 but not identical to the neoclassical assumption that firms maximize profits; Lavoie, 2014). Growth 122 maximization might be interpreted as expressing the goals of people in key positions, but, from an 123 evolutionary perspective, it is thought to result from a mechanism akin to natural selection 124 (Metcalfe, 2008). The first interpretation is insufficient if we accept that: (1) in big corporations, the 125 managerial bureaucracy is a coherent social-psychological system with motives and preferences of 126 its own (Gordon, 1968, p. 639; for an insider view, see Nace, 2005, pp. 1-10), (2) this system is 127 becoming techno-social-psychological with the progressive incorporation of decision-making 128 algorithms and the increasing opacity of such algorithms (Danaher, 2016), and (3) human mentality 129 and goals are partly shaped by firms themselves (Galbraith, 1985). 130 The type of AI best suited to participate in firms' decisions in this context is described in a 131 recent review in Science: AI researchers aim to construct a synthetic homo economicus, the 132 mythical perfectly rational agent of neoclassical economics. We review progress toward creating 133 this new species of machine, machina economicus (Parkes and Wellman, 2015, p. 267; a more 134 orthodox denomination would be Machina oeconomica). 135 Firm growth is thought to rely critically on retained earnings (Galbraith, 1985; Lavoie, 2014, p. 136 134-141). Therefore, economic selection can be generally expected to favor firms in which these are greater. The aggregate retained earnings4 137 RE of all firms in an economy can be expressed as: 138 RE=FE(R,L,K)-w⋅L-(i+δ)⋅K-g. (1) 139 Bold symbols represent vectors (to indicate multidimensionality). F is an aggregate production 140 function, relying on inputs of various types of natural resources R, labor L and capital K (including intelligent machines), and being affected by environmental factors5 141 E; w are wages, i are returns to 142 capital (dividends, interests) paid to households, δ is depreciation and g are the net taxes paid to 143 governments. 144 Increases in retained earnings face constraints, such as trade-offs among different parameters of 145 Eq. 1. The present thought experiment explores the consequences of economic selection in a 146 scenario in which two sets of constraints are nearly absent: sociopolitical constraints on market 147 dynamics are averted by a neoliberal institutional setting, while technical constraints are overcome 148 by asymptotically advanced technology (with extreme AI allowing for extreme technological 149 development also in other fields). The environmental and the social implications are discussed in 150 turn. Note that this scenario is not defined by some contingent choice of AIs' goals by their 151 programmers: The goals of maximizing each firm's growth and retained earnings are assumed to 152 emerge from the collective dynamics of large sets of entities subject to capitalistic rules of 153 interaction and, therefore, to economic selection.

#### That outweighs.

Turchin and Denkenberger 18 [Alexey Turchin & David Denkenberger 18. Turchin is a researcher at the Science for Life Extension Foundation; Denkenberger is with the Global Catastrophic Risk Institute (GCRI) @ Tennessee State University, Alliance to Feed the Earth in Disasters (ALLFED). 05/03/2018. “Classification of Global Catastrophic Risks Connected with Artificial Intelligence.” AI & SOCIETY, pp. 1–17.] // Re-Cut Justin

According to Yampolskiy and Spellchecker (2016), the probability and seriousness of AI failures will increase with time. We estimate that they will reach their peak between the appearance of the first self-improving AI and the moment that an AI or group of AIs reach global power, and will later diminish, as late-stage AI halting seems to be a low-probability event. AI is an extremely powerful and completely unpredictable technology, millions of times more powerful than nuclear weapons. Its existence could create multiple individual global risks, most of which we can not currently imagine. We present several dozen separate global risk scenarios connected with AI in this article, but it is likely that some of the most serious are not included. The sheer number of possible failure modes suggests that there are more to come.

### 1NC – AT: Diversionary War – General

(0:45)

#### Diversionary war thesis is wrong:

#### 1. Scale – diversionary wars are small and don’t escalate---growth is the implicit trigger

Sung Chul Jung 14. Myongji University, 2014 “Searching for non-aggressive targets,” November, Research Gate, [https://www.researchgate.net/publication/278396883\_Searching\_for\_non-aggressive\_targets //](https://www.researchgate.net/publication/278396883_Searching_for_non-aggressive_targets%20//) Re-Cut Justin

Faced with the possibility of losing their position due to domestic opposition, political leaders may sometimes consider initiating a foreign conflict as a means to redirect attention away from domestic issues. In such instances, which states are most likely to become diversionary targets? This study assumes that unpopular leaders prefer small-scale conflicts that can create rally-round-the-flag effects without triggering substantial domestic opposition to the use of military force abroad. Based on this assumption, hypotheses are developed which predict that states under constraint (i.e. states with democratic institutions or showing high trade openness) tend to attract diversionary-motivated actions, while states likely to reciprocate harshly (i.e. states experiencing their own domestic troubles or in relative decline) are less likely to become diversionary targets. Logit analyses of directed dyad-years from 1960 to 2001 and illustrations of marginal effects provide strong support for three of the four hypotheses - namely, that democracies and trading states are more likely, and that declining powers are less likely to be targets of diversionary actions. This study's findings show that not all potential targets are equally attractive for diversionary actions, and that a state's democratization, economic openness, and power growth can worsen, rather than improve, its security.

#### 2. Economic decline increases cooperation.

Davis and Pelc 17 [Christina L. Davis & Krzysztof J. Pelc 17, Christina L. Davis is a Professor of Politics and International Affairs at Princeton; Krzysztof J. Pelc is an Associate Professor of Political Science at McGill University, “Cooperation in Hard Times: Self-restraint of Trade Protection,” Journal of Conflict Resolution, 61(2): 398-429] // Re-Cut Justin

Conclusion Political economy theory would lead us to expect rising trade protection during hard times. Yet empirical evidence on this count has been mixed. Some studies find a correlation between poor macroeconomic conditions and protection, but the worst recession since the Great Depression has generated surprisingly moderate levels of protection. We explain this apparent contradiction. Our statistical findings show that under conditions of pervasive economic crisis at the international level, states exercise more restraint than they would when facing crisis alone. These results throw light on behavior not only during the crisis, but throughout the WTO period, from 1995 to the present. One concern may be that the restraint we observe during widespread crises is actually the result of a decrease in aggregate demand and that domestic pressure for import relief is lessened by the decline of world trade. By controlling for product-level imports, we show that the restraint on remedy use is not a byproduct of declining imports. We also take into account the ability of some countries to manipulate their currency and demonstrate that the relationship between crisis and trade protection holds independent of exchange rate policies. Government decisions to impose costs on their trade partners by taking advantage of their legal right to use flexibility measures are driven not only by the domestic situation but also by circumstances abroad. This can give rise to an individual incentive for strategic self-restraint toward trade partners in similar economic trouble. Under conditions of widespread crisis, government leaders fear the repercussions that their own use of trade protection may have on the behavior of trade partners at a time when they cannot afford the economic cost of a trade war. Institutions provide monitoring and a venue for leader interaction that facilitates coordination among states. Here the key function is to reinforce expectations that any move to protect industries will trigger similar moves in other countries. Such coordination often draws on shared historical analogies, such as the Smoot–Hawley lesson, which form a focal point to shape beliefs about appropriate state behavior. Much of the literature has focused on the more visible action of legal enforcement through dispute settlement, but this only captures part of the story. Our research suggests that tools of informal governance such as leader pledges, guidance from the Director General, trade policy reviews, and plenary meetings play a real role within the trade regime. In the absence of sufficiently stringent rules over flexibility measures, compliance alone is insufficient during a global economic crisis. These circumstances trigger informal mechanisms that complement legal rules to support cooperation. During widespread crisis, legal enforcement would be inadequate, and informal governance helps to bolster the system. Informal coordination is by nature difficult to observe, and we are unable to directly measure this process. Instead, we examine the variation in responses across crises of varying severity, within the context of the same formal setting of the WTO. Yet by focusing on discretionary tools of protection—trade remedies and tariff hikes within the bound rate—we can offer conclusions about how systemic crises shape country restraint independent of formal institutional constraints. Insofar as institutions are generating such restraint, we offer that it is by facilitating informal coordination, since all these instruments of trade protection fall within the letter of the law. Future research should explore trade policy at the micro level to identify which pathway is the most important for coordination. Research at a more macro-historical scope could compare how countries respond to crises under fundamentally different institutional contexts. In sum, the determinants of protection include economic downturns not only at home but also abroad. Rather than reinforcing pressure for protection, pervasive crisis in the global economy is shown to generate countervailing pressure for restraint in response to domestic crisis. In some cases, hard times bring more, not less, international cooperation.

#### 3. Austerity – decreased military funding and conciliatory pressures

Christopher Clary 15. PhD in Political Science from MIT, M.A. in National Security Affairs, Postdoctoral Fellow, Watson Institute for International Studies, Brown University. “Economic Stress and International Cooperation: Evidence from International Rivalries,” April 25th, Available Online via SSRN Subscription // Re-Cut Justin

Do economic downturns generate pressure for diversionary conflict? Or might downturns encourage austerity and economizing behavior in foreign policy? This paper provides new evidence that economic stress is associated with conciliatory policies between strategic rivals. For states that view each other as military threats, the biggest step possible toward bilateral cooperation is to terminate the rivalry by taking political steps to manage the competition. Drawing on data from 109 distinct rival dyads since 19i9 50, 67 of which terminated, the evidence suggests rivalries were approximately twice as likely to terminate during economic downturns than they were during periods of economic normalcy. This is true controlling for all of the main alternative explanations for peaceful relations between foes (democratic status, nuclear weapons possession, capability imbalance, common enemies, and international systemic changes), as well as many other possible confounding variables. This research questions existing theories claiming that economic downturns are associated with diversionary war, and instead argues that in certain circumstances peace may result from economic troubles. I define a rivalry as the perception by national elites of two states that the other state possesses conflicting interests and presents a military threat of sufficient severity that future military conflict is likely. Rivalry termination is the transition from a state of rivalry to one where conflicts of interest are not viewed as being so severe as to provoke interstate conflict and/or where a mutual recognition of the imbalance in military capabilities makes conflict-causing bargaining failures unlikely. In other words, rivalries terminate when the elites assess that the risks of military conflict between rivals has been reduced dramatically. This definition draws on a growing quantitative literature most closely associated with the research programs of William Thompson, J. Joseph Hewitt, and James P. Klein, Gary Goertz, and Paul F. Diehl.1 My definition conforms to that of William Thompson. In work with Karen Rasler, they define rivalries as situations in which “[b]oth actors view each other as a significant political-military threat and, therefore, an enemy.”2 In other work, Thompson writing with Michael Colaresi, explains further: The presumption is that decisionmakers explicitly identify who they think are their foreign enemies. They orient their military preparations and foreign policies toward meeting their threats. They assure their constituents that they will not let their adversaries take advantage. Usually, these activities are done in public. Hence, we should be able to follow the explicit cues in decisionmaker utterances and writings, as well as in the descriptive political histories written about the foreign policies of specific countries.3 Drawing from available records and histories, Thompson and David Dreyer have generated a universe of strategic rivalries from 1494 to 2010 that serves as the basis for this project’s empirical analysis.4 This project measures rivalry termination as occurring on the last year that Thompson and Dreyer record the existence of a rivalry. Economic crises lead to conciliatory behavior through five primary channels. (1) Economic crises lead to austerity pressures, which in turn incent leaders to search for ways to cut defense expenditures. (2) Economic crises also encourage strategic reassessment, so that leaders can argue to their peers and their publics that defense spending can be arrested without endangering the state. This can lead to threat deflation, where elites attempt to downplay the seriousness of the threat posed by a former rival. (3) If a state faces multiple threats, economic crises provoke elites to consider threat prioritization, a process that is postponed during periods of economic normalcy. (4) Economic crises increase the political and economic benefit from international economic cooperation. Leaders seek foreign aid, enhanced trade, and increased investment from abroad during periods of economic trouble. This search is made easier if tensions are reduced with historic rivals. (5) Finally, during crises, elites are more prone to select leaders who are perceived as capable of resolving economic difficulties, permitting the emergence of leaders who hold heterodox foreign policy views. Collectively, these mechanisms make it much more likely that a leader will prefer conciliatory policies compared to during periods of economic normalcy. This section reviews this causal logic in greater detail, while also providing historical examples that these mechanisms recur in practice.

#### 4. Laundry list of empirics flow neg – they have to explain every example in this card to win.

Blackwill ‘9 – former US ambassador to India and US National Security Council Deputy for Iraq, former dean of the Kennedy School of Government at Harvard (Robert D., RAND, “The Geopolitical Consequences of the World Economic Recession—A Caution”, http://www.rand.org/pubs/occasional\_papers/2009/RAND\_OP275.pdf, WEA) // Re-Cut Justin

Did the economic slump lead to strategic amendments in the way Japan sees the world? No. Did it slow the pace of India’s emergence as a rising great power? No. To the contrary, the new Congress-led government in New Delhi will accelerate that process. Did it alter Iran’s apparent determination to acquire a nuclear capability or something close to it? No. Was it a prime cause of the recent domestic crisis and instability in Iran after its 2009 presidential election? No. Did it slow or accelerate the moderate Arab states intent to move along the nuclear path? No. Did it affect North Korea’s destabilizing nuclear calculations? No. Did it importantly weaken political reconciliation in Iraq? No, because there is almost none in any case. Did it slow the Middle East peace process? No, not least because prospects for progress on issues between Israel and the Palestinians are the most unpromising in 25 years. Did it substantially affect the enormous internal and international challenges associated with the growth of Jihadiism in Pakistan? No. But at the same time, it is important to stress that Pakistan, quite apart from the global recession, is the epicenter of global terrorism and now represents potentially the most dangerous international situation since the 1962 Cuban Missile Crisis. Did the global economic downturn systemically affect the future of Afghanistan? No. The fact that the United States is doing badly in the war in Afghanistan has nothing to do with the economic deterioration. As Henry Kissinger observes, “The conventional army loses if it does not win. The guerrilla wins if he does not lose.” And NATO is not winning in Afghanistan. Did it change in a major way the future of the Mexican state? No. Did the downturn make Europe, because of its domestic politics, less willing and able over time to join the U.S. in effective alliance policies? **No**, there will likely be no basic variations in Europe’s external policies and no serious evolution in transatlantic relations. As President Obama is experiencing regarding Europe, the problems with European publics in this regard are civilizational in character, not especially tied to this recession—in general, European publics do not wish their nations to take on foreign missions that entail the use of force and possible loss of life. Did the downturn slow further EU integration? Perhaps, at the margin, but in any case one has to watch closely to see if EU integration moves like a turtle or like a rock. And so forth. To be clear, there will inevitably be major challenges in the international situation in the next five years. In fact, this will be the most dangerous and chaotic global period since before the 1973 Middle East war. But it is not obvious that these disturbing developments will be primarily a result of the global economic problems. It is, of course, important to be alert to primary and enduring international discontinuities. **If such a convulsive geopolitical event is out there, what is it?** One that comes to mind is another catastrophic attack on the American homeland. Another is the collapse of Pakistan and the loss of government control of its nuclear arsenal to Islamic extremists. But again, neither of these two geopolitical calamities would be connected to the current economic decline. Some argue that, even though geopolitical changes resulting from the current global economic tribulations are not yet apparent, they are occurring beneath the surface of the international system and will become manifest in the years to come. In short, causality not perceptible now will become so. This subterranean argument is difficult to rebut. To test that hypothesis, the obvious analytical method is to seek tangible data that demonstrates that it is so. In short, show A, B, and/or C (in this case, geopolitical transformations caused by the world slump) to have occurred, thus substantiating the contention. One could then examine said postulated evidence and come to a judgment regarding its validity. To instead contend that, even though no such data can be adduced, the assertion, nevertheless, is true because of presently invisible occurrences seems more in the realm of religious conviction than rigorous analysis. But it is worth asking, as the magisterial American soldier/statesman George Marshall often did, “Why might I be wrong?” If the global economic numbers continue to decline next year and the year after, one must wonder whether any region would remain stable— whether China would maintain internal stability, whether the United States would continue as the pillar of international order, and whether the European Union would hold together. In that same vein, it is unclear today what effect, if any, the reckless financial lending and huge public debt that the United States is accumulating, as well as current massive governmental fiscal and monetary intervention in the American economy, will have on U.S. economic dynamism, entrepreneurial creativity, and, consequently, power projection over the very long term. One can only speculate on that issue at present, but it is certainly worth worrying about, and it is the most important “known unknown”27 regarding this subject.28 In addition, perhaps the Chinese Communist Party’s grip on China is more fragile than posited here, and possibly Pakistan and Mexico are much more vulnerable to failed-state outcomes primarily because of the economic downturn than anticipated in this essay. While it seems unlikely that these worst-case scenarios will eventuate as a result of the world recession, they do illustrate again that crucial uncertainties in this analysis are the global downturn’s length and severity and the long-term effects of the Obama Administration’s policies on the U.S. economy. Finally, if not, why not? If the world is in the most severe international economic crisis since the 1930s, why is it not producing structural changes in the global order? A brief answer is that the transcendent geopolitical elements have not altered in substantial ways with regard to individual nations in the two years since the economic crisis began. What are those enduring geopolitical elements? For any given country, they include the following: • Geographic location, topography, and climate. As Robert Kaplan puts it, “to embrace geography is not to accept it as an implacable force against which humankind is powerless. Rather, it serves to qualify human freedom and choice with a modest acceptance of fate.”29 In this connection, see in particular the works of Sir Halford John Mackinder and his The Geographical Pivot of History (1904)30, and Alfred Thayer Mahan, The Influence of Sea Power upon History, 1660–1783 (1890).31 • Demography—the size, birth rate, growth, density, ethnicity, literacy, religions, migration/emigration/ assimilation/absorption, and industriousness of the population. • The histories, foreign and defense policy tendencies, cultural determinants, and domestic politics of individual countries. • The size and strength of the domestic economy. • The quality and pace of technology. • The presence of natural resources. • The character, capabilities, and policies of neighboring states. For the countries that matter most in the global order, perhaps unsurprisingly, **none of these decisive variables** have changed very much since the global downturn began, except for nations’ weaker economic performances. That single factor is not likely to trump all these other abiding geopolitical determinants and therefore produce international structural change. Moreover, the fundamental power relationships between and among the world’s foremost countries have also not altered, nor have those nations’ perceptions of their vital national interests and how best to promote and defend them. To sum up this pivotal concept, in the absence of war, revolution, or other extreme international or domestic disruptions, for nation-states, the powerful abiding conditions just listed do not evolve much except over the very long term, and thus neither do countries’ strategic intent and core external policies— even, as today, in the face of world economic trials. This point was made earlier about Russia’s enduring national security goals, which go back hundreds of years. Similarly, a Gulf monarch recently advised—with respect to Iran—not to fasten on the views of President Ahmadinejad or Supreme Leader Khamenei. Rather, he counseled that, to best understand contemporary Iranian policy, one should more usefully read the histories, objectives, and strategies of the Persian kings Cyrus, Darius, and Xerxes, who successively ruled a vast empire around 500 BC.32 The American filmmaker Orson Welles once opined that “To give an accurate description of what never happened is the proper occupation of the historian.” 33 Perhaps the same is occasionally true of pundits.

### 1NC – AT: Nuke War

(0:40)

No impact to nuclear war:

#### 1. Counter-forcing – only a few million die.

Mueller 9 [Woody Mueller, Chair of National Security Studies, Professor of Political Science at Ohio State University, Cato Senior Fellow, 2009 “Atomic Obsession: Nuclear Alarmism from Hiroshima to Al-Qaeda,” *Google Books*, October 5th, p. 8] // Re-Cut Justin

To begin to approach a condition that can credibly justify applying such extreme characterizations as societal annihilation, a full-out attack with hundreds, probably thousands, of thermonuclear bombs would be required. Even in such extreme cases, the area actually devastated by the bombs' blast and thermal pulse effective **would be limited**: 2,000 1-MT explosions with a destructive radius of 5 miles each would directly demolish **less than 5 percent** of the territory of the United States, for example. Obviously, if major population centers were targeted, this sort of attack could inflict massive casualties. Back in cold war days, when such devastating events sometimes seemed uncomfortably likely, a **number of studies** were conducted to estimate the consequences of massive thermonuclear attacks. One of the **most prominent** of these considered several probabilities. The most likely scenario--one that could be perhaps considered at least to begin to approach the rational--was a "counterforce" strike in which well over 1,000 thermonuclear weapons would be targeted at America's ballistic missile silos, strategic airfields, and nuclear submarine bases in an effort to destroy the country’s strategic ability to retaliate. Since the attack **would not** directly **target population centers**, most of the ensuing deaths would be from radioactive fallout, and the study estimates that from 2 to 20 million, depending mostly on wind, weather, and sheltering, would perish during the first month.15 That sort of damage, which would kill less than 10 percent of the population, might or might not be enough to trigger words like “annihilation.”

#### 2. No winter – rainout is guaranteed because of conversion to hydrophilic black carbon---eliminates the entire climate effect---and that’s an overestimate.

Reisner et al. 18 [Jon Reisner, atmospheric researcher at LANL Climate and Atmospheric Sciences; Gennaro D'Angelo, UKAFF Fellow and member of the Astrophysics Group at the School of Physics of the University of Exeter, Research Scientist with the Carl Sagan Center at the SETI Institute, currently works for the Los Alamos National Laboratory Theoretical Division; Eunmo Koo, scientist in the Computational Earth Science Group at LANL, recipient of the NNSA Defense Program Stockpile Stewardship Program award of excellence; Wesley Even, R&D Scientist at CCS-2, LANL, specialist in computational physics and astrophysics; Matthew Hecht is a member of the Computational Physics and Methods Group in the Climate, Ocean and Sea Ice Modelling program (COSIM) at LANL, who works on modeling high-latitude atmospheric effects in climate models as part of the HiLAT project; Elizabeth Hunke, Lead developer for the Los Alamos Sea Ice Model, Deputy Group Leader of the T-3 Fluid Dynamics and Solid Mechanics Group at LANL; Darin Comeau, Scientist at the CCS-2 COSIM program, specializes in high dimensional data analysis, statistical and predictive modeling, and uncertainty quantification, with particular applications to climate science; Randall Bos is a research scientist at LANL specializing in urban EMP simulations; James Cooley is a Group Leader within CCS-2. 03/16/2018. “Climate Impact of a Regional Nuclear Weapons Exchange: An Improved Assessment Based On Detailed Source Calculations.” Journal of Geophysical Research: Atmospheres, vol. 123, no. 5, pp. 2752–2772] // Re-Cut Justin

\*BC = Black Carbon

The no-rubble simulation produces a significantly more intense fire, with more fire spread, and consequently a significantly stronger plume with larger amounts of BC reaching into the upper atmosphere than the simulation with rubble, illustrated in Figure 5. While the no-rubble simulation **represents the worst-case scenario** involving vigorous fire activity, **only a relatively small amount of carbon makes its way into the stratosphere** during the course of the simulation. But while small compared to the surface BC mass, stratospheric BC amounts from the current simulations are significantly higher than what would be expected from burning vegetation such as trees (Heilman et al., 2014), e.g., the higher energy density of the building fuels and the initial fluence from the weapon produce an intense response within HIGRAD with initial updrafts of order 100 m/s in the lower troposphere. Or, in comparison to a mass fire, wildfires will burn only a small amount of fuel in the corresponding time period (roughly 10 minutes) that a nuclear weapon fluence can effectively ignite a large area of fuel producing an impressive atmospheric response. Figure 6 shows vertical profiles of BC multiplied by 100 (number of cities involved in the exchange) from the two simulations. The total amount of BC produced is in line with previous estimates (about 3.69 Tg from no-rubble simulation); however, the majority of BC resides **below the stratosphere** (3.46 Tg below 12 km) and can be **readily impacted by scavenging from precipitation** either via pyro-cumulonimbus produced by the fire itself (not modeled) or other synoptic weather systems. While the impact on climate of these more realistic profiles will be explored in the next section, it should be mentioned that **these estimates are** still **at the high end**, considering the inherent simplifications in the combustion model that lead to **overestimating BC production**. 3.3 Climate Results Long-term climatic effects critically depend on the initial injection height of the soot, with larger quantities reaching the upper troposphere/lower stratosphere inducing a greater cooling impact because of longer residence times (Robock et al., 2007a). Absorption of solar radiation by the BC aerosol and its subsequent radiative cooling tends to heat the surrounding air, driving an initial upward diffusion of the soot plumes, an effect that depends on the initial aerosol concentrations. **Mixing and sedimentation** tend to **reduce this process**, and low altitude emissions are also significantly impacted by precipitation if aging of the BC aerosol occurs on sufficiently rapid timescales. But once at stratospheric altitudes, aerosol dilution via coagulation is hindered by low particulate concentrations (e.g., Robock et al., 2007a) and lofting to much higher altitudes is inhibited by gravitational settling in the low-density air (Stenke et al., 2013), resulting in more stable BC concentrations over long times. Of the initial BC mass released in the atmosphere, most of which is emitted below 9 km, **70% rains out within the first month** and 78%, or about 2.9 Tg, is removed within the first two months (Figure 7, solid line), with the remainder (about 0.8 Tg, dashed line) being transported above about 12 km (200 hPa) within the first week. This outcome differs from the findings of, e.g., Stenke et al. (2013, their high BC-load cases) and Mills et al. (2014), who found that most of the BC mass (between 60 and 70%) is lifted in the stratosphere within the first couple of weeks. This can also be seen in Figure 8 (red lines) and in Figure 9, which include results from our calculation with the initial BC distribution from Mills et al. (2014). In that case, only 30% of the initial BC mass rains out in the troposphere during the first two weeks after the exchange, with the remainder rising to the stratosphere. In the study of Mills et al. (2008) this percentage is somewhat smaller, about 20%, and smaller still in the experiments of Robock et al. (2007a) in which the soot is initially emitted in the upper troposphere or higher. In Figure 7, the e-folding timescale for the removal of tropospheric soot, here interpreted as the time required for an initial drop of a factor e, is about one week. This result compares favorably with the “LT” experiment of Robock et al. (2007a), considering 5 Tg of BC released in the lower troposphere, in which 50% of the aerosols are removed within two weeks. By contrast, the initial e-folding timescale for the removal of stratospheric soot in Figure 8 is about 4.2 years (blue solid line), compared to about 8.4 years for the calculation using Mills et al. (2014) initial BC emission (red solid line). The removal timescale from our forced ensemble simulations is close to those obtained by Mills et al. (2008) in their 1 Tg experiment, by Robock et al. (2007a) in their experiment “UT 1 Tg”, and © 2018 American Geophysical Union. All rights reserved. by Stenke et al. (2013) in their experiment “Exp1”, in all of which 1 Tg of soot was emitted in the atmosphere in the aftermath of the exchange. Notably, the e-folding timescale for the decline of the BC mass in Figure 8 (blue solid line) is also close to the value of about 4 years quoted by Pausata et al. (2016) for their long-term “intermediate” scenario. In that scenario, which is also based on 5 Tg of soot initially distributed as in Mills et al. (2014), the factor-of2 shorter residence time of the aerosols is caused by particle growth via coagulation of BC with organic carbon. Figure 9 shows the BC mass-mixing ratio, horizontally averaged over the globe, as a function of atmospheric pressure (height) and time. The BC distributions used in our simulations imply that the upward transport of particles is substantially less efficient compared to the case in which 5 Tg of BC is directly injected into the upper troposphere. The semiannual cycle of lofting and sinking of the aerosols is associated with atmospheric heating and cooling during the solstice in each hemisphere (Robock et al., 2007a). During the first year, the oscillation amplitude in our forced ensemble simulations is particularly large during the summer solstice, compared to that during the winter solstice (see bottom panel of Figure 9), because of the higher soot concentrations in the Northern Hemisphere, as can be seen in Figure 11 (see also left panel of Figure 12). Comparing the top and bottom panels of Figure 9, the BC reaches the highest altitudes during the first year in both cases, but the concentrations at 0.1 hPa in the top panel can be 200 times as large. Qualitatively, the difference can be understood in terms of the air temperature increase caused by BC radiation emission, which is several tens of kelvin degrees in the simulations of Robock et al. (2007a, see their Figure 4), Mills et al. (2008, see their Figure 5), Stenke et al. (2013, see high-load cases in their Figure 4), Mills et al. (2014, see their Figure 7), and Pausata et al. (2016, see one-day emission cases in their Figure 1), due to high BC concentrations, but it amounts to only about 10 K in our forced ensemble simulations, as illustrated in Figure 10. Results similar to those presented in Figure 10 were obtained from the experiment “Exp1” performed by Stenke et al. (2013, see their Figure 4). **In that scenario as well, somewhat less than 1 Tg of BC remained in the atmosphere after the initial rainout**. As mentioned before, the BC aerosol that remains in the atmosphere, lifted to stratospheric heights by the rising soot plumes, undergoes sedimentation over a timescale of several years (Figures 8 and 9). This mass represents the effective amount of BC that can force climatic changes over multi-year timescales. In the forced ensemble simulations, it is about 0.8 Tg after the initial rainout, whereas it is about 3.4 Tg in the simulation with an initial soot distribution as in Mills et al. (2014). Our more realistic source simulation involves the worstcase assumption of no-rubble (along with other assumptions) and hence serves as an upper bound for the impact on climate. As mentioned above and further discussed below, our scenario induces perturbations on the climate system similar to those found in previous studies in which the climatic response was driven by roughly 1 Tg of soot rising to stratospheric heights following the exchange. Figure 11 illustrates the vertically integrated mass-mixing ratio of BC over the globe, at various times after the exchange for the simulation using the initial BC distribution of Mills et al. (2014, upper panels) and as an average from the forced ensemble members (lower panels). All simulations predict enhanced concentrations at high latitudes during the first year after the exchange. In the cases shown in the top panels, however, these high concentrations persist for several years (see also Figure 1 of Mills et al., 2014), whereas the forced ensemble simulations indicate that the BC concentration starts to decline after the first year. In fact, in the simulation represented in the top panels, mass-mixing ratios larger than about 1 kg of BC © 2018 American Geophysical Union. All rights reserved. per Tg of air persist for well over 10 years after the exchange, whereas they only last for 3 years in our forced simulations (compare top and middle panels of Figure 9). After the first year, values drop below 3 kg BC/Tg air, whereas it takes about 8 years to reach these values in the simulation in the top panels (see also Robock et al., 2007a). Over crop-producing, midlatitude regions in the Northern Hemisphere, the BC loading is reduced from more than 0.8 kg BC/Tg air in the simulation in the top panels to 0.2-0.4 kg BC/Tg air in our forced simulations (see middle and right panels). The more rapid clearing of the atmosphere in the forced ensemble is also signaled by the soot optical depth in the visible radiation spectrum, which drops below values of 0.03 toward the second half of the first year at mid latitudes in the Northern Hemisphere, and everywhere on the globe after about 2.5 years (without never attaining this value in the Southern Hemisphere). In contrast, the soot optical depth in the calculation shown in the top panels of Figure 11 becomes smaller than 0.03 everywhere only after about 10 years. The two cases show a similar tendency, in that the BC optical depth is typically lower between latitudes 30º S-30º N than it is at other latitudes. This behavior is associated to the persistence of stratospheric soot toward high-latitudes and the Arctic/Antarctic regions, as illustrated by the zonally-averaged, column-integrated mass-mixing ratio of the BC in Figure 12 for both the forced ensemble simulations (left panel) and the simulation with an initial 5 Tg BC emission in the upper troposphere (right panel). The spread in the globally averaged (near) surface temperature of the atmosphere, from the control (left panel) and forced (right panel) ensembles, is displayed in Figure 13. For each month, the plots show the largest variations (i.e., maximum and minimum values), within each ensemble of values obtained for that month, relative to the mean value of that month. The plot also shows yearly-averaged data (thinner lines). The spread is comparable in the control and forced ensembles, with average values calculated over the 33-years run length of 0.4-0.5 K. This spread is also similar to the internal variability of the globally averaged surface temperature quoted for the NCAR Large Ensemble Community Project (Kay et al., 2015). These results imply that surface air temperature differences, between forced and control simulations, which lie within the spread may not be distinguished from effects due to internal variability of the two simulation ensembles. Figure 14 shows the difference in the globally averaged surface temperature of the atmosphere (top panel), net solar radiation flux at surface (middle panel), and precipitation rate (bottom panel), computed as the (forced minus control) difference in ensemble mean values. The sum of standard deviations from each ensemble is shaded. Differences are qualitatively significant over the first few years, when the anomalies lie near or outside the total standard deviation. Inside the shaded region, differences may not be distinguished from those arising from the internal variability of one or both ensembles. The surface solar flux (middle panel) is the quantity that appears most affected by the BC emission, with qualitatively significant differences persisting for about 5 years. The precipitation rate (bottom panel) is instead affected only at the very beginning of the simulations. The red lines in all panels show the results from the simulation applying the initial BC distribution of Mills et al. (2014), where the period of significant impact is much longer owing to the higher altitude of the initial soot distribution that results in longer residence times of the BC aerosol in the atmosphere. When yearly averages of the same quantities are performed over the IndiaPakistan region, the differences in ensemble mean values lie within the total standard deviations of the two ensembles. The results in Figure 14 can also be compared to the outcomes of other previous studies. In their experiment “UT 1 Tg”, Robock et al. (2007a) found that, when only 1 Tg of soot © 2018 American Geophysical Union. All rights reserved. remains in the atmosphere after the initial rainout, temperature and precipitation anomalies are about 20% of those obtained from their standard 5 Tg BC emission case. Therefore, the largest differences they observed, during the first few years after the exchange, were about - 0.3 K and -0.06 mm/day, respectively, comparable to the anomalies in the top and bottom panels of Figure 14. Their standard 5 Tg emission case resulted in a solar radiation flux anomaly at surface of -12 W/m2 after the second year (see their Figure 3), between 5 and 6 time as large as the corresponding anomalies from our ensembles shown in the middle panel. In their experiment “Exp1”, Stenke et al. (2013) reported global mean surface temperature anomalies not exceeding about 0.3 K in magnitude and precipitation anomalies hovering around -0.07 mm/day during the first few years, again consistent with the results of Figure 14. In a recent study, Pausata et al. (2016) considered the effects of an admixture of BC and organic carbon aerosols, both of which would be emitted in the atmosphere in the aftermath of a nuclear exchange. In particular, they concentrated on the effects of coagulation of these aerosol species and examined their climatic impacts. The initial BC distribution was as in Mills et al. (2014), although the soot burden was released in the atmosphere over time periods of various lengths. Most relevant to our and other previous work are their one-day emission scenarios. They found that, during the first year, the largest values of the atmospheric surface temperature anomalies ranged between about -0.5 and -1.3 K, those of the sea surface temperature anomalies ranged between -0.2 and -0.55 K, and those of the precipitation anomalies varied between -0.15 and -0.2 mm/day. All these ranges are compatible with our results shown in Figure 14 as red lines and with those of Mills et al. (2014, see their Figures 3 and 6). As already mentioned in Section 2.3, the net solar flux anomalies at surface are also consistent. This overall agreement suggests that the **inclusion of organic carbon aerosols, and** ensuing **coagulation** with BC, **should not dramatically alter the climatic effects** resulting from our forced ensemble simulations. Moreover, aerosol growth would likely **shorten the residence time of the BC particulate in the atmosphere** (Pausata et al., 2016), possibly **reducing the duration of these effects.**

#### 3. Prefer empirics – small arsenals and tests prove.

Frankel et al. 15 [Dr. Michael J. Frankel is a senior scientist at Penn State University’s Applied Research Laboratory, where he focuses on nuclear treaty verification technologies, is one of the nation’s leading experts on the effects of nuclear weapons, executive director of the Congressional Commission to Assess the Threat to the United States from Electromagnetic Pulse Attack, led development of fifteen-year global nuclear threat technology projections and infrastructure vulnerability assessments; Dr. James Scouras is a national security studies fellow at the Johns Hopkins University Applied Physics Laboratory and the former chief scientist of DTRA’s Advanced Systems and Concepts Office; Dr. George W. Ullrich is chief technology officer at Schafer Corporation and formerly senior vice president at Science Applications International Corporation (SAIC), currently serves as a special advisor to the USSTRATCOM Strategic Advisory Group’s Science and Technology Panel and is a member of the Air Force Scientific Advisory Board. 04-15-15. “The Uncertain Consequences of Nuclear Weapons Use.” The Johns Hopkins University Applied Physics Laboratory. DTIC. <https://apps.dtic.mil/dtic/tr/fulltext/u2/a618999.pdf>] Justin

Scientific work based on real data, rather than models, also cast additional doubt on the basic premise. Interestingly, publication of several contradictory papers describing experimental observations actually predated Schell’s work. In 1973, nine years before publication of The Fate of the Earth, a published report failed to find any ozone depletion during the peak period of atmospheric nuclear testing.26 In another work published in 1976, attempts to measure the actual ozone depletion associated with Russian megaton-class detonations and Chinese nuclear tests were also unable to detect any significant effect.27 At present, with the reduced arsenals and a perceived low likelihood of a large-scale exchange on the scale of Cold War planning scenarios, official concern over nuclear ozone depletion has essentially fallen off the table. Yet continuing scientific studies by a small dedicated community of researchers suggest the potential for dire consequences, even for relatively small regional nuclear wars involving Hiroshimasize bombs. Nuclear Winter The possibility of catastrophic climate changes came as yet another surprise to Department of Defense scientists. In 1982, Crutzen and Birks highlighted the potential effects of high-altitude smoke on climate,29 and in 1983, a research team consisting of Turco, Toon, Ackerman, Pollack, and Sagan (referred to as TTAPS) suggested that a five-thousand-megaton strategic exchange of weapons between the United States and the Soviet Union could effectively spell national suicide for both belligerents.30 They argued that a massive nuclear exchange between the United States and the Soviet Union would inject copious amounts of soot, generated by massive firestorms such as those witnessed in Hiroshima, into the stratosphere where it might reside indefinitely. Additionally, the soot would be accompanied by dust swept up in the rising thermal column of the nuclear fireball. The combination of dust and soot could scatter and absorb sunlight to such an extent that much of Earth would be engulfed in darkness sufficient to cease photosynthesis. Unable to sustain agriculture for an extended period of time, much of the planet’s population would be doomed to perish, and—in its most extreme rendition—humanity would follow the dinosaurs into extinction and by much the same mechanism.31 Subsequent refinements by the TTAPS authors, such as an extension of computational efforts to three-dimensional models, continued to produce qualitatively similar results. The TTAPS results were severely criticized, and a lively debate ensued between passionate critics of and defenders of the analysis. Some of the technical objections critics raised included the TTAPS team’s neglect of the potentially significant role of clouds;32 lack of an accurate model of coagulation and rainout;33 inaccurate capture of feedback mechanisms;34 “fudge factor” fits of micrometer-scale physical processes assumed to hold constant for changed atmospheric chemistry conditions and uniformly averaged on a grid scale of hundreds of kilometers;35 the dynamics of firestorm formation, rise, and smoke injection;36 and estimates of the optical properties and total amount of fuel available to generate the assumed smoke loading. In particular, more careful analysis of the range of uncertainties associated with the widely varying published estimates of fuel quantities and properties suggested a possible range of outcomes encompassing much milder impacts than anything predicted by TTAPS.37 Aside from the technical issues critics raised, the five-thousand-megaton baseline exchange scenario TTAPS envisioned was rendered obsolete when the major powers decreased both their nuclear arsenals and the average yield of the remaining weapons. With the demise of the Soviet Union, the nuclear winter issue essentially fell off the radar screen for Department of Defense scientists, which is not to say that it completely disappeared from the scientific literature. In the last few years, a number of analysts, including some of the original TTAPS authors, suggested that even a “modest” regional exchange of nuclear weapons—one hundred explosions of fifteenkiloton devices in an Indian–Pakistani exchange scenario—might yet produce significant worldwide climate effects, if not the full-blown “winter.”38 However, such concerns have failed to gain much traction in Department of Defense circles.

#### 4. Threshold of impact is high.

Turchin and Denkenberger 18 [Alexey Turchin & David Denkenberger 18. Turchin is a researcher at the Science for Life Extension Foundation; Denkenberger is with the Global Catastrophic Risk Institute (GCRI) @ Tennessee State University, Alliance to Feed the Earth in Disasters (ALLFED). 05/03/2018. “Classification of Global Catastrophic Risks Connected with Artificial Intelligence.” AI & SOCIETY, pp. 1–17.] // Re-Cut Justin

“Civilizational collapse risks” As most human societies are fairly complex, a true civilizational collapse would require a drastic reduction in human population, and the break-down of connections between surviving populations. Survivors would have to rebuild civilization from scratch, likely losing much technological abilities and knowledge in the process. Hanson (2008) estimated that the minimal human population able to survive is around 100 people. Like X risks, there is little agreement on what is required for civilizational collapse. Clearly, different types and levels of the civilizational collapse are possible (Diamond, 2005) (Meadows, Randers, & Meadows, 2004). For instance, one definition of the collapse of civilization involves, collapse of long distance trade, widespread conflict, and loss of government (Coates, 2009). How such collapses relate to existential risk needs more research.

#### Empirics and worse disasters disprove.

Eken 17 [Mattias Eken – PhD student in Modern History at the University of St Andrews. “The understandable fear of nuclear weapons doesn’t match reality”. 3/14/17. <https://theconversation.com/the-understandable-fear-of-nuclear-weapons-doesnt-match-reality-73563>] Recut Justin

Nuclear weapons are unambiguously the most destructive weapons on the planet. Pound for pound, they are the most lethal weapons ever created, capable of killing millions. Millions live in fear that these weapons will be used again, with all the potential consequences. However, the destructive power of these weapons **has been vastly exaggerated**, albeit for good reasons. Public fear of nuclear weapons being used in anger, whether by terrorists or nuclear-armed nations, has risen once again in recent years. **This is** in no small part **thanks to the current political climate** between states such as the US and Russia and the various nuclear tests conducted by North Korea. But whenever we talk about nuclear weapons, it’s easy to get carried away with doomsday scenarios and apocalyptic language. As the historian Spencer Weart once argued: “**You say ‘nuclear bomb’ and everybody immediately thinks of the end of the world.**” Yet the means necessary to produce a nuclear bomb, let alone set one off, remain incredibly complex – and while the damage that would be done if someone did in fact detonate one might be very serious indeed, **the chances that it would mean “the end of the world” are vanishingly small**. In his 2013 book Command and Control, the author Eric Schlosser tried to scare us into perpetual fear of nuclear weapons by recounting stories of near misses and accidents involving nuclear weapons. One such event, the 1980 Damascus incident, saw a Titan II intercontinental ballistic missile explode at its remote Arkansas launch facility after a maintenance crew accidentally ruptured its fuel tank. Although the warhead involved in the incident didn’t detonate, Schlosser claims that “if it had, much of Arkansas would be gone”. But that’s not quite the case. The nine-megaton thermonuclear warhead on the **Titan II** missile had a blast radius of 10km, or an area of about 315km². The state of Arkansas spreads over 133,733km², meaning the weapon **would have caused destruction across 0.2% of the state.** That would naturally have been a terrible outcome, but certainly not the catastrophe that Schlosser evokes. Claims exaggerating the effects of nuclear weapons have become commonplace, especially after the September 11 terrorist attacks in 2001. In the early War on Terror years, Richard Lugar, a former US senator and chair of the Senate Foreign Relations Committee, argued that terrorists armed with nuclear weapons pose an existential threat to the Western way of life. What he failed to explain is how. It is by no means certain that a single nuclear detonation **(or even several)** would do away with our current way of life. Indeed, **we’re still here despite having nuked our own planet more than 2,000 times** – a tally expressed beautifully in this video by Japanese artist Isao Hashimoto). While the 1963 Limited Test Ban Treaty forced nuclear tests underground, **around 500 of** all **the nuclear weapons detonated were unleashed in the Earth’s atmosphere**. This includes the world’s largest ever nuclear detonation, the 57-megaton bomb known as **Tsar Bomba**, detonated by the Soviet Union on October 30 1961. Tsar Bomba was more than 3,000 times more powerful than the bomb dropped on Hiroshima. That is immense destructive power – but as one physicist explained, **it’s only “one-thousandth the force of an earthquake, one-thousandth the force of a hurricane”.** The Damascus incident proved how incredibly hard it is to set off a nuclear bomb and the limited effect that would have come from just one warhead detonating. Despite this, some scientists have controversially argued that an even limited all-out nuclear war might lead to a so-called nuclear winter, since the smoke and debris created by very large bombs could block out the sun’s rays for a considerable amount of time. To inflict such ecological societal annihilation with weapons alone, we would have to detonate hundreds if not thousands of thermonuclear devices in a short time. Even in such extreme conditions, the area actually devastated by the bombs would be limited: for example, **2,000 one-megaton explosions with a destructive radius of five miles each would directly destroy less than 5% of the territory of the US**. Of course, if the effects of nuclear weapons have been greatly exaggerated, there is a very good reason: since these weapons are indeed extremely dangerous, any posturing and exaggerating which intensifies our fear of them makes us less likely to use them. But it’s important, however, to understand why people have come to fear these weapons the way we do. After all, nuclear weapons are here to stay; they can’t be “un-invented”. If we want to live with them and mitigate the very real risks they pose, we must be honest about what those risks really are. Overegging them to frighten ourselves more than we need to keeps nobody safe.