#### Superior studies- theirs are confirmation-bias laden and repeatedly disproven

S. Fred **Singer 18**. Professor emeritus at the University of Virginia and a founding director and now chairman emeritus of the Science & Environmental Policy Project, specialist in atmospheric and space physics, founding director of the U.S. Weather Satellite Service, now part of NOAA, served as vice chair of the U.S. National Advisory Committee on Oceans &amp; Atmosphere, an elected fellow of several scientific societies, including APS, AGU, AAAS, AIAA, Sigma Xi, and Tau Beta Pi, and a senior fellow of the Heartland Institute and the Independent Institute. 6-27-2018. "Remember Nuclear Winter?." American Thinker. https://www.americanthinker.com/articles/2018/06/remember\_nuclear\_winter.html

Nuclear Winter burst on the academic scene in December 1983 with the publication of the hypothesis in the prestigious journal Science. It was accompanied by a study by Paul Ehrlich, et al. that hinted that it might cause the extinction of human life on the planet. MCANW stands for Medical Campaign Against Nuclear Weapons. Photo via Wellcome Images. The five authors of the Nuclear Winter hypothesis were labeled TTAPS, using the initials of their family names (T stands for Owen Toon and P stands for Jim Pollak, both Ph.D. students of Carl Sagan at Cornell University.) Carl Sagan himself was the main author and driving force. Actually, Sagan had scooped the Science paper by publishing the gist of the hypothesis in Parade magazine, which claimed a readership of 50 million! Previously, Sagan had briefed people in public office and elsewhere, so they were all primed for the popular reaction, which was tremendous. Many of today's readers may not remember Carl Sagan. He was a brilliant astrophysicist but also highly political. Imagine Al Gore, but with an excellent science background. Sagan had developed and narrated a television series called Cosmos that popularized astrophysics and much else, including cosmology, the history of the universe. He even suggested the possible existence of extraterrestrial intelligence and started a listening project called SETI (Search for Extraterrestrial Intelligence). SETI is still searching today and has not found any evidence so far. Sagan became a sort of icon; many people in the U.S. and abroad knew his name and face. Carl Sagan also had another passion: saving humanity from a general nuclear war, a laudable aim. He had been arguing vigorously and publicly for a "freeze" on the production of more nuclear weapons. President Ronald Reagan outdid him and negotiated a nuclear weapons reduction with the USSR. In the meantime, much excitement was stirred up by Nuclear Winter. Study after study tried to confirm and expand the hypothesis, led by the Defense Department (DOD), which took the hypothesis seriously and spent millions of dollars on various reports that accepted Nuclear Winter rather uncritically. The National Research Council (NRC) of the National Academy of Sciences published a report that put in more quantitative detail. It enabled critics of the hypothesis to find flaws – and many did. The names Russell Seitz, Dick Wilson (both of Cambridge, Mass.), Steve Schneider (Palo Alto, Calif.), and Bob Ehrlich (Fairfax, Va.) (no relation to Paul Ehrlich) come to mind. The hypothesis was really "politics disguised as science." The whole TTAPS scheme was contrived to deliver the desired consequence. It required the smoke layer to be of just the right thickness, covering the whole Earth, and lasting for many months. The Kuwait oil fires in 1991 produced a lot of smoke, but it rained out after a few days. I had a mini-debate with Sagan on the TV program Nightline and published a more critical analysis of the whole hypothesis in the journal Meteorology & Atmospheric Physics. I don't know if Carl ever saw my paper. But I learned a lot from doing this analysis that was useful in later global warming research. For example, the initial nuclear bursts inject water vapor into the stratosphere, which turns into contrail-like cirrus clouds. That actually leads to a strong initial warming and a "nuclear summer."

## T

#### Interpretation: “private entities” excludes governments

UpCounsel n.d. [(UpCounsel, interactive online service that makes it faster and easier for businesses to find and hire legal help solely based on their preferences) “Private Entity: Everything You Need to Know”] JL

A private entity can be a partnership, corporation, individual, nonprofit organization, company, or any other organized group that is not government-affiliated. Indian tribes and foreign public entities are not considered private entities.

#### Violations:

#### The aff requires bans governments from alienating resources for non-publicly justified purposes – 1AC Babcock

The PTD offers both an approach for managing an open access commons and a gap-filling tool until a regulatory regime is adopted.507 The doctrine is based on the idea that the “sovereign holds certain common properties in trust in perpetuity for the free and unimpeded use of the general public.”508 The public’s right to access and use trust resources is never lost, and neither the government nor private individuals can alienate or otherwise adversely affect those resources unless for a comparable public purpose.509 The resources the doctrine protects “have long been part of a ‘taxonomy of property’ [that recognizes] the division of natural wealth into private and public property.”510

#### The 1AC defends “sustainable space activities” broadly – that includes activities towards space like rocket launches which aren’t appropriation – Westwod inserts yellow

1AC Aganaba-Jeanty 16 (, T., 2016. Space Sustainability and the Freedom of Outer Space. [online] Taylor & Francis. Available at: <https://www.tandfonline.com/doi/full/10.1080/14777622.2016.1148463> [Accessed 15 December 2021] Timiebi is an assistant professor of Space and Society, in the School for the Future of Innovation in Society, an affiliate faculty with the Interplanetary Initiative, a senior global futures scientist with the Global Futures Lab, and holds a courtesy appointment at the Sandra Day O’Connor College of Law, all at Arizona State University. Timiebi was a post-doctoral fellow and is a senior fellow at the Centre for International Governance Innovation (CIGI) based in Waterloo, Ontario Canada where she focused on environmental and space governance. Timiebi was Executive Director of the World Space Week Association coordinating the global response to the UN 1999 declaration that World Space Week should be celebrated Oct 4-10 annually. She is currently on the Advisory Board for the Space Generation Advisory Council supporting the UN Programme on Space Applications. She is also on the Science Advisory Board of World View Enterprises and the SETI Institute. - pp. 10-13.)-rahulpenu //recut pranav

---Critique of status quo polices for space sustainability

---New regimes key

---Sustainability needs to be in law

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Definitions of space sustainability The Secure World Foundation defines space sustainability as “ensuring that all humanity can continue to use outer space for peaceful purposes and socioeconomic benefit.”39 It is also described as “the ability of all humanity to continue to use outer space for peaceful purposes and socioeconomic benefit over the long term.” It is proposed that, read together, these broad definitions take as their premise that: (1) all humanity thus far is using space for peaceful purposes and for socioeconomic benefit; (2) this use is threatened; (3) measures must be taken to protect it; and (4) all humanity currently possesses the ability, in the sense of having a skill or the capacity, to ensure space sustainability for peaceful purposes. Under this conceptualization, the negative effect of not using space sustainably is primarily economic.40 Bearing in mind the governmental origins of space exploitation, where market economics did not play a primary role in decision making, the growing focus on the economic perspective in space affairs acknowledges Carolyn Deere’s opinion that problems emerge in the international domain from an absence of powerful economic interests.41 Of course, as more space applications are developed, economic interests become more prevalent in that market protectionism then underlies the rationales for many positions taken. Space sustainability is also conceptualized as defining good behavior, its boundaries, and disincentives for negative behavior in space.42 Space sustainability then becomes a much more limited political concept calling for specific measures to strengthen norms.43 Some notable examples follow: An International Code of Conduct—the European Union proposed a non-binding voluntary code whose purpose is “security, safety, sustainability” for all space activities providing for general measures on space operations and space debris.44 The Scientific and Technical Subcommittee of UNCOPUOS working group objective of establishing guidelines for the long-term sustainability of outer space activities. Proposed International Civil Aviation Organization for Space—the establishment of an international organization focused on space safety and the establishment of binding safety standards similar to the International Civil Aviation Organization.45 Industry efforts for a global space situational awareness database Group of Governmental Experts (GGE) on Transparency and Confidence Building Measures. 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The second component is the political environment, and includes promoting stability and preventing conflict between nations.”50 Bearing this in mind and notwithstanding the potential confusion caused by the interchangeability of terms used, at the core of all proposals conceptualizing space sustainability or related concepts are the notions that: (1) space assets are kept safe and secure, and that the assets are not harmed or interfered with; (2) peaceful space activities continue as free from purposeful/intentional or unintentional harmful interference; (3) the space environment is preserved for peaceful uses; and (4) international cooperative efforts are required. These four points are understood to be the current core conditions for and of space sustainability. It must be acknowledged that space sustainability, in this context, is severed from the ecological roots of sustainable development. 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This logic emphasizes that “the more different countries, companies, and individuals depend on space for a growing array of purposes, the more they need equitable rules, shared decision-making procedures, and effective compliance mechanisms to maximize the benefits that they all can gain from space, while minimizing risks from irresponsible space behaviors or deliberate interference with legitimate space activities.”52 While it is acknowledged that such a need exists, the difficulty in reaching agreement on how to bring it about is one reason why some states are more focused on producing a dialogue on long-term sustainability. This is seen in the proliferation of reports outlining best practices and options that enhance sustainability through increased information sharing, as well as a focus on technical issues rather than on the creation of any new legal regimes. To minimize some of the risks of non-sustainable space use, Weeden53 proposes a three-pillar technical approach to space sustainability: (1) debris mitigation; (2) debris removal; and (3) space traffic management. This is conjoined with an immediate need for data in support of conjunction assessment and collision avoidance. This emphasis on data sharing/collection includes enabling research into potential solutions to the problem of space debris, and enhancing transparency and cooperation among states. Weeden also suggests that this narrow approach to space sustainability serves both to educate space actors about the severity of the space debris problem and to provide stability to reduce the likelihood of conflict. A common approach to data also serves as verification for a potential code of conduct in space, setting the stage for future space governance models. These proposals follow the logic of sustainability for global security. While this logic is in line with the dominant conceptualization of benefit sharing and freedom of outer space, the position taken in this article is that it does not adequately speak to sustainability from the perspective of aspirant space states. To do so requires a significantly broader discussion and solutions aimed towards aligning space law and policy with the sustainable development paradigm, if understood as being an inclusive paradigm and not focused on the individualistic/self-interested nature of the current conception of sustainable development. A systemic, sustainable development law approach calls for a conscious engagement with the web of overlapping social, environmental, cultural, and legal frameworks, as well as cultural considerations, economic policies, expectations, players, and interests.54 Bearing in mind current U.S. space policy,55 such a broad overarching objective may not be achievable as part of the dialogue on the “Long Term Sustainability of Outer Space Activities,” but U.S. policy regarding preservation of the space environment nevertheless offers insights because international initiatives congruent with it are likely to garner the most support. Schrogl56 proposed that sustainability is rendered to threats and risks to satellite operations. This approach acknowledges the intersection of multiple issue areas: environment, security, mobility, knowledge, resources, and energy. This intersection of issue areas is more akin to the wider discourse of sustainability development of and on the Earth, and prompts a discussion of value to emerging and aspirant space actors. Otherwise, the dominant conceptualization of space sustainability removes any focus upon providing for the needs of those not among the most advanced space nations. This problem is highlighted in Peter and Rathgeber’s definition of space sustainability: Sustainable space activities can be seen as activities (in space, from space, through space and towards space) that meet the needs of the present space actors without comprising the ability of future generations to meet their own needs of performing space related operations safely.57 Peter and Rathgeber claim that the emergence of new institutional space actors, particularly from the south, is putting a greater pressure on the space environment and that the participation of the south in space sustainability efforts is unsatisfactory.58 Yet, the role of less-advanced nations in sustainability initiatives is more so on the receiving end in that advanced nations seek to engage newcomers to space during the early phase of the development of future directives and codes of conduct for sustainable space activities; that is,not really to seek their input, but to ensure compliance by the less-advanced nations.59 Their space activities are judged as either threats to or consistent with space sustainability, rather than as part of articulating the content of space sustainability.60 This indicates that, for national space programs of established space nations, a truly international focus on space sustainability is not a priority**.** It is interesting to note, at this juncture in the discussion, a fundamental provision proposed by a group of developing states during the development of the U.N. Space Benefits Declaration.61 (1) All States should pursue their activities in Outer Space with due regard to the need to preserve Outer Space, in such a way as not to hinder its continued utilization and exploration. (2) States should pay attention to all aspects related to the protection and preservation of the Outer Space environment, especially those potentially affecting the Earth’s environment. (3) States with relevant space capabilities and with programs for the utilization and exploration of outer space should share with developing countries on an equitable basis the scientific and technological knowledge necessary for the proper development of programs oriented to the more rational utilization and exploration of Outer Space.62 Paragraph 3 is fundamental and truly revealing when read in the light of the analysis of Schrogl.63 Schrogl claims that the declaration takes up the problem of space debris, which might endanger future space utilization to a significant extent. However, he also states that “the wish [of the Developing countries] to be informed about debris prevention measures voiced. . . is reasonable but actually needs no mentioning since these technological developments are discussions and documented publicly to the greatest extent.”64

#### Vote negative for limits – their interpretation justifies affs banning any government from appropriating space – that skirts the core topic controversy of what private entities specifically should do and kills uniqueness because national appropriation is already prohibited – unlimited topics incentivize obscure affs that negs won’t have prep on – limits are key to reciprocal prep burden – extra T creates a slippery slope that incentivizes Frankenstein affs with infinite additional planks to circumvent neg links

## Case

### 1NC – Solvency

#### Massive public sector alt cause PTD expansion is only a temporary solution, and the plan kills private sector innovation – Westwood inserts blue.

1AC Babcock 19 (, H., 2019. THE PUBLIC TRUST DOCTRINE, OUTER SPACE, AND THE GLOBAL COMMONS: TIME TO CALL HOME ET. [online] Lawreview.syr.edu. Available at: <https://lawreview.syr.edu/wp-content/uploads/2019/09/H-Babcock-Article-Final-Document-v2.pdf#page=67> [Accessed 15 December 2021] Professor Babcock served as general counsel to the National Audubon Society from 1987-91 and as deputy general counsel and Director of Audubon’s Public Lands and Water Program from 1981-87. Previously, she was a partner with Blum, Nash & Railsback, where she focused on energy and environmental issues, and an associate at LeBoeuf, Lamb, Leiby & MacRae where she represented utilities in the nuclear licensing process. From 1977-79, she served as a Deputy Assistant Secretary of Energy and Minerals in the U.S. Department of the Interior. Professor Babcock has taught environmental and natural resources law as a visiting professor at Pace University Law School and as an adjunct at the University of Pennsylvania, Yale, Catholic University, and Antioch law schools. Professor Babcock was a member of the Standing Committee on Environmental Law of the American Bar Association, and served on the Clinton-Gore Transition Team.)-rahulpenu

INTRODUCTION Space exploration is heating up. Governments and private interests are on a fast track to develop technologies to send people and equipment to celestial bodies, like the moon and asteroids, to extract their untapped resources.1 Near-space is rapidly filling up with public and private satellites, causing electromagnetic interference problems and dangerous space debris from collisions and earlier launches.2 The absence of a global management system for the private commercial development of outer space resources will allow these near space problems to be exported further into the galaxy.3 Moreover, without a governing authority or rules controlling entry or limiting despoliation, outer space could turn into the “Wild West” of the twenty-first century.4 Space treaties executed in the last century espoused the principle that space should be developed for the benefit of all mankind and banned both private ownership and militarization of space resources.5 But, they left development of a system for managing non-military activities in outer space to another day.6 Private commercial interests, which would be absorbing the risks and paying the high costs of space development, oppose any management scenario premised on that principle, as it would enable less developed countries to free ride on their investments.7 These interests, unsurprisingly, support privatizing outer space.8 But acceding to their wishes by establishing a system of property-based rules would transport Earth’s current division between haves and have-nots into outer space, and could lead to destabilizing hostilities—the exact consequences that the early treaty drafters hoped to avoid.9 To date, most scholars in this area have focused on developing management systems premised on private ownership or possession of the surface of some celestial body.10 This Article explores an alternative concept, the commons, in which no individual owns the property in question or can exclude others from it. Viewing property as a commons is closer to the principles set out in the various space treaties than implementation of a private property regime, and also offers a workable property regime. This Article demonstrates these conclusions by showing similarities between a large, Earth-bound commons, like the ocean and outer space, and how various commons management scenarios allow equitable use of resources, while preventing their despoliation and devolution into hostile disputes over entitlements to them. However, each of these commons management scenarios is flawed in some way and runs a similar risk to management approaches for private property of allowing the resource to be over-used or inequitably distributed. The public trust doctrine (**PTD**), an ancient doctrine that governments and individuals have used effectively for centuries to protect the public’s interests in terrestrial common pool resources (CPR) **and** to **fill** regulatory **gaps**, can be helpful in both respects.11 An examination of the doctrine identifies **commonalities** **between** outer **space** **and** **terrestrial** public trust **resources**.12 The **ease** and **low** **cost** of its implementation and enforcement, as well as its infinite malleability, are additional reasons to select it as a stopgap measure with some modification.13 This Article’s structure is straight forward. Part I acquaints the reader with the problem. It explains why the need to develop a management regime for space is becoming increasingly critical as advancing technology is allowing more and more private commercial interests to play at the edge of outer space with attendant negative externalities. 14 Soon these technological advances will allow private commercial interests to invade outer space with the potential for similar adverse impacts.15 Part II examines the international legal framework governing those activities and finds it lacks any capacity to regulate activities in outer space, in part because it is riddled with ambiguities and contradictions when it comes to ownership of outer space and its resources. Part III turns to that problem by discussing two types of property: private property and property owned in common with others. It examines the key features of each as well as their positive and negative attributes, how each might function in outer space, and what the consequences might be if one or the other prevailed. Because any property arrangement that results in its appropriation by the owner and the exclusion of others violates international space law, Part III also identifies various less-thanfull fee property arrangement, like leases and easements, to see if these problems can be avoided and concludes they cannot.16 It then examines property held in common to determine its viability under international space law and finds it consistent. Part IV investigates various approaches to managing property in outer space, be it held in private ownership or in common. Different approaches for managing private property in space are explored, including the right of first possession, tradable property claims, and establishing an exclusive economic zone, as well for managing an open access commons, such as the application of stewardship principles, norms, and the PTD. Each approach is evaluated in terms of its consistency with international law; its ability to promote and protect a sustainable, equitable, non-monopolistic, non-hostile environment in outer space; its efficiency; and its cost effectiveness. Only the PTD, which has been used for centuries to protect the public’s interests in CPRs and has demonstrated its ability to adapt to new circumstances, may be able to meet these goals.17 This Article finds commonalities between outer space and Earth-bound public trust resources, like the oceans. Additionally, the doctrine’s open access purpose resonates with language found in international treaties governing activities in outer space.18 This Article concludes that using the PTD will lead to a durable, equitable management regime in a commons where the wealthy are neither able to accumulate and control the resources that outer space has to offer nor over-exploit and deplete them. However, neither the doctrine nor ownership in common supplies any incentives for development, which may lead private enterprises to question whether development of outer space resources is worth the risks and costs.19 But, limited use of private property management approaches, like lotteries and tradable development claims—a form of overlapping hybridity between one type of property, a commons, and a management regime from another, private property—may fill this gap.20 This Article’s contribution to the literature on managing outer space resources and commons theory is using the PTD to bridge the gap between them and to suggest a hybrid management approach that melds commons theory with private property incentives.

#### sustainability requires much broader discussions than the aff AND they’re not a radical reconceptualization of sustainability, but the same “dominant conceptualization” their ev criticizes – Westwood is blue.

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### 1NC – Scenario 2

#### This ev is terrible – they’re massively extra T, squo arms control solves escalation, their ev shits on the aff AND space militarization is inevitable – Westwood inserts blue.

1AC Perez 21 Veronica Delgado-Perez. 12/14/21. Argument | The Commercialization of Space Risks Launching a Militarized Space Race. <https://www.theintlscholar.com/periodical/12/14/2020/analysis-commercialization-space-risk-international-law-military-space-race> [Veronica Delgado-Perez is a Staff Writer at The International Scholar.] // CVHS SR

Fundamentals of the Final Frontier It is a geopolitical imperative to determine what, if any, commercial activities and use of extraterrestrial resources are permitted within the confines of international law. Without clear-cut agreements on what activity is recognized by international law, the world will undoubtedly see states push the boundaries ever further in an attempt to gain the edge over geopolitical competitors — even more-so in an era of renewed great power competition. Yet to date, there exists no comprehensive treaty or legal reference to commercial activity in space. However, this should come as no surprise. It has only been since the turn of the century that technology and markets have progressed to the point where commercial space exploration and exploitation has become possible. Only recently have experts and analysts of geopolitics and international law begun to seriously examine questions surrounding the legal framework that would govern extraterrestrial resource-mining and other commercial activities. In the last decade, the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) dealt with commercial aspects in outer space. In one of their last reports, the Committee expressed that the era of the commercial utilization of outer space’s resources is intrinsically linked to the escalation of international competition over resources, which could threaten international peace and security. By encouraging the international community to engage in outer space’s activities for the benefit of humankind as a whole, “some delegations” have expressed that states should avoid the promotion of laws and regulations related to the commercialization of outer space, arguing that it should be considered the heritage of all humanity. In that regard, states must then ensure that domestic law on the use of outer space complies with international space law, which means that states should respect the principles outlined in the Outer Space Treaty and ensure that national regulations do not contravene international provisions. Even though the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies (which entered into force in 1967), refers to the exploration and use of outer space, it does not address questions of a commercial nature, which compromises the ability of states and international actors to address new challenges to extraterrestrial activities. In several provisions, the treaty highlights that these activities may be carried out for peaceful purposes and the benefit of all people, reaffirming that outer space is not subject to national appropriation. Were outer space not considered a global commons, that would imply that the resources and results of commercial exploration may fall within the jurisdiction of a country. It is thus incumbent upon Washington — and its commercial enterprises — to demonstrate how American commercial exploration of space benefits other countries and complies with international space law, or otherwise to adhere to the spirit of past treaties which emphasize the impartiality of outer space until such time as the law is clarified. International Law is Adrift in Space The potential benefits of commercial space exploration cannot be ignored. From an economic standpoint, the space industry would generate a significant economic boon for both states and private companies, due to the abundance and variety of resources — particularly scarce minerals that are difficult to extract on Earth. As one example of the vastness of resources held in outer space, one asteroid has the potential to contain more than the total supply of platinum extracted throughout the history of mankind. It may very well open the door to an advanced era of space navigation, building extraterrestrial infrastructure that facilitates the exploration and use of space’s resources, and extra-planetary human habitation. Inevitably, there are significant drawbacks to the commercialization of space exploration. These can vary, for instance, from the commercial dominance of space’s natural resources only by those states with the technical and financial capital to support space missions, to geopolitical competition over extraterrestrial resources that threatens world peace and security, to the potential for the monopolization of extraterrestrial resources by states and private companies. As was the case during the Cold War, the Soviet Union and the United States began a Space Race in which they struggled to achieve supremacy in space exploration and domination of science. Today, the number of space powers has increased thanks to continual advancements in flight, combustion, and fueling technologies. In the three decades since the end of the Cold War, technologically advanced countries like China, Japan, and France which previously had no space program have successfully navigated to the top tier of space-faring agencies and programs. In 2018, the U.S. allocated $41 billion to space programs, followed by China at $5.8 billion, and Russia at $3.1 billion. Collectively, the three major space powers control almost 65% of the global industry, showing space powers are monopolizing space and reinforcing the inequality gap between states that do not have sufficient economic and technological capacity to invest. With new actors on the game stage, conflicts of interest may arise. There is a risk that each actor adopts a kind of short-term Realist approach to space policy — one which is driven by self-interest in reaping the greatest benefits of extraterrestrial exploration and commercialization while controlling access to others. If unmitigated, states may choose to militarize outer space to gain a strategic edge over competitors and adversaries. This process has already begun. Under the Trump administration, the Pentagon established the U.S. Space Force as a new branch of the Armed Forces to protect the country and allied interests in space. Already, Delta 4 — one of the U.S. Space Force’s missions — conducts strategic and theater missile warnings, manages weapon systems, and provides information to missile defense forces. The measure shows that for the U.S., outer space is not only a domain of scientific exploration but has the potential to become increasingly securitized. With the impending expiration of the Strategic Arms Reduction Treaty (START) between the U.S. and Russia on February 5, 2021, a number of security dilemmas could arise. If the world’s two largest nuclear powers do not edge toward extending the treaty, Washington and Moscow risk returning to the era of unrestricted expansion of launch platforms and strategically-deployed nuclear warheads — potentially with the aid of military infrastructure in space. Although President-elect Biden has expressed his interest in negotiating an extension of New START, how Moscow and Washington might proceed remains an open question. Bilateral progress towards a new arms-control regime would require establishing limits on the number and range of long- and mid-range missiles, establishing measures to limit the expansion of traditional missile deployment to space, and banning the deployment of nuclear weapons and weapons of mass destruction in outer space. More than the risk of the securitization of space, state, and private actors could begin to claim exclusive legal rights over the resources they discover. Indeed, the U.S. Commercial Space Launch Competitiveness Act, which came into force in 2015, expressly recognizes the right of U.S. Citizens to possess, own, transport, use, and sell space resources. By this means, domestic law already acknowledges the legal claim to property by individuals, which is prohibited by international law. Under the Outer Space Treaty, states renounced any traditional form of acquisition of territories and agreed not to foray unilaterally into space to extend their national policies on Earth or to exercise any kind of sovereignty over celestial bodies or resources. The absence of a modern international treaty that addresses these issues should be received with grave concern, as there is significant potential for risk to become reality. Existing UN treaties lack the technological context and foresight to address legal questions regarding the potential for commercial exploration and exploitation of outer space or its resources. During the sixties and seventies, when international instruments like the Outer Space treaty were conceived, the principal aim of states was to support and expand the scale of the state’s national capacity for operation in space and the development of legal instruments to guide state’s international cooperation in the peaceful exploration of outer space. These instruments were never designed to respond to commercial questions over mining or tourism in space, private investment in space activities, or the emergence of non-state private enterprises operating in space. As a result, private enterprises operating in the vacuum of space also float in an unstable legal vacuum which threatens to implode in geopolitical competition. Beyond Stars and States In an increasingly commercial outer space in which there are no set limits to the exploitation of resources or claim to property, states and private companies will inevitably pursue the development of new extraterrestrial industries to suit their geoeconomic interests. If unchecked, the legal protection of outer space as a domain of exploration for the benefit of all humanity would functionally fail. To protect investments and profit from national space industries, states would likely resort to military force to protect and secure private assets. Over time, space would ultimately become a fourth border domain over which states claim, exercise, and defend sovereignty — including through the use of force. The challenge is thus to prevent the circumstances that could lead to space-borne conflict before it is made possible. Notwithstanding, commercial exploration and the use of natural resources need not lead to predation among actors involved in space. The potential rewards — both technological and environmental — that could come from investment in the harvesting of resources in space are immense. International law cannot afford to wait for the security dilemma posed by commercial activity in space to manifest before addressing it but must anticipate and proactively adopt measures to address future issues that govern extraterrestrial human activity. The only remedy for the lack of legal governance over commercial activity in space is the creation of new international laws through a comprehensive international treaty on commercial operations in space. The new treaty must expressly regulate commercial activities by states and private companies, enshrine an international liability and compensation regime covering damages caused with workable sanction provisions, and reinforce norms that restrict any militarization of outer space. The international community should focus its efforts on establishing a legal regime, with mandatory provisions (rather than non-binding resolutions, observations, commentaries, and conclusions) which generate both international responsibility and provide enforceable sanctions in the event of violations. The effort should be borne out by expanding the scope and strengthening the oversight powers of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), rather than creating a new organ with redundant bureaucracy. Beyond the tasks of encouraging space research programs, studying space activities, and addressing legal questions, COPUOS should be granted the necessary powers to perform control and oversight monitoring functions. Experience has taught the international community that cooperative arrangements between states and international organizations can prevent competition for resources from escalating to kinetic conflict. Through cooperation, there is a chance to preserve extraterrestrial resources for future generations, secure an equitable allocation of resources and benefits with a mind to each country’s specific needs, and prevent the expansion of geopolitical conflict to the domain of space. Space powers must recognize the value in partnering with other states to advance the development of space programs more efficiently. It should be clear now that all nations could reap the benefits of collective action, exploration, and commercialization of resources from beyond Earth’s atmosphere while preventing a drawn-out international conflict to the final frontier. The will of states not to jeopardize the fundamental basis of international law must be reflected in coordination and surveillance efforts to ensure that the advantages derived from space exploration allow humanity to continue evolving.

#### No miscalc – debris hits stations all the time.

Cain ’15 (Fraser; 12/23/15; writer for Universe Today; “How Do Astronauts Avoid Debris”; http://www.universetoday.com/121067/how-do-astronauts-avoid-debris)

So, just how do we keep our space stations, ships and astronauts from being riddled with holes from all of the space junk in orbit around Earth? We revel in the terror grab bag of all the magical ways to get snuffed in space. Almost as much as we celebrate the giant brass backbones of the people who travel there. We’ve already talked about all the scary ways that astronauts can die in space. My personal recurring “Hail Mary full of grace, please don’t let me die in space” nightmare is orbital debris. We’re talking about a vast collection of spent rockets, dead satellites, flotsam, jetsam, lagan and derelict. It’s not a short list. NASA figures there are **21,000 bits of junk** bigger than 10 cm, **500,000 particles** between 1 and 10 cm, and more than **100 million** smaller than 1 cm. Sound familiar, humans? This is our high tech, sci fi great Pacific garbage patch. Sure, a tiny rivet or piece of scrap foil doesn’t sound very dangerous, but consider the fact that astronauts are orbiting the Earth at a velocity of about 28,000 km/h. And the Tang packets, uneaten dehydrated ice cream, and astronaut poops are also traveling at 28,000 km/h. Then think about what happens when they collide. Yikes… or yuck. Here’s the International Space Station’s solar array. See that tiny hole? Embiggen and clarinosticate! That’s a tiny puncture hole made in the array by a piece of orbital crap. The whole station is **pummeled by tiny pieces of space program junk drawer contents**. Back when the Space Shuttle was flying, NASA had to **constantly replace their windows because of the damage they were experiencing** from the orbital equivalent of Dennis the Menace hurling paint chips, fingernail clippings, and frozen scabs.

### 1NC – Scenario 3

#### Space launches are comparatively better & decrease overall emissions

Emerging Technology 18, 10-19-2018, "Asteroid mining might actually be better for the environment," MIT Technology Review, <https://www.technologyreview.com/2018/10/19/139664/asteroid-mining-might-actually-be-better-for-the-environment/>

But profit margins are only part of the picture. A potentially more significant aspect of these missions is the impact they will have on Earth’s environment. But nobody has assessed this environmental impact in detail. Today, that changes thanks to the work of Andreas Hein and colleagues at the University of Paris-Saclay in France. These guys have calculated the greenhouse-gas emissions from asteroid-mining operations and compared them with the emissions from similar Earth-based activities. Their results provide some eyebrow-raising insights into the benefits that asteroid mining might provide. The calculations are relatively straightforward. Rocket launches release significant amounts of greenhouse gases into the atmosphere. The fuel on board the first stage of a rocket burns in Earth’s atmosphere to form carbon dioxide. For kerosene-burning rockets, one kilogram of fuel creates three kilograms of CO2. (The second and third stages operate outside the Earth’s atmosphere and so can be ignored.) Reentries are just as damaging. That’s because a significant mass of a re-entering vehicle ablates in the upper atmosphere, producing NOx such as nitrous oxide (N2O), a greenhouse gas that is about 300 times more potent than CO2. By one estimate, the space shuttle released about 20% of its mass in the form of N2O every time it returned to Earth. Hein and co use these numbers to calculate that a kilogram of platinum mined from an asteroid would release some 150 kilograms of CO2 into Earth’s atmosphere. However, economies of scale from large asteroid-mining operations could lower this to about 60 kilograms of CO2 per kilogram of platinum. That needs to be compared with the emission from Earth-based mining. Here, platinum mining generates significant greenhouse gases, mostly from the energy it takes to remove this stuff from the ground. Indeed, the numbers are huge. The mining industry estimates that producing one kilogram of platinum on Earth releases around 40,000 kilograms of carbon dioxide. “The global warming effect of Earth-based mining is several orders of magnitude larger,” say Hein and co. The figures for water are also encouraging. In this case, the authors calculate the greenhouse-gas emissions from an asteroid-mining operation that returns water to anywhere within the moon’s orbit, a so-called cis-lunar orbit. They compare this to the emissions from sending the same volume of water from Earth into orbit. The big difference is that a water-carrying vehicle from Earth can haul only a small percentage of its mass as water. But an asteroid-mining spacecraft can transport a significant multiple of its mass as water to cis-lunar orbit. “Substantial savings in greenhouse gas emissions can be achieved,” say Hein and co. This interesting work should help to focus minds on the environmental impacts of mining, which are rapidly increasing in profile. But it is only a first step. There is significant uncertainty in the numbers here, so these will need to be better understood.

### 1NC – Scenario 1

#### Their internal link is about space surveillance in the ‘50s NOT modern SSN – even if squo tracking is imperfect – it’s good enough to not trigger missile radars – *hold the line* – their warrant is *one line* that says the phrase *once* – Westwood inserts blue.

1AC Hoots 15 (Felix; Fall 2015; Distinguished Engineer in the System Analysis and Simulation Subdivision, Ph.D. in Mathematics from Auburn University, M.S. in Mathematics from Tennessee Tech University; Crosslink, “Keeping Track: Space Surveillance for Operational Support,” <https://aerospace.org/sites/default/files/2019-04/Crosslink%20Fall%202015%20V16N1%20.pdf>)

The launch of Sputnik on October 4, 1957, marked the beginning of the Space Age. It also marked the beginning of an intense space race that brought a remarkable rate of rocket launches. In a very short time, the number of objects in orbit grew dramatically. This created a host of strategic challenges, including the need for space surveillance. In particular, the Air Force needed a way to prevent false alarms as satellites came within view of missile-warning radars, while the Navy needed a way to alert deployed units of possible reconnaissance by satellites overhead. These needs led to the establishment of a military mission to maintain a catalog of all Earth-orbiting objects—active payloads, rocket bodies, and debris—along with detailed information about trajectory and point of origin. Such a catalog could be used to filter normal orbital passages from potential incoming missiles and predict the passage of suspected spy satellites. The first catalog was relatively small in comparison with today’s version, which lists more than 22,000 items (as of May 2015). Also, the current version supports much more than the original military mission—and Aerospace is helping to extend its utility even further. The Space Catalog The Space Catalog is maintained by the Joint Space Operations Center (JSpOC) at Vandenberg Air Force Base, part of U.S. Strategic Command. One of the missions of JSpOC is to detect, track, and identify all artificial objects in Earth orbit. A key component of this mission is the Space Surveillance Network, a worldwide system of ground-based radars along with ground-based and orbital telescopes. The radars are used primarily for tracking near-Earth satellites with orbital period of 225 minutes or less, as well as some eccentric orbits that come down to near-Earth altitudes as they go towards their perigee. Ground-based telescopes are used for tracking more distant satellites, with orbital period greater than 225 minutes, and space-based sensors are used to track both near and distant satellites. The JSpOC tasks these sensors to track specific satellites and to record data such as time, azimuth, elevation, and range. This data is used to create orbital element sets or state vectors that represent the observed position of the satellite. The observed position can then be compared with the predicted position. The dynamic models used for predicting satellite motion are not perfect; factors such as atmospheric density variation caused by unmodeled solar activity can cause the predicted position to gradually stray from the true position. The observations are used to correct the predicted trajectory so the network can continue to track the satellite. This process of using observations to correct and refine an orbit in an ongoing feedback loop is called catalog maintenance, and it continues as long as the satellite remains in orbit. Ideally, the process is automatic, with manual inter vention only required when satellites maneuver or get near to reentry due to atmospheric drag. Sometimes, however, more effort is required. For example, a sensor may encounter a satellite trajectory that does not correspond well to anything in the catalog. Such observations are known as partially correlated observations if they are somewhat close to a known orbit or uncorrelated observations (or uncorrelated tracks) if they are far from any known orbit. Also, if a satellite is not tracked for five days, it is placed on an attention list for manual intervention. In that case, an analyst will attempt to match the wayward satellite to one of these partially correlated or uncorrelated tracks. If that effort succeeds, then the element sets are updated, and the object is returned to automatic catalog maintenance. On the other hand, if the satellite cannot be matched to a partially correlated or uncorrelated track, the satellite information continues to age. If it reaches 30 days without a match, the satellite is placed on the lost list. Risk Prediction One of the most visible uses of the catalog is to warn about collision risks for active payloads. This function predicts potential close approaches three to five days in advance to allow time to plan avoidance maneuvers, if necessary. Unplanned maneuvers may disturb normal operations and deplete resources for future maneuvers, so one would like to have high confidence in the collision-risk predictions. The reliability of the predictions depends directly on the accuracy of the orbit calculation, which in turn depends on the quality and quantity of the tracking data, which is limited by the capability of the Space Surveillance Network. Simply put, there are not enough tracking resources in the network to achieve high-quality orbits for every object in the catalog. Furthermore, many smaller objects can only be tracked by the most sensitive radars, and this tracking is infrequent. Most objects in the catalog are considered debris, which can neither maneuver nor broadcast telemetry. On the other hand, some satellite operators depend exclusively on the satellite catalog to know where their satellites are, and users of the satellite orbital data depend on the catalog to know when the satellites will be within view. This situation creates a challenging problem in balancing Space Surveillance Network resources to support the collision-warning task (tracking as many potential hazards as possible) while also providing highly accurate support to operational satellites (tracking the spacecraft as precisely as possible). The practical solution is to perform collision risk assessment using a large screening radius to ensure no close approaches are missed despite lower-quality predictions. Once an object is identified as having a potentially close approach, then the tasking level is raised, with the expectation that more tracking data will be obtained to refine the collision risk calculations. When the danger has passed, the object reverts to a normal tracking level. Collisions and spontaneous breakups do happen. The first satellite breakup occurred on June 29, 1961, when residual fuel in an Ablestar rocket body exploded, creating 296 trackable pieces of debris. Since that time, there have been more than 200 satellite breakups, the most notable being the missile intercept of the Fengyun-1C satellite, which created more than 3300 trackable fragments. In most cases, these breakups are first detected by the phased-array radars in the Space Surveillance Network. When multiple objects are observed where only one was expected, the downstream sensors are alerted, but no tasking is issued because specific debris orbits are not yet established. Tracks are taken and tagged as uncorrelated. Analysts at JSpOC then attempt to link uncorrelated tracks from different sensors to form a candidate orbit. Subsequent tracking improves the orbit to the point that the object can be named and numbered and moved into the catalog for automatic maintenance.

#### The Rogoway ev is terrible – 1] Double bind - It’s about ICBM launches which the aff scenario isn’t OR the aff gets rid of early-warning satellites bc they’re an unfair appropriation of outer space which makes their impacts inevitable 2] Says there’s a 30 minute reaction time before counter-launch – that’s enough time for double-checking retaliation – their scenario is not miscalc, but active retaliation – hold them to a higher explanation for how conflict happens than a 2 second blip at the top of the 1ar.

#### New Sheet ---

#### IF they win an internal link to Russia war, it’s good –

#### Russia is modernizing to Surprise nuclear HEMP attack the United States

Peter Pry 1-25 (Peter Vincent Pry served on the staffs of the Commission to Assess the Threat to the United States from Electromagnetic Pulse Attack, the U.S. House Armed Services Committee, and the Central Intelligence Agency. He currently is director of the U.S. Nuclear Strategy Forum and president of EMPACT America, “The Russian Federation’s Military Doctrine, Plans, and Capabilities for Electromagnetic Pulse (EMP) Attack” WVW Broadcast Network, 1-25-21, https://www.worldviewweekend.com/news/article/russian-federations-military-doctrine-plans-and-capabilities-electromagnetic-pulse-emp)//babcii

“Super-EMP is a…first-strike weapon,” according to Aleksey Vaschenko, who describes Russian nuclear weapons specially designed to make extraordinarily powerful EMP fields as Russia’s means for defeating the United States in “A Nuclear Response To America Is Possible”: “The further direction of the work on the development of Super-EMP was associated with the increase of its kill effect by focusing Y-radiation, which should have resulted in an increase of the pulse’s amplitude. These properties of Super-EMP make it a first strike weapon, which is designed to disable the state and military command and control system, the economy, ICBMs, especially mobile based ICBMs, missiles on the flight trajectory, radar sites, spacecraft, energy supply systems, and so forth. So, Super-EMP is obviously offensive in nature and is a destabilizing first-strike weapon…The Russian nuclear component relies on the Super-EMP factor, which is the Russian response to U.S. nuclear blackmail.” Hypersonic Warheads: New HEMP Threat Russian development of hypersonic missile warheads is a dangerous new dimension of the nuclear and HEMP threat. Great speed (Mach 20, twenty times the speed of sound) and flying a flat trajectory, skimming along the top of the upper atmosphere, significantly reduces visibility to U.S. early-warning satellites and radars, while also reducing arrival time. Maneuvering makes hypersonic warheads more difficult to track and intercept, virtually impossible to intercept with existing U.S. National Missile Defenses. Former senior Defense Department official Dr. Mark Schneider writes, “The main reason for Russian hypersonic missiles is a nuclear surprise attack and America has no defense against it.” Four-star General John Hyten, then chief of the U.S. Strategic Command that controls the nuclear Triad (now Vice Chairman Joint Chief of Staff), agrees with Schneider: “Hypersonic capabilities are a significant challenge. We are going to need a different set of sensors to see hypersonic threats. Our enemies know that.” Russia deployed its first regiment of SS-19 ICBMs armed with hypersonic Avangard nuclear warheads at the end of December 2019. Hypersonic vehicles fly over most of their trajectory at 50-100 kilometers altitude: the optimum height-of-burst for Super-EMP warheads. Hypersonic weapons are potentially a new avenue for surprise nuclear HEMP attack that could defeat deterrence. We cannot see the attack coming and may not know against whom to retaliate, especially if HEMP attack blinds satellites and radars needed for early-warning and threat assessment. Hypersonically delivered HEMP attack could win World War III with a single electronic blow.

#### That ionizes Van Allen belts and destroys all SATS

Peter Pry 20 (Peter Vincent Pry served on the staffs of the Commission to Assess the Threat to the United States from Electromagnetic Pulse Attack, the U.S. House Armed Services Committee, and the Central Intelligence Agency. He currently is director of the U.S. Nuclear Strategy Forum and president of EMPACT America, “Have Russia And China Already 'Militarized' Space?”, Real Clear Defense, July 16, 2020, https://www.realcleardefense.com/articles/2020/07/16/have\_russia\_and\_china\_already\_militarized\_space\_115469.html)//babcii

HEMP and SGEMP High-altitude EMP (HEMP) from a nuclear detonation in space propagates downward through the atmosphere, not through the vacuum of space, so no Russian or PRC satellites would be at risk from HEMP, unless the HEMP field is over China or Russia so satellite ground stations could be damaged—a highly unlikely scenario, that Moscow or Beijing would make a HEMP attack on themselves. Satellites are at risk from an exo-atmospheric detonation for HEMP from the gamma rays. If they reach the satellite and are close enough, they can damage satellites by a phenomenon called System Generated EMP (SGEMP).[[xiv]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn14) But Russia and China have almost certainly hardened their satellites against SGEMP and other phenomena that might be generated by the worst-case SGEMP threat they plan to employ: a Super-EMP weapon which is designed specifically to produce powerful gamma rays. The U.S. hardens military satellites against SGEMP too, but probably not against the SGEMP produced by Super-EMP weapons, as the U.S. has no Super-EMP weapons. The U.S. does not even have simulators for Super-EMP weapons to test against this threat. China and Russia can further protect their LEO satellites (those most at risk) from SGEMP by timing the HEMP attack so their satellites are over-the-horizon and will not be illuminated by gamma rays. An exo-atmospheric nuclear detonation for HEMP can also damage LEO satellites by “pumping” the Van Allen belt with ionized particles, as happened after the 1962 STARFISH PRIME high-yield exo-atmospheric nuclear test that inadvertently damaged U.S. satellites.[[xv]](https://www.realcleardefense.com/articles/2020/07/16/have_russia_and_china_already_militarized_space_115469.html#_edn15) Satellites can be hardened to survive this environment too, and presumably would be if HEMP attack is an important military option, as it is for Russia and China. Ionization of the Van Allen belt is a much bigger threat to LEO satellites if the HEMP attack uses a high-yield weapon detonated above 100 kms HOB—and this too is another way of using a nuclear detonation in space to sweep the skies of U.S. satellites.

#### Increased ionizaiton prevents space col

Daniel **Baker 14**, Director of the Laboratory for Atmospheric and Space Physics, as well as a professor in atmospheric and planetary sciences, and in physics, at the University of Colorado-Boulder, "New Twists in Earth's Radiation Belts," American Scientist, 2014, https://www.americanscientist.org/article/new-twists-in-earths-radiation-belts.

The satellite carried a pioneering scientific payload, prepared at the State University of Iowa by a team of researchers led by James A. Van Allen. And the instruments on Explorer I made the first revolutionary discovery of the Space Age: Earth is enshrouded in doughnut-shaped rings, or toroids, of high-energy, high-intensity radiation. The discovery of those radiation belts—now called the Van Allen belts—revealed how Earth’s magnetic field interacts with the space environment around it. The field, generated by Earth’s molten metallic core and planetary spin, creates the magnetosphere, a magnetic bubble surrounding the planet; the size and shape of the magnetosphere change in response to the blowing of the solar wind, the constant stream of charged particles flowing from the Sun. The magnetosphere is crucial to life on Earth; it shields the atmosphere, as well as life on the surface, from damage by the solar wind and by even more energetic cosmic rays. But close in, Earth’s magnetic field lines trap and accelerate free-floating particles, largely protons and electrons, and bounce them back and forth between the poles of the planet. Those zones of trapped, agitated particles make up the Van Allen belts that Explorer I flew through. It was discovered that the belts took the form of two concentric rings: The inner belt extends from an altitude of about 1,000 to 6,000 kilometers above Earth, whereas the outer belt spans from about 13,000 to 60,000 kilometers. Earth’s Van Allen belts are imperfect shields, however. High-speed particles can leak from the belts and collide with molecules in the atmosphere, giving rise to aurora displays. If there is a major magnetic eruption on the Sun, the resulting outrush of particles may break through the outer magnetosphere and overload the Van Allen belts in more destructive ways. The rapid injection of particles into the belts can damage the circuitry and solar panels on satellites in orbit; swarms of protons and electrons released when solar wind particles crash into the atmosphere induce electrical currents that can overload terrestrial power systems and cause blackouts. Almost exactly a century preceding the Explorer I launch, on the night of August 28 to 29, 1859, people around the world got to witness what happens when an enormous solar storm overwhelms Earth’s magnetosphere. The New York Times reported that thousands of New Yorkers watched “the heavens…arrayed in a drapery more gorgeous than they have been for years.” An even more spectacular aurora display occurred on September 2, when the sky lit up as far south as Central America in the Northern Hemisphere. Disturbances in Earth’s magnetic field were so powerful that magnetometer readings were driven off their scales. Telegraph networks were unusable for nearly eight hours in most parts of the world due to high-energy particles in the atmosphere. In several regions, operators reported that their telegraphs were sparking from the electrical current induced by the aurora. Earth had experienced a one-two punch of solar storms the likes of which have not been recorded since. Humanity was just beginning to develop electrical technology in 1859. There were no high-power electrical lines crisscrossing the continents, nor were there sensitive satellites orbiting Earth. In 1989, just before the rise of the Internet and GPS systems, a smaller but still potent solar storm demonstrated the heightened risk. The 1989 storm induced huge ground currents that knocked out Quebec’s electrical power grid and caused problems at 200 sites in the United States, particularly in regions situated on igneous rock because it resists conduction and therefore flows current into nearby wires. If another solar event like the one in 1989 happened today it could disrupt global communications, causing chaos for days. Another 1859-style superstorm could knock out some power grids and communications networks for weeks or more. Our Sun operates on an 11-year cycle of activity, and today it is near the maximum of that pattern, meaning it could at any time produce large-scale events. In mid-July 2012, a solar storm of immense power narrowly missed the Earth; had it happened a week earlier, the planet might have been in the direct path of the blast. My colleagues and I are vigorously pursuing studies of space storms and the changes in our near-Earth space environment, which we lump under the term space weather. There is a pressing need for our technological society to understand in ever better detail the workings of the space environment around us. A clearer picture of the dynamics of the Van Allen belts is one important piece of this puzzle. Space Storm Damage What happens to satellites during space storms is of great practical importance. After the pioneering work of Van Allen and his coworkers in the United States, along with their counterparts in the Soviet Union, there was an explosion of interest in the use of space for human needs. Over just a few years in the late 1950s and early 1960s, space hardware went from technological demonstration and scientific curiosity to full-fledged societal imperatives. Earth satellites were launched into space to meet needs for communication, navigation, weather observations, remote Earth sensing, and military reconnaissance. Today the Earth is circled by spacecraft from just above our atmosphere to distances of tens of thousands of kilometers above Earth’s surface. It would be almost inconceivable to try to imagine our modern U.S. society without the capabilities provided by spacecraft systems. But any of the many hundreds of spacecraft operating in Earth orbits today can be damaged by space radiation if the circumstances are right. In 2003, 46 of the 70 satellite failures reported that year occurred during a geomagnetic storm in October. When high-energy protons and other ions hit orbiting spacecraft, they often leave ionization tracks in electronic chips. These tracks can upset spacecraft computer memories and otherwise disrupt sensitive electronics. As a result, satellite solar power panels may be damaged, optical tracker systems may become confused, and spacecraft command-and-control software may be scrambled. High-energy protons and ions may also injure, and potentially kill, astronauts who are in space during a major solar particle event. Manned launches have had to be rescheduled as a result, a major obstacle to long missions such as ones that might go to Mars. The high-energy protons in the inner Van Allen zone are especially a continuing risk to satellites and humans alike. Energetic electrons in the space environment can also be devastating to spacecraft. They can readily penetrate even thick spacecraft shielding and bury themselves in insulating materials, such as coaxial cables or electronics boards, deep within spacecraft systems. As charge builds up in the insulating materials, a powerful internal electrical discharge can occur, much like a miniature lightning strike. Numerous recent spacecraft failures have been attributed to this mechanism. Another space weather effect is known as surface charging. Lower energy electrons cannot penetrate the shielding but can accumulate on insulating satellite surfaces. As with interior insulators, charge buildup on the surface may lead to a powerful, disruptive discharge, generating electrical signals in the spacecraft’s vicinity that can scramble and disorient the satellite and its subsystems. A Third Belt In light of the world’s dependence on Earth-orbiting platforms, it must be realized that every one of these spacecraft fly through—essentially continuously—the high-energy radiation environment that Van Allen’s group discovered over five decades ago. Thus, one of the most enduring and persistent aspects of space weather is the hostile radiation belts girding the Earth. Probes have returned data showing that the Van Allen belts wax and wane in intensity, depending on both local conditions and Sun activity. Even 50-plus years after their discovery, we still need a deeper and more insightful comprehension of the Van Allen belts’ behavior.

#### Space col is key to avert extinction.

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Space colonization is not only the subject of fiction but of serious science too. The late physicist Stephen Hawking argued that unless colonies were established in space the human race would become extinct. There are several natural phenomena beyond our control that could spell our obliteration. Over a long enough period of time our planet is vulnerable to catastrophic meteorite strikes, or getting exposed to the deadly radiation of a nearby supernova explosion. As our Sun burns its fuel it will start to expand and, in a few million years, will scorch Earth. We can also self-destruct by waging nuclear war, or by tilting our planet’s climate towards a runaway greenhouse effect. Space colonization is therefore the ultimate insurance policy of long-term human survival[4]. Physics and Biology: how to solve the challenges of interstellar travel But colonizing space is hard. Three are the main problem categories for humans surviving away from Earth over an indefinite period of time. The first, and probably easiest to solve, is finding a place suitable for colonization. Our solar system provides several possible habitats, the most obvious ones being of course the Moon and Mars. The Jovian moons could also be colonization targets. The Artemis Project[5], a private venture to establish a permanent, self-sustainable human base on the Moon, has proposed the Jovian moon Europa as an alternative future habitat, given the possibility of a hot interior and a liquid ocean of water under the icy surface, both of which could provide for a sustainable human base. Colonizing the Solar System could be a stepping-stone for venturing to worlds beyond, of which there are aplenty. In 2009 NASA launched the Kepler space telescope to discover Earth-size planets orbiting other stars in habitable zones. More than 1,300 planets have been discovered so far, in about 440 star systems; the nearest planet may be “only” 12 light years away. Based on Kepler’s findings scientists estimate that there could be as many as 11 billion rocky, Earth-like planets orbiting habitable zones of Sun-like stars in our Galaxy. The possibilities for expanding humanity’s reach in the cosmos are truly astronomical.

#### Russia war good – we’d go first, we’d win, causes minimal damage, and they would surrender

David J. Lonsdale 19 (David Lonsdale is the Director of the Centre for Security Studies at the University of Hull, UK. 5/17/2019. “The 2018 Nuclear Posture Review: A return to nuclear warfighting?” https://www-tandfonline-com.proxy.lib.umich.edu/doi/full/10.1080/01495933.2019.1573074)

The important question is: what objectives would the U.S. pursue within a nuclear conflict, and how would they be achieved? It appears that the primary objectives sought would be damage limitation (an important component of warfighting) and the reestablishment of deterrence. This fits with the preliminary qualifying statement to this section of the review, in which it is stated that the U.S. would use nuclear weapons in compliance with the law of armed conflict.86 Indeed, the NPR is at pains to note that nuclear forces would only be used for defensive purposes. One assumes that this rules out counter-value targeting (deliberate attacks against enemy population centers). This leaves counterforce operations as the only option. Strikes against enemy nuclear forces and their command and control, in conjunction with active ballistic missile defenses (BMD), would help ensure damage limitation for the U.S. and its allies.87 A focus on counterforce options is reminiscent of later Cold War strategy, when the U.S. increasingly procured weapon systems with increased accuracy and penetrative capability designed for warfighting. Indeed, Lieber and Press argue that increases in accuracy and remote sensing have enhanced the potency of counterforce options, to the point that low-casualty counterforce options are possible for the first time.88 One can reasonably assume, although it is not explicitly noted in the review, that the restoration of deterrence would be achieved through a combination of intra-war deterrence by denial (as noted above in relation to counter-escalation strategies) and punishment for coercive purposes. Inclusion of the latter is premised on references to “unacceptable consequences” resulting from nuclear attack elsewhere in the NPR. 89 However, in the face of no counter-value targeting, it is reasonable to question how these costs would be inflicted. There are three possible answers, although none of them is discussed in the NPR. First, it may be that the enemy values highly their nuclear forces; so that the loss of them would inflict unacceptable costs. Alternatively, there may be an unwritten assumption that counterforce strikes would inevitably produce “bonus” counter-value damage. Much of the nuclear force infrastructure (including command and control, airbases, etc.) is within or near population centers. Thus, even a limited counterforce strike is likely to have a significant detrimental effect on counter-value targets. This assumption, however, is somewhat thrown into question by the stated desire to procure accurate limited-yield weapons and to operate within the norms of the war convention. Low-yield accurate weapons would be ideal for counterforce missions and would minimize damage to counter-value target sets. Thus, bonus damage is likely to be limited. Finally, although again not explicitly noted in the NPR, perhaps there is a return to the notion of attacking targets associated with political control. Yet again, though, concerns over collateral damage would likely restrict a campaign aimed at the means of political control. We are, thus, left with many questions concerning how the coercive effects of nuclear weapons would be administered. This is problematic, for as Thomas C. Schelling eloquently noted, “The power to hurt can be counted among the most impressive attributes of military force.” 90 It has to be concluded that the uncertainties in this area of strategy reflect either a paradox or incomplete strategic thinking in the NPR. Clarity on these matters would be welcome, especially as it would enhance deterrence credibility still further. Although countervailing is back on the agenda in the 2018 NPR, there is no mention of prevailing in a nuclear conflict. Indeed, the review quotes Defense Secretary Mattis, echoing the early thoughts of Brodie, that nuclear war can never be won, and thus must never be fought.91 This is both curious and disappointing from a warfighting perspective, and speaks to the need for the further development of strategic thinking in U.S. nuclear strategy under Trump. Damage limitation and the reestablishment of deterrence are perfectly admirable goals within the context of nuclear conflict. However, if the U.S. is to achieve its objectives in a post-deterrence environment, it must have a comprehensive theory of victory. Damage limitation and the reestablishment of deterrence are limited negative objectives. They do not provide a positive driving force for the use of nuclear weapons. To reiterate, victory refers to a policy objective that must be achieved in the face of the enemy. And, as Clausewitz reminds us, the will of the enemy must be broken by destroying his ability to resist, or putting him in such a position as his defeat is inevitable.92 If we consider the conditions under which U.S. nuclear weapons could be used, as stipulated by the 2018 NPR, then we can assume that an enemy power (likely Russia, China, North Korea, or a state-sponsored terror group) has launched a substantial attack on either the U.S. or one of its allies. We can think in terms of a Russian assault on the Baltic States, a North Korean attack on South Korea, or perhaps a Chinese invasion of Taiwan. Alternatively, the U.S. may have been subjected to a substantial strategic attack, involving either weapons of mass destruction (including biological or chemical) or a crippling cyberattack. In any of these scenarios, more expansive objectives would be required. As Lieber and Press note, “In some cases, wars may be triggered by events that compel U.S. leaders to pursue decisive victory, conquest, and/or regime change.” 93 Thus, in order to achieve its objectives, the U.S. would variously need to: punish an aggressor to reinstate deterrence; defeat enemy forces for damage limitation or to reclaim lost territory; and, in the North Korean case, presumably overthrow a communist regime. In some of these cases, damage limitation and the reestablishment of deterrence would not be enough. Enemy forces would have to be defeated, removed, destroyed, or coerced (to withdraw from allied territory). Any operations in pursuit of these goals would need a theory of victory built on a detailed understanding of the use of nuclear weapons in the service of military objectives; i.e., nuclear warfighting. This could include defeating enemy nuclear forces for force protection of U.S. and allied conventional forces. Alternatively, U.S. nuclear forces may be required to defeat regionally superior enemy conventional forces. And yet, as previously noted, the NPR rules out a return to nuclear warfighting. This is a significant disjuncture in U.S. nuclear strategy. It is even more curious when one considers the range of modern forces the Trump administration seeks to acquire under the 2018 NPR.

I’ll concede Space Weather solves decline – impact turning it

#### (New Sheet)

1. **Collapse is inevitable and growth causes existential disease and warming. Independently, national space militarization is inevitable.**

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Less than two decades into the twenty-first century, it is evident that **capitalism has failed** as a social system. The world is mired in economic stagnation, financialization, and the most extreme inequality in human history, accompanied by mass unemployment and underemployment, precariousness, poverty, hunger, wasted output and lives, and what at this point can only be called a planetary ecological **“death spiral.”**1 The digital revolution, the greatest technological advance of our time, has rapidly mutated from a promise of free communication and liberated production into new means of surveillance, control, and displacement of the working population. The institutions of liberal democracy **are at the point of collapse**, while fascism, the rear guard of the capitalist system, is again on the march, along with patriarchy, racism, imperialism, and war. To say that capitalism is a failed system is not, of course, to suggest that its breakdown and disintegration is imminent.2 It does, however, mean that it has passed from being a historically necessary and creative system at its inception to being a historically unnecessary and destructive one in the present century. Today, more than ever, the world is faced with the epochal choice between “the revolutionary reconstitution of society at large and the common ruin of the contending classes.”3 Indications of this failure of capitalism are everywhere. Stagnation of investment punctuated by bubbles of financial expansion, which then inevitably burst, now characterizes the so-called free market.4 Soaring inequality in income and wealth has its counterpart in the declining material circumstances of a majority of the population. Real wages for most workers in the United States have barely budged in forty years despite steadily rising productivity.5 Work intensity has increased, while work and safety protections on the job have been systematically jettisoned. Unemployment data has become more and more meaningless due to a new institutionalized underemployment in the form of contract labor in the gig economy.6 Unions have been reduced to mere shadows of their former glory as capitalism has asserted totalitarian control over workplaces. With the demise of Soviet-type societies, social democracy in Europe has perished in the new atmosphere of “liberated capitalism.”7 The capture of the surplus value produced by overexploited populations in the poorest regions of the world, via the global labor arbitrage instituted by multinational corporations, is leading to an unprecedented amassing of financial wealth at the center of the world economy and relative poverty in the periphery.8 Around $21 trillion of offshore funds are currently lodged in tax havens on islands mostly in the Caribbean, constituting “the fortified refuge of Big Finance.”9 Technologically driven monopolies resulting from the global-communications revolution, together with the rise to dominance of Wall Street-based financial capital geared to speculative asset creation, have further contributed to the riches of today’s “1 percent.” Forty-two billionaires now enjoy as much wealth as half the world’s population, while the three richest men in the United States—Jeff Bezos, Bill Gates, and Warren Buffett—have more wealth than half the U.S. population.10 In every region of the world, inequality has increased sharply in recent decades.11 The gap in per capita income and wealth between the richest and poorest nations, which has been the dominant trend for centuries, is rapidly widening once again.12 More than 60 percent of the world’s employed population, some **two billion people**, now work in the impoverished informal sector, forming a massive global proletariat. The global reserve army of labor is some 70 percent larger than the active labor army of formally employed workers.13 Adequate **health care**, **housing**, **education**, and **clean water** and **air** are increasingly out of reach for large sections of the population, even in wealthy countries in North America and Europe, while transportation is becoming more difficult in the United States and many other countries due to irrationally high levels of dependency on the automobile and disinvestment in public transportation. Urban structures are more and more characterized by **gentrification** and **segregation**, with cities becoming the playthings of the well-to-do while marginalized populations are shunted aside. About half a million people, most of them children, are homeless on any given night in the United States.14 New York City is experiencing a major rat infestation, attributed to warming temperatures, mirroring trends around the world.15 In the United States and other high-income countries, life expectancy is in decline, with a remarkable resurgence of Victorian illnesses related to poverty and exploitation. In Britain, gout, scarlet fever, whooping cough, and even scurvy are now resurgent, along with tuberculosis. With inadequate enforcement of work health and safety regulations, black lung disease has returned with a vengeance in U.S. coal country.16 Overuse of antibiotics, particularly by capitalist agribusiness, is leading to an **antibiotic-resistance crisis**, with the dangerous growth of superbugs generating increasing numbers of deaths, which by mid–century could surpass annual cancer deaths, prompting the World Health Organization to declare a “global health emergency.”17 These dire conditions, arising from the workings of the system, are consistent with what Frederick Engels, in the Condition of the Working Class in England, called “social murder.”18 At the instigation of giant corporations, philanthrocapitalist foundations, and neoliberal governments, public education has been restructured around corporate-designed testing based on the implementation of robotic common-core standards. This is generating massive databases on the student population, much of which are now being surreptitiously marketed and sold.19 The corporatization and privatization of education is feeding the progressive subordination of children’s needs to the cash nexus of the commodity market. We are thus seeing a dramatic return of Thomas Gradgrind’s and Mr. M’Choakumchild’s crass utilitarian philosophy dramatized in Charles Dickens’s Hard Times: “Facts are alone wanted in life” and “You are never to fancy.”20 Having been reduced to **intellectual dungeons**, many of the poorest, most racially segregated schools in the United States are mere **pipelines for prisons or the military.**21 More than two million people in the United States are behind bars, a higher rate of incarceration than any other country in the world, **constituting a new Jim Crow.** The total population in prison is nearly equal to the number of people in Houston, Texas, the fourth largest U.S. city. African Americans and Latinos make up 56 percent of those incarcerated, while constituting only about 32 percent of the U.S. population. Nearly 50 percent of American adults, and a much higher percentage among African Americans and Native Americans, have an immediate family member who has spent or is currently spending time behind bars. Both black men and Native American men in the United States are nearly three times, Hispanic men nearly two times, more likely to die of police shootings than white men.22 Racial divides are now widening across the entire planet. Violence against women and the expropriation of their unpaid labor, as well as the higher level of exploitation of their paid labor, are integral to the way in which power is organized in capitalist society—and how it seeks to divide rather than unify the population. More than a third of women worldwide have experienced physical/sexual violence. Women’s bodies, in particular, are objectified, reified, and commodified as part of the normal workings of monopoly-capitalist marketing.23 The mass media-propaganda system, part of the larger corporate matrix, is now merging into a social media-based propaganda system that is more porous and seemingly anarchic, but more universal and more than ever favoring money and power. Utilizing modern marketing and surveillance techniques, which now dominate all digital interactions, vested interests are able to tailor their messages, largely unchecked, to individuals and their social networks, creating concerns about “fake news” on all sides.24 Numerous business entities promising technological manipulation of voters in countries across the world have now surfaced, auctioning off their services to the highest bidders.25 The elimination of net neutrality in the United States means further concentration, centralization, and control over the entire Internet by monopolistic service providers. Elections are increasingly prey to unregulated “dark money” emanating from the coffers of corporations and the billionaire class. Although presenting itself as the world’s leading democracy, the United States, as Paul Baran and Paul Sweezy stated in Monopoly Capital in 1966, “is democratic in form and plutocratic in content.”26 In the Trump administration, following a long-established tradition, 72 percent of those appointed to the cabinet have come from the higher corporate echelons, while others have been drawn from the military.27 War, engineered by the United States and other major powers at the apex of the system, has become perpetual in strategic oil regions such as the Middle East, and threatens to escalate into a global thermonuclear exchange. During the Obama administration, the United States was engaged in wars/bombings in seven different countries—Afghanistan, Iraq, Syria, Libya, Yemen, Somalia, and Pakistan.28 Torture and assassinations have been reinstituted by Washington as acceptable instruments of war against those now innumerable individuals, group networks, and whole societies that are branded as terrorist. A new Cold War and nuclear arms race is in the making between the United States and Russia, while Washington is seeking to place road blocks to the continued rise of China. The Trump administration has created a new space force as a separate branch of the military in an attempt to ensure U.S. dominance in the militarization of space. Sounding the alarm on the increasing dangers of a nuclear war and of climate destabilization, the distinguished Bulletin of Atomic Scientists moved its doomsday clock in 2018 to two minutes to midnight, the closest since 1953, when it marked the advent of thermonuclear weapons.29 Increasingly severe economic sanctions are being imposed by the United States on countries like Venezuela and Nicaragua, despite their democratic elections—or because of them. Trade and currency wars are being actively promoted by core states, while racist barriers against immigration continue to be erected in Europe and the United States as some 60 million refugees and internally displaced peoples flee devastated environments. Migrant populations worldwide have risen to 250 million, with those residing in high-income countries constituting more than 14 percent of the populations of those countries, up from less than 10 percent in 2000. Meanwhile, ruling circles and wealthy countries seek to wall off islands of power and privilege from the mass of humanity, who are to be left to their fate.30 More than three-quarters of a billion people, over 10 percent of the world population, are chronically malnourished.31 Food stress in the United States keeps climbing, leading to the rapid growth of cheap dollar stores selling poor quality and toxic food. Around forty million Americans, representing one out of eight households, including nearly thirteen million children, are food insecure.32 Subsistence farmers are being pushed off their lands by agribusiness, private capital, and sovereign wealth funds in a global depeasantization process that constitutes the greatest movement of people in history.33 Urban overcrowding and poverty across much of the globe is so severe that one can now reasonably refer to a “planet of slums.”34 Meanwhile, the world housing market is estimated to be worth up to $163 trillion (as compared to the value of gold mined over all recorded history, estimated at $7.5 trillion).35 The Anthropocene epoch, first ushered in by the Great Acceleration of the world economy immediately after the Second World War, has generated enormous rifts in planetary boundaries, extending from **climate change** to **ocean acidification**, to the sixth extinction, to disruption of the global nitrogen and phosphorus cycles, to the loss of freshwater, to the disappearance of forests, to widespread toxic-chemical and radioactive pollution.36 It is now estimated that **60 percent of** the world’s **wildlife** vertebrate population (including mammals, reptiles, amphibians, birds, and fish) **have been wiped out** since 1970, while the worldwide abundance of invertebrates has declined by 45 percent in recent decades.37 What climatologist James Hansen calls the “species exterminations” resulting from accelerating climate change and rapidly shifting climate zones are only compounding this general process of biodiversity loss. Biologists expect that half of all species will be facing extinction by the end of the century.38 If present climate-change trends continue, the “global carbon budget” associated with a 2°C increase in average global temperature will be broken in sixteen years (while a 1.5°C increase in global average temperature—staying beneath which is the key to long-term stabilization of the climate—will be reached in a decade). Earth System scientists warn that the world is now perilously close to a **Hothouse Earth**, in which **catastrophic climate change will be locked in and irreversible**.39 The ecological, social, and economic costs to humanity of continuing to increase carbon emissions by 2.0 percent a year as in recent decades (rising in 2018 by 2.7 percent—3.4 percent in the United States), and failing to meet the minimal 3.0 percent annual reductions in emissions currently needed to avoid a catastrophic destabilization of the earth’s energy balance, are simply incalculable.40 Nevertheless, major energy corporations continue to lie about climate change, promoting and **bankrolling climate denialism**—while admitting the truth in their internal documents. These corporations are working to accelerate the extraction and production of fossil fuels, including the dirtiest, most greenhouse gas-generating varieties, reaping enormous profits in the process. The melting of the Arctic ice from global warming is seen by capital as a new El Dorado, opening up massive additional oil and gas reserves to be exploited without regard to the consequences for the earth’s climate. In response to scientific reports on climate change, Exxon Mobil declared that it intends to extract and sell all of the fossil-fuel reserves at its disposal.41 Energy corporations continue to intervene in climate negotiations to ensure that any agreements to limit carbon emissions are defanged. Capitalist countries across the board are putting the accumulation of wealth for a few above combatting climate destabilization, threatening the very future of humanity. Capitalism is best understood as a competitive class-based mode of production and exchange geared to the accumulation of capital through the exploitation of workers’ labor power and the private appropriation of surplus value (value generated beyond the costs of the workers’ own reproduction). The mode of economic accounting intrinsic to capitalism designates as a value-generating good or service anything that passes through the market and therefore produces income. It follows that the greater part of the social and environmental costs of production outside the market are excluded in this form of valuation and are treated as mere negative “externalities,” unrelated to the capitalist economy itself—whether in terms of the shortening and degradation of human life or the destruction of the natural environment. As environmental economist K. William Kapp stated, “capitalism must be regarded as an economy of unpaid costs.”42 We have now reached a point in the twenty-first century in which the externalities of this irrational system, such as the costs of war, the depletion of natural resources, the waste of human lives, and the disruption of the planetary environment, now far exceed any future economic benefits that capitalism offers to society as a whole. The accumulation of capital and the amassing of wealth are increasingly occurring at the expense of an irrevocable rift in the social and environmental conditions governing human life on earth.43

#### Growth is unsustainable AND causes extinction.

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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

#### Economic crisis sparks widespread movements towards localized sustainability.

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In time, this pressure is likely to shift from submitting requests to the state to making demands on it, and then to taking increasing control of it. There will be increasing insistence that frivolous industries must be phased out so that scarce resources can be devoted to meeting fundamental town and regional needs. Meanwhile towns will be driven by necessity to bypass the center and take initiatives such as setting up their own farms, energy supplies and factories, thus transferring various functions out of the control of the centre. There will be increasing recognition that the local is the only level where the right decisions for self-sufficient communities can be made. In time, these shifts will lead to the transfer of functions and power from state-level agencies to the local level, leaving the center with relatively few tasks, and mainly with the role of facilitating local activities. This radical restructuring could conceivably be a smooth and peaceful process, driven by a general recognition that scarcity is making local self-governing communities the only viable option. If this happens then in effect, Stage 1 will be recognized as having constituted the revolution, essentially a cultural phenomenon, and the macroscopic structural changes in Stage 2 will be seen as a consequence of the revolution. Thus a case for Anarchist theory and practice It will be evident that the alternative social organization sketched above is a fairly common Anarchist vision (although there are also varieties that are not being advocated). The argument is that settlements enabling a high quality of life for all, despite very low resource use rates, must involve all members in thoroughly participatory deliberations regarding the design, development and running of their local productive, political and social systems. Their ethos must be non-hierarchical, cooperative and collectivist, seeking to avoid all forms of domination and to prioritize the public good. They must draw on the voluntary good will and energy of conscientious citizens who are ready to contribute generously and to identify and deal with problems informally and spontaneously, and to focus on seeking mutually beneficial arrangements with little if any need for industrial infrastructures and transport networks, bureaucracy, paid officials or politicians. Regional and wider issues will be tackled by the characteristic Anarchist mechanisms of federations and (powerless) delegates bringing recommendations back down to town meetings. The principle of 'subsidiarity' is evident in the practice of grass-roots politics, the avoidance of hierarchies, and the central role of town assemblies. The very low resource costs sustainability requires are achievable because of the proximity, diversity of functions and integration, the familiarity enabling informal communication and spontaneous action, and the elimination of many processes (e.g., transport, waste dumping, fertilizer production, packaging). In the 1930s the Spanish Anarchists in the Barcelona region showed what could be done by ordinary workers and citizens. An impressive current example is the Catalan Integral Cooperative movement (Dafermos 2017; TSW 2015a). Thousands work in hundreds of different cooperatives providing hundreds of thousands of dollars worth of food, goods and services, including unemployment and other welfare services. They operate more than twenty food 'pantries' largely via voluntary labor, handling more than a thousand products. Their goal is to build an alternative society focused on meeting needs, with no involvement of the state or market principles. Many eco-villages operate according to Anarchist principles, achieving high levels of sustainability (again see Lockyer 2017 and Grinde et al. 2018). In addition it will be evident that the discussion of transition strategy also follows Anarchist principles, especially in the notion of 'prefiguring' the new here and now within the old, not depending on the centre let alone a vanguard party, and recognizing the importance of ideas and values. The advent of GFC 2 Unfortunately the foregoing transition sequence is likely to be greatly disrupted and possibly thwarted a global financial crisis of much greater magnitude than the 2008 event. It is widely recognized that the much higher levels of debt are likely to bring on at least a serious recession, and probably worse in the next few years. The global economy is heavily dependent on petroleum supply, which is been kept up by 'fracking', but this has only been made possible by enormous debt; none of the major companies in the arena has ever made a profit. Several analysts have pointed out that the price levels necessary to make the new sources of petroleum profitable now seem to be above those necessary to enable economies to function normally. In addition, Ahmed (2017) has argued persuasively that the rapidly worsening population, food, water and ecological conditions affecting Middle Eastern petroleum suppliers are increasing their chances of becoming failed states. Meanwhile the proportion of their petroleum production they must use internally is increasing, adding to the possibility that their capacity to export will dry up within a decade. These and other deteriorating resource and ecological conditions (especially falling Energy Return on Energy Invested rates) are likely to trigger serious global economic disruption long before localist initiatives have been well enough established. Yet it is very unlikely that the kind of transition envisaged could begin unless there is major breakdown in the existing consumer-capitalist system. As long as it keeps the supermarket shelves stocked, discontent is likely to be muted, and focused on demands for more jobs and higher incomes rather than system replacement. The Goldilocks outcome would seem to be an economic depression that falls short of catastrophic breakdown, but is serious enough to convince large numbers that the system is not going to provide for them. The challenge to the Left This analysis has especially important implications for those who are radically critical of consumercapitalist society. Firstly it is evident that the revolution required to solve the problem is far bigger than that which Marx envisaged. Merely getting rid of capitalism will not suffice. Secondly, the most promising frontier now for such critics is the challenge to current society being set by unsustainable resource and ecological impacts. Latouche said the limits to growth are giving critical theory its last chance (2012: 75). Yet the foregoing argument has been that this opportunity has hardly been recognized, let alone taken up. Bookchin saw this some time ago. "The New Left, like the old left, has never grasped the revolutionary potential of the ecological issues, nor has it used ecology as a basis for understanding the problems of communist reconstruction and utopia" (1973: 242). Significant and increasing numbers of ordinary people are seriously concerned about these issues and are thinking more or less in the general direction of replacing consumer-capitalism with localism and simpler ways. These themes are likely to be the most effective foundations for critical social theory and practice now. But unfortunately the Left has a deeply entrenched reluctance to embrace these ideas. The traditional assumption has been that when power has been taken from the capitalist class, the contradictions preventing full application of the productive forces will be removed and technical advance will lift all to material wealth. Socialism is distinctly not conceived today in terms of frugality or localism. Indeed some socialists embrace 'ecomodernist' ideas, notably Phillips (2014) and Sharzer (2012), who explicitly spurn the suggestion that local or simpler ways are necessary or desirable. David Harvey represents the many Marxists who reject localism both as a goal and as a revolutionary strategy in favor of the typical socialist focus on action at the state level (Harvey 2017). For a critique, see Springer (2017). The Marxist position fails to address current circumstances, where the goal must be to contradict individualistic competitive affluence and must focus on citizen involvement in local economies. Major change at the central or state level cannot be achieved before a profound cultural revolution has been achieved, and this is most likely to occur via developments at the local level. Delusion and denial: the inability to respond There are difficult and puzzling issues for social theorists that will not be taken up in this article. They are the psychological and institutional reasons for the failure to deal adequately with the limits to growth predicament, or with its major sub-problems such as the looming petroleum supply, debt, and climate change crises. The core phenomenon to be explained here would seem to be failure to even recognize the existence and/or seriousness of the problems, rather than lack of appropriate remedial action. The essential causal factor is surely that if the limits to growth analysis is accepted then perhaps the most deeply entrenched post-Enlightenment assumption has to be jettisoned, i.e., the taken-for-granted conviction that progress and the good life are defined by capacity to produce and consume more and more material wealth. The suggestion that the supreme social goal should be materially simple lifestyles and systems, with no prospect of rising to greater affluence over time, would seem to be about as distasteful and unthinkable to workers and the lumpenproletariat as to the super-affluent 1%. 6. Conclusions: a reorientation of social theory The argument is that the advent of the limits to growth issue should be seen as requiring a major shift in the focal concerns of social theorists, especially those interested in critical perspectives on contemporary society and in sustainability and utopian themes. To begin with, a limits perspective involves a commitment to an inescapable logic that leads to quite specific conclusions regarding desirable social forms and how they might be achieved. If the limits are as severe as has been argued, then the goal must be transition from consumer-capitalist society to a general form that involves far lower resource use, and this has to mean mostly small-scale local economies that are self-governing, basically cooperative and committed to materially frugal lifestyles. If this is so, then the transition is essentially a cultural problem, and it is difficult to imagine how these ways could be established other than through a slow grass-roots process whereby ordinary people increasingly coerced by scarcity and economic deterioration take on the restructuring of their own suburbs, towns and regions (Alexander and Gleeson 2019). A major implication drawn above is that centralized agencies, especially the state, cannot drive these changes through.

#### New Sheet –

#### Cyberwar stops conventional escalation---that outweighs.

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But now, somehow, it seems that war may no longer seem so terrible.

How has this come to pass? The culprit is the bits and bytes that are the principal weapons of cyberwar. It is now possible to intervene swiftly and secretly anywhere in the world, riding the rails of the global information infrastructure to strike at one’s enemies. Such attacks can be mounted with little risk of discovery, as the veil of anonymity that cloaks the virtual domain is hard to pierce. And even when "outed," a lack of convincing forensic evidence to finger the perpetrator makes heated denials hard to disprove.

Beyond secrecy, there is also great economy. The most sophisticated cyber weaponry can be crafted and deployed at a tiny fraction of the cost of other forms of intervention. No aircraft carriers needed, no "boots on the ground" to be shot at or blown up by IEDs. Instead, there is just a dimly lit war room where hacker-soldiers click for their country, and the hum of air conditioners keeping powerful computers from overheating. Cool room, cool war.

The early returns seem to suggest the great efficacy of this new mode of conflict. For example, the Stuxnet worm, a complex program of ones and zeros, infected a sizeable proportion of Iran’s several thousand centrifuges, commanding them to run at higher and higher speeds until they broke. All this went on while Iranian technicians tried fruitlessly to stop the attack. The result: a serious disruption of Tehran’s nuclear enrichment capabilities — and possibly of a secret proliferation program.

The sabotage occurred without any missile strikes or commando raids. And, for now, without any open acknowledgment of responsibility, although reporters and others have pointed their fingers at the United States and Israel. It is loose lips in high places, not sophisticated "back hacking," that seem to have divulged the secret of Stuxnet.

Another example of the looming cool war is the malicious software known as Flame, which sought information via cyber snooping from target countries in the Middle East. The code that comprises it seems to make the point that we no longer need physical agents in place if we can now rely on artificially intelligent agents to dredge up the deepest secrets. There will be no new John le Carré to chronicle this era’s spies. Not when the closest thing to George Smiley is a few lines of source code.

Beyond Stuxnet-like "cybotage" and software-driven spying, the coming cool war might also influence whether some traditional wars are even going to break out. The good news is that a preemptive cyber attack on the military command-and-control systems of two countries getting ready to fight a "real war" might give each side pause before going into the fight. In this instance, the hackers mounting such attacks should probably publicize their actions — perhaps even under U.N. auspices — lest the disputants think it was the enemy who had crippled their forces, deepening their mutual antagonism. There are no doubt some risks in having a third party mount a preemptive cyberattack of this sort — but the risks are acceptable when weighed against the chance of averting a bloody war.

The other potential upside of cool war capabilities, in addition to tamping down military crises between nations, would lie in multilateral tracking of transnational criminal and terrorist networks. These villains thrive in the virtual wilderness of cyberspace, and it is about time that they were detected, tracked, and disrupted. Think of Interpol, or an international intelligence alliance, using something like Flame to get inside a drug cartel’s communications network. Or al Qaeda’s. The potential for illuminating these dark networks — and bringing them to justice — is great and should not be forgone.

On balance, it seems that cyberwar capabilities have real potential to deal with some of the world’s more pernicious problems, from crime and terrorism to nuclear proliferation. In stark contrast to pitched battles that would regularly claim thousands of young soldiers’ lives during Robert E. Lee’s time, the very nature of conflict may come to be reshaped along more humane lines of operations. War, in this sense, might be "made better" — think disruption rather than destruction. More decisive, but at the same time less lethal.

Against these potential benefits, one must also weigh the key downside of an era of cyber conflict: the outbreak of a Hobbesian "war of all against all." This possibility was first considered back in 1979 by the great science fiction writer Frederik Pohl, whose dystopian The Cool War — a descriptor that might end up fitting our world all too well — envisioned a time when virtually every nation fielded small teams of hit men and women. Their repertoires included launching computer viruses to crash stock markets and other nefarious, disruptive capabilities.

In Pohl’s novel, the world system is battered by waves of social distrust, economic malaise and environmental degradation. Only the rebellion of a few cool warriors – some, but not all, were hacker types — at the end, offers a glimmer of hope for a way out and a way ahead.

The question that confronts us today is whether to yield to the attractions of cyberwar. We have come out of one of mankind’s bloodiest centuries, and are already in an era in which wars are smaller — if still quite nasty. Now we have the chance to make even these conflicts less lethal. And in reality, there may be no option. Once the first network or nation takes this path — as some observers believe the United States is doing — others will surely follow, starting a new arms race, this time not in weaponry, but in clandestine and devastating programs like Stuxnet and the Flame virus.

It is a curious irony that the United States, a power traditionally reluctant to go to war but furious in its waging, is now seemingly shifting gears. It is becoming a nation with the capability to go to war easily, while at the same time far less ferociously. Is this an improvement? Perhaps. Delaying Iranian proliferation with bits and bytes seems far superior to the costs and risks that would be incurred, and the human suffering inflicted, by trying to achieve such effects with bombs and bullets.

But looking ahead, how will Americans respond when others begin to employ cyber means to achieve their ends, perhaps even by attacking us? After all, Stuxnet escaped from that Iranian facility into the wild, and is certainly being studied, reverse engineered and tweaked by many around the world. No country may be foolish enough to engage the incomparable U.S. military in open battle, but we seem like fairly easy pickings to the computer mice that may soon roar.

Despite all these concerns, though, a cool war world will be a better place to live in than its Cold War predecessor. Yes, conflict will continue in the years to come, but it will morph in ways that make our self-destruction as a civilization less likely — even if it means living with occasional disruptions to vulnerable high-tech systems.

The bargain made when "cyber" and "war" came together need not turn out to be Faustian. This story can still have a happy ending: As war becomes "cooler," mankind’s future may edge a bit closer to the utopian end that all of us, secretly or not so secretly, truly desire.

#### Only conventional war causes nuclear miscalculation.

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How then did China react to the NPR’s call to reduce US reliance on nuclear weapons and invest in conventional capabilities to bridge that gap in America’s security needs? Chinese civilian and military strategists have regularly and consistently communicated their concern about a US conventional attack negating China’s strategic deterrent prior to the US release of the NPR in 2010.37 After publication of that document, Chinese analysts suggested that the US decision to invest in conventional capabilities such as CPGS was part of the United States’ desire to seek “absolute security” and maintain its military supremacy. Chinese analysts fear that these advanced conventional capabilities designed by the United States to meet its nuclear deterrence needs are not constrained by the “nuclear taboo” and, in fact, are more usable.38 The Chinese believe that the very usability of advanced conventional weapons designed to perform a deterrence role actually undermines nuclear deterrence and causes other nations to rely more on their nuclear weapons arsenals because they cannot compete with the United States conventionally. Chinese analysts also fear a global conventional-weapons arms race, and some analysts warn that “a world free of nuclear weapons may open the door to the resumption of a large-scale conventional war.”39 The most worrisome development from China comes from The Science of Military Strategy (December 2013), published to inform Chinese military professionals of how the “People’s Liberation Army (PLA) perceives military development in China and around the world” and to offer a framework for the PLA to address them.40 In that publication, the authors outline China’s concern that its limited nuclear force is vulnerable to a first strike that would negate any ability to execute a retaliatory strike. To address this issue, the authors suggest that China may decide to launch on warning of an impending nuclear attack.41 Such a decision increases the possibility of an accidental nuclear launch, given the difficulties in characterizing the type of incoming attack or the dangers of a malfunction in the early warning system. Finally, the NPR repeatedly calls for the need to promote strategic stability with China. However, although that concept has been used in the context of nuclear relations for decades, it has no common, universally accepted definition.42 Further, it also means that China’s concept of what constitutes strategic stability may be different than that of the United States, possibly leading to a misunderstanding. Chinese scholars have recognized this disconnect, noting that US “experts have not given serious consideration to what the true meaning of strategic stability is, and have not adequately prepared to achieve strategic stability with China.”43 Although it is not the only component of strategic stability, the Chinese perceive changes in the US nuclear posture as a threat to that stability.44 Specifically, Chinese analysts have repeatedly insisted that US advanced conventional capabilities, including CPGS coupled with ballistic missile defense, represent a direct threat to China’s secure second-strike capabilities. Therefore, Chinese analysts perceive a major contradiction in the NPR. “Advocacy for military capabilities that are seen to be detrimental to strategic stability in the same document that promotes strategic stability ultimately represents a circular logic” that if not addressed will make it difficult for China to participate in talks meant to promote strategic stability.45 Implications for Nuclear Deterrence A gulf exists between how the United States and Russia/China view the value of nuclear weapons. These adversarial perceptions are well documented, predating the development and release of the NPR, but were not taken into account during drafting of the new policy. The US decision to rely less on nuclear weapons to meet its national security needs, instead bridging the gap with advanced conventional capabilities, did not have the desired effect on our adversaries. Instead of inspiring confidence, it reinforced some of their worst fears. The NPR overstated the improvement in US-Russia relations, and the US declaration that Russia was not an enemy did not consider how Russia viewed the relationship. Failure to take into account that country’s deep-seated suspicion of the United States invalidated the NPR’s assumption that improved ties would allow the United States to rely less on nuclear weapons. Further, US policy and Russian policy do not agree on the usability of nuclear weapons. The US desire to decrease the role of nuclear weapons and compensate with conventional weapons suggests that US policy makers do not feel that nuclear weapons are usable. However, this perception contrasts with Russia’s nuclear doctrine and statements, which have been consistent for well over a decade, that these weapons are quite usable. These differences are further emphasized as the United States debates unilateral reduction in nuclear capabilities while Russia violates a landmark arms-control treaty to increase the types and capabilities of its nuclear arsenal to gain a strategic advantage.46 This situation creates a dangerous divide that has the potential for miscalculation and deterrence failure. Both Russia and China are concerned with US use of advanced conventional capabilities in a strategic manner to negate their nuclear deterrent. According to the NPR, the United States has the strongest conventional capabilities in the world and an alliance system that further augments those capabilities. America has also demonstrated its willingness to use conventional power repeatedly over the last 25 years. The very usability of conventional precision-strike weapons capable of creating effects once reserved only for nuclear forces undermines deterrence by creating or reinforcing perceptions in our adversaries that their nuclear forces are vulnerable and that the United States may have an incentive to strike them. Both China and Russia are reevaluating their nuclear doctrines and relying more on nuclear weapons to counter this perceived threat. Conclusion From nuclear weapons’ pinnacle of importance at the end of the Cold War to today, the United States has steadily decreased the attention paid to its nuclear arsenal and strategy, but nuclear deterrence has not decreased in its overall importance. It is clear that our adversaries place much more value in their nuclear arsenals than does the United States, precisely to deter America’s unmatched conventional power. The US decision to rely more on conventional weapons to achieve nuclear deterrence has created dangerous potential for miscalculation in its deterrent relationships with Russia and China. The United States has fallen into a “mirror imaging” trap by assuming that other nations place the same low value on nuclear weapons that it does and that they have the same priority of reaching “Global Zero.” The Obama administration has even gone so far as to recommend unilateral nuclear reductions, which were made outside arms-control negotiations with Russia.47 Part of this policy is that other nuclear-armed nations will follow the US example and choose to reduce the size of their nuclear arsenal. This assumption does not take into account how our opponents interpret their security environment and the role that nuclear weapons play in safeguarding their interests. Relations with other nuclear powers have been fairly cooperative and benign since the end of the Cold War. Crises that arose were managed, and peaceful solutions have been negotiated, contributing to the mistaken belief that nuclear weapons are no longer relevant. However, could it be that those weapons encourage leaders to be benign and cooperative?48 In 1946 J. Robert Oppenheimer reflected that “it did not take atomic weapons to make man want peace. But the atomic bomb was the turn of the screw. It has made the prospect of war unendurable.”49 That is, far from being unusable, nuclear weapons are used every day to encourage compromise in international relations because failure to compromise may lead to the unthinkable. In drafting the NPR, the US government failed to consider the perceptions of our adversaries or to tailor strategy to the unique threat that each poses. As we have pointed out, deterrence is a psychological function in the mind of the adversary. Failure to acknowledge and account for how our enemies view their security environment, their relationship with the United States, their unique history and culture, or the value they place on nuclear weapons to meet their security needs has made our deterrence relationships potentially less stable. Increasing our emphasis on conventional weapons that adversaries view as more usable and a threat to their nuclear arsenals has caused them to feel insecure. To counter this trend, they have modernized and increased the size of their arsenals and rely more on nuclear weapons to meet their security needs. Nuclear deterrence has always been a risky proposition, and the fact that it has not failed in the past 70 years may have as much to do with our deterrence strategy as plain luck. But as risky as relying on nuclear deterrence is, it is still the “least bad” option and has not lost its relevance. Therefore, it is important that we strive to understand our adversaries as we develop and implement our nuclear-deterrent strategies so that we do not undermine its effectiveness. Nuclear deterrence may be much more fragile than any of us realize. It is imperative that we do not take the “nuclear taboo” for granted by assuming that our adversaries place the same value on the relevance of nuclear weapons that we do.

#### New Sheet --

#### Water shortages – Westwood inserts yellow (New Sheet)

Loper 19 [Dr. Robert D. Loper, Ph.D. from the Air Force Institute of Technology, Assistant Professor of Space Physics, Spring 2019. “Carrington-class Events as a Great Filter for Electronic Civilizations in the Drake Equation.” Publications of the Astronomical Society of the Pacific. https://iopscience.iop.org/article/10.1088/1538-3873/ab028e/meta]

Eastwood et al. (2017), the National Academy of Sciences (2008), and the Royal Academy of Engineering (2013) outline the potential economic impacts of severe space weather. In particular, major direct impacts from a Carrington-class CME could be outlined as including the following. 1. Power grid failure due to destruction of large transformers by geomagnetically induced currents. The large transformers in question here generally cost about $1 million per unit and require about 18 months to manufacture, ship, and install. The National Academy of Sciences (2008) report estimates such a power grid failure would cost $1–2 trillion per year6 and last four to ten years. 2. Outages or failures of LEO (low Earth orbit) space assets due to enhancement of the inner Van Allen belt. A severe solar storm can also cause ionospheric uplift which can dramatically increase satellite drag (Tsurutani et al. 2012). Additionally, LEO spacecraft operation could be disrupted by solar energetic protons (SEPs) generated in the shock of the CME passage through the solar wind (Royal Academy of Engineering 2013). 3. Outages or failures of GEO (geosynchronous equatorial orbit) space assets due to enhancement of the outer Van Allen belt or due to SEPs generated in the shock of the CME passage (Royal Academy of Engineering 2013). 4. GPS outages due to GEO spacecraft outages or failures, or GPS degradation due to ionospheric uplift and enhancement, potentially lasting several days or longer. 5. Communications outages due to high-frequency and ultrahigh-frequency radio blackouts, as well as cellular communication network and internet collapse due to extended power outages beyond the limits of generators and stored fuel. In particular, although optical ﬁber cables are the foundation of much of the global communication network, electrical power is still needed to power optical repeaters and transmitters (Royal Academy of Engineering 2013). 6. Increased radiation doses to astronauts and airline passengers (Royal Academy of Engineering 2013). This is more of a risk for long-haul airline ﬂights or manned spaceﬂight. Major indirect effects could include, but are by no means limited to, the following: 1. water and waste water shortages due to reduced or eliminated pumping from power grid failure; 2. fuel shortages due to reduced or eliminated pumping from power grid failure, which could result in transportation stoppages; 3. food shortages due to transportation stoppages, which could contribute to increased death rates and incite rioting and/or looting; 4. reduced hospital care due to water shortages and power outages, which could contribute to increased death rates and rates of infection; and 5. a years-long power grid and internet degradation or outage might irrevocably damage the global economy, in turn greatly prolonging the time to restore the power grid beyond the estimate of four to ten years. If one recalls major disasters caused by terrestrial weather events like hurricanes Katrina (New Orleans, 2005) and Maria (Puerto Rico, 2017), one can imagine the sorts of major effects on people and life in those areas. The most striking difference is that, whereas humanitarian aid came to bear on these disasters, a Carrington-class event would be a global catastrophe with little or no aid forthcoming. Much greater loss of life could result, and our civilization could be driven back to a much more fractured and pre-electronic one. For the purposes of another planet’s Drake equation, our civilization would be eliminated from the calculation. Conversely, another planet whose electronic civilization were struck by a Carrington-class CME would be eliminated from our calculation. Riley (2012) estimates the probability of another Carringtonclass event occuring within the following decade at about 12%. This estimate preceded the solar storm of 2012, but a good rule of thumb would be to estimate this to be the probability of having a Carrington event during any given solar cycle. Love (2012) and Kataoka (2013) have calculated probabilities in rough agreement, but there are a wide range of probabilities in the literature, ranging from once per 60 years (Tsubouchi & Omura 2007) to once per 500 years (Yermolaev et al. 2018). This work will retain the result of Riley (2012), which is also used in National Academy of Sciences (2008) and Royal Academy of Engineering (2013). This roughly agrees with the “once in a century” designation usually given to the Carrington event. Royal Academy of Engineering (2013) indicates that this designator is not well understood given the relative lack of data, but also that there are several tens of Carrington-class CMEs every century that either miss Earth or have lesser impact due to a northward orientation of the interplanetary magnetic ﬁeld. As shown in Figure 1, such a CME has a very wide angular extent (in the 2012 July event, the CME extended in about a 135° arc from the Sun), which could strike Earth in three out of eight occurrences. There is also some indication that a solar storm could trigger other Great Filter events. Knipp et al. (2016) outlines a solar storm in 1967 May that nearly triggered a nuclear war, as American radar operators initially mistook a solar storm for Soviet jamming. It might also be possible that a Carrington-class event could unleash or exascerbate an infectious disease due to reduced hospital care at a critical time, resulting in a pandemic.

#### Resource conflict is inevitable from population and economic shifts--- scarcity creates cooperation that defuses conflict broadly

Dr. Thomas Bernauer 20, Professor of Political Science and Director of the Institute of Science, Technology and Policy (ISTP) at ETH Zurich, and Dr. Tobias Böhmelt, Professor of Government at the University of Essex, “International Conflict and Cooperation Over Freshwater Resources”, Nature Sustainability, Volume 3, https://www.nature.com/articles/s41893-020-0479-8

Unsustainable use of freshwater resources worldwide creates enormous challenges for human societies populating these natural systems, and these challenges are likely to grow with climate change. Will societies respond with increased cooperation to manage freshwater resources more sustainably or will there be more conflict over this scarce but vital resource? This review of research on conflict and cooperation over transboundary freshwater resources shows that, thus far, the prevailing response is cooperation, albeit non-violent conflict is quite frequent, too. It also documents substantial progress in understanding the drivers of water-related cooperation and conflict. Key knowledge gaps remain, particularly with respect to transboundary water conflict and cooperation in the past 10 to 15 years and in terms of local water-related events. The key prerequisite for filling these gaps is that the research community engages in a joint effort to address persistent shortcomings in existing event datasets on water cooperation and conflict.

Main

Scientific and policy debates over human impacts on global freshwater resources have been intensifying, particularly in the context of growing concerns about the implications of climate change for already stressed freshwater systems1,2,3. Climate change is likely to lead to greater variability and, in some places, an overall decrease of available freshwater, while human water use is likely to increase. The latter is driven primarily by population and economic growth as well as more consumption of goods with a high water footprint4. Projections such as these have led some scholars and policymakers to expect an increasing risk of conflicts, including violent ones, over scarce freshwater resources. Others, objecting to this Neo-Malthusian predicament, are more optimistic in view of humanity’s potential for social and technological innovation. While such expectations about the future are marked by great uncertainty, empirical research can help us understand whether and under what conditions human and climate-induced water scarcity has led to conflict or cooperative problem solving.

Human impacts on freshwater systems are well understood from a geophysical and biological perspective5,6,7,8,9,10. Much less is known about the implications of these impacts for the wellbeing of human societies relying on them. For example, controversy surrounds whether and how higher freshwater-related stress, resulting from overconsumption (water demand) or from climate-related variability and scarcity (water supply), might affect people, and how societies will respond and perform in terms of adaptive capacity and resilience. Potential effects of increased water stress on human security range from higher poverty and social instability to human migration and violent conflict within and between nations11,12,13,14.

Research on freshwater conflict and cooperation to mitigate and adapt to water problems has contributed in important ways to scientific and policy debates over the past two decades. Scholars have developed concepts and approaches to measure conflict and cooperation and to systematically assess their drivers. The most important literature in this field focuses on international freshwater catchments, on global comparisons of such catchments, and conflict and cooperation amongst riparian countries15,16,17,18,19,20. International river basins are defined by either a common water flow destination, or water flowing year-round across boundaries21. There currently are around 310 international river basins that are shared by 150 countries. They cover 47% of the world’s land surface and are home to 52% of the world’s population15. In this Review, we assess what we can learn from research on international freshwater conflict and cooperation, where our understanding remains limited, and how we can overcome existing gaps22.

Most studies on freshwater conflict and cooperation focus on individual international freshwater catchments and on policy options for dealing with the respective local challenges (for example, the Brahmaputra23, Indus24 or La Plata25 river basins). Complementing case-specific studies, we focus this Review on more general, global answers to several key questions: how prevalent are water conflict and cooperation in international freshwater catchments globally? Which catchments are more prone to water conflict or cooperation, and under what circumstances do we observe more conflict or cooperation? What conditions make catchments and their riparian countries more resilient to water-related stress and what role does international cooperation play here? Together with insights on specific freshwater catchments, answers to these questions contribute to a comprehensive assessment of anthropogenic impacts, adaptation and vulnerability with respect to global freshwater resources, and also to more informed policy choices.

Why focus on international water basins?

Freshwater-related conflict and cooperation can, in principle, be studied at any geographic, hydrological or social scale, for example, from small social groups such as a village to the water-catchment level as a hydrological unit. Climate change may be more likely to lead to local or sub-national than to international conflicts and there is an urgent need to concentrate more strongly on those as well. However, most scientific progress so far has been made on international freshwater conflict and cooperation, and we focus on this research for two additional reasons. The first reason is analytical. Generalizable conclusions about conflict and cooperation over freshwater resources should be based on a systematic comparison of a large number of clearly defined and homogeneous units, ideally for a known population. These conditions are met for countries and international freshwater catchments, all of which can be systematically identified and characterized, based on hydrological, political and other data. Such identification is more difficult for other units of analysis, such as social or ethnic groups, villages, cities and subsystems of water catchments. This also explains why the literature on freshwater conflict and cooperation at sub-national scales remains less developed (for exceptions, see refs. 18,26,27).

Second, because international freshwater catchments extend beyond national jurisdictions and their policy-making structures, effective policy responses to water stress require international collective action. In contrast to domestic water problems, which in principle can be addressed through interventions by a single government, problem-solving approaches among countries in international freshwater catchments are more complex and potentially more prone to failure15,19,20,28.

Characterizing freshwater catchments

A large literature focuses on individual cases and provides valuable insights into how water stress may lead to cooperative or conflictive outcomes, for example, via differences in how international negotiations and river management institutions are designed29,30,31,32,33,34,35,36,37. The main limitation of this research is that cooperation and conflict are empirically identified and measured differently, and explanations of particular outcomes are case-specific and based mostly on qualitative interpretation of evidence. This makes it difficult to generate generalizable conclusions about international freshwater cooperation and conflict, such as global development over time, spatial and temporal drivers, and which freshwater systems are at particular risk.

Quantitative research on conflict and cooperation in international river basins has made substantial progress over the past two decades. This applies in particular to generating better empirical data on the characteristics of international freshwater catchments and a widely accepted approach to measuring levels of cooperation and conflict. With regard to the characteristics of international freshwater catchments, based on geographic information systems and geophysical, political and other data, researchers have characterized the global landscape of international freshwater catchments. Generating this information is challenging, particularly because of technical difficulties in delineating, with high spatial resolution, the geophysical boundaries of freshwater catchments and the (sometimes time-varying) political boundaries of countries15,20,38.

One example for why increased spatial resolution is important concerns a popular hypothesis in the international water management literature. It holds that river settings with an upstream–downstream political geography are more prone to conflict. In such settings, the upstream country is likely to have an incentive to exploit its position in ways to impose damages on the downstream state (for example, reduced river flow). However, identifying where any given country in a catchment is located relative to other states is far from trivial, particularly in complex river geographies. Available data and methods now allow us to capture country and catchment boundaries with adequate precision. This also facilitates determining which countries in a catchment are more upstream or downstream, and how two or more states relate to each other in terms of freshwater dependencies15. We can thus use these measures to assess, for instance, whether upstream–downstream asymmetries between countries in freshwater catchments are, all else equal, associated with more water conflict and less cooperation.

To capture hydro-political dependence among riparian states, Beck et al.16, for example, employ a flow accumulation matrix that was created for each international river basin. They calculate the number of cells draining into a given country and determine the dependence of each riparian country on the other countries within a basin16. A flow interdependence matrix then indicates the flow contribution to each of the riparian countries. Based on these new data, they show that, contrary to conventional wisdom, there is no robust evidence for the claim that upstream–downstream catchments suffer from more water conflict than catchments with less pronounced upstream–downstream asymmetries.

Quantifying water conflict and cooperation

Generating accurate data on international freshwater conflict and cooperation is associated with a variety of challenges. In contrast to geophysical phenomena, social or political ones are usually not directly observable, but must be inferred from secondary sources. That said, most scholars now agree on what water-related cooperation and conflict means at the conceptual level, what procedures should be used to assess information from particular sources to generate numerical scores from this information, and how to structure such data for meaningful analysis14,20,39. In line with common practice in conflict research, conflict and cooperation are viewed as a social interaction that involves at least two actors. Hence, freshwater catchments with more than two countries are disaggregated into country pairs (for example, three country pairs, or dyads, in a catchment with three riparians).

Three main approaches capture conflict and/or cooperation over international freshwater catchments. First, conflict can be measured by means of widely available data on armed conflict40 and/or so-called militarized interstate disputes41. These outcomes are then combined with explanatory variables characterizing freshwater systems. Using this approach, various studies have examined whether water scarcity could, all else equal, increase the probability of armed hostilities between countries42. Second, cooperation over international freshwater resources can be operationalized via international water agreements, treaties, or joint river basin management approaches, among other variables along those lines43,44,45,46,47,48. For example, Giordano et al.47 identify 688 agreements signed between 1820 and 2007 that constitute 250 independent treaties and apply to 113 basins. Third, research coding event data for both conflict and cooperation builds on data collection approaches used in the study of international relations and conflict between countries (for example, the WEIS49 coding project or, more recently, the CAMEO50 framework and the Open Event Data Alliance51). Such coding is based on content analysis of global news media reporting, available from digital archives of translated reports, such as BBC Monitoring52 or Factiva53. Research teams have extracted large amounts of text material from these sources, using search algorithms that seek to strike a balance between capturing relevant reports and avoiding too many irrelevant items38. Human coders then identified water-related events and scored these on scales ranging from conflict to cooperation.

Studies based on the first approach, that is, those explaining armed conflict or militarized disputes in terms of water stress, have produced inconclusive findings15,16,41. Even if there is evidence for some water-related influence, other determinants of armed conflict actually play a much more important role than water stress. For example, Beck et al.16 or Bernauer and Böhmelt17 report a stronger impact of factors like income or population, which are indeed among the most robust predictors in ‘traditional’ armed-conflict models54. This finding mirrors the literature on climate change and political violence. Besides, this literature has three limitations. First, it focuses on identifying a possible correlation (all else equal) between water stress and conflict, but cannot tell us whether conflict, if observed, was directly water-related. This raises questions about the causal influence of water stress. Second, armed conflict is an extreme, and rare, form of social interactions. Concentrating on this disregards other types of conflictive interactions that water stress may induce. In fact, the basins-at-risk (BAR) scale discussed below demonstrates that non-violent conflict events are far more prevalent than violent ones. Third, this literature does not tell us much about the flip-side of conflict, that is, the conditions under which water stress may induce cooperative efforts and motivate societies to unleash their adaptive capacities11,13,27,41. The works on transboundary water cooperation42,43,44,45,46,47 address the latter point to some extent, but many of these studies focus on binary classifications of treaty formation. However, the overall degree of cooperation and eventual success cannot be comprehensively captured by a dichotomous item on whether states concluded a treaty on a transboundary water resource or not.

The main limitations of event-data coding, which we consider the most promising approach, pertain to the quality of the text material and the human-coding process. Media reporting in richer countries with free media is more likely to pick up events of interest and report on them with accuracy. This means, for instance, that conflictive events, relative to cooperative ones, might be underreported in authoritarian political systems. While this problem is not trivial, it is usually mitigated because at least the more important events (because of scale and intensity) tend to be covered by several media sources, including those in neighbouring countries or the international press. One alternative is to scrape the Internet or use social-media data, such as data from Twitter. But such information suffers from biases, too, because governments and other actors can manipulate Internet access and post wrong or misleading information. In addition, there are no information platforms that would offer consistent information for events-data coding in one or a few languages—the latter is needed to make the task manageable for a small- to medium-size research team (there are around 6,500 spoken languages in the world).

Another challenge is that in extracting and characterizing events from media text material, humans can make mistakes (for example, overlook certain information) or subjective assessments. Agreed definitions of key concepts and detailed coding instructions, scales and procedures have helped to reduce subjectivity and error. While the obvious next step would be to use automated (computerized) coding approaches, the material from which to code freshwater conflict and cooperation is more heterogeneous than for other applications, such as central bank statements, consumer sentiment or political party programs. Moreover, machine-learning algorithms may also be biased due to the data they are trained on. In sum, while some challenges remain and the data generated on freshwater conflict and cooperation are not perfect, they are probably as good in quality as the most commonly used social-sciences data, such as economic growth, democracy, poverty and so on.

Event-data coding of transboundary water conflict and cooperation is arguably the most widely used approach and has generated numerical information on freshwater-related events between pairs of countries in a given international catchment over time38. The BAR55,56,57 scale is one of the most prominent measures here: it ranges between –7 (maximum conflict) and +7 (maximum cooperation) and captures the degree of conflict and cooperation over international freshwater catchments between 1948 and 2008. Other datasets include the International River Basin Conflict and Cooperation (IRCC) data38 and the Issue Correlates of War − River Claims dataset56. Evidently, one shortcoming of the BAR data is that the most recent year covered is 2008. While we can still learn a lot from analysing data for 50 years, including information on the more recent past remains highly desirable from a policy perspective and in the scholarly interest.

Figure 1 illustrates the distribution of cooperation and conflict events across all freshwater catchments and countries, using median values of conflict and cooperation per year from 1948–2008. Perhaps surprisingly, states’ interaction over freshwater catchments is generally, that is, on global average of all catchments and countries in a given year, characterized by more cooperation than conflict. For the majority of years from 1948–2008, the median values of the BAR scale are well above 0, indicating that cooperation was more prevalent than conflict. From a policy perspective, it is interesting to pinpoint those catchments that experience most conflict or cooperation: hence, disaggregating the BAR scale by catchment.

Chart

Description automatically generated with medium confidence

The graph depicts three median splines across the BAR scale’s observation period for all possible BAR values, only cooperative (positive) ones, and only conflictive (negative) ones. The graph is based on data from www.transboundarywaters.science.oregonstate.edu.

Understanding the spatial and temporal distribution of international freshwater conflict and cooperation, in a descriptive sense, is important in its own right. However, it is also imperative to understand the drivers of variation in conflict and cooperation. Why do some catchments and/or pairs of countries in those catchments experience more conflict? Why is cooperation more prevalent in other cases?

Predictors of water cooperation and conflict

Accurate characterizations of international freshwater catchments and precise data on water conflict and cooperation are a precondition for meaningful analysis of drivers of water conflict and cooperation. Such analysis views conflict and cooperation as the outcomes to be explained and focuses both on conflict and cooperation at varying levels of intensity (for example, from conflictual verbal exchanges to violent conflict over water). Such research is obviously also of interest to practitioners because they are interested in which particular factors induce conflict or cooperation to identify risks and opportunities for cooperative solutions. Studies of factors associated with, or that cause variation in, the outcome variable (for example, the outbreak of armed conflict, the emergence of a water treaty, or values on the BAR scale) are based on a range of statistics, from correlational analysis to estimating the predictive power of specific determinants. In the following, we discuss the most common and robust predictors of transboundary water conflict and cooperation55,58,59.

#### Shortages force a shift to sustainable agriculture

Ann Hayden 21, Senior Director of Western Water and Resilient Landscapes at the Environmental Defense Fund, Emmy Cattani, Fifth-Generation Member of Cattani Farms, “Silver Lining to Water Woes Could Be Farmers Putting Their Lands To New Uses Besides Crops”, Fresno Bee, 4/21/2021, https://www.fresnobee.com/opinion/readers-opinion/article250540959.html

The Central Valley has reached a critical juncture.

On one path, without proactive, collaborative planning, the Valley could become a haphazard patchwork of dusty fields infested with invasive weeds and pests, further impairing already poor air quality, devastating the agricultural economy and putting many farmworkers out of work.

On another path, the Valley can remain a thriving agricultural region amid a mosaic of new land uses, like vibrant habitat corridors for the endangered San Joaquin kit fox or wildlife-friendly groundwater recharge areas for migratory birds or outdoor recreational green spaces for families.

A bill that on Thursday unanimously passed out of the Assembly Committee on Water, Parks and Wildlife can help move the Valley down this second, more resilient path.

Introduced by Assemblymembers Robert Rivas (D-Hollister) and Rudy Salas (D-Bakersfield), AB 252 will help ease the Valley’s transition to sustainable groundwater use and open the door to exciting new opportunities.

In 2014, the Legislature passed the historic Sustainable Groundwater Management Act, the most sweeping change to California water law in a century. Commonly referred to as SGMA (pronounced “sigma”), this law was passed to address decades of groundwater overpumping, which caused significant impacts. During the last drought, overpumping caused land to sink and damaged roads and canals, dried up community drinking water wells, and de-watered wetlands.

The implementation of SGMA is critically important to build long-term water sustainability for the Central Valley and will require a variety of tools and approaches to succeed.

One unfortunate reality of adjusting to increased water scarcity is that a significant amount of the state’s irrigated agricultural land — potentially the size of Yosemite National Park — will need to shift to less water-intensive agriculture or be taken out of production over the next couple decades. This will undoubtedly be challenging and will be exacerbated by more frequent droughts — like what we’re now experiencing — that will put additional strain on limited water supplies.

AB 252 will create the Multi-benefit Land Repurposing Incentive Program to compensate farmers who voluntarily re-purpose some of their previously irrigated land to create new uses that Valley communities need and want. Benefits could include water sustainability, habitat corridors for wildlife, and open space and recreational areas. Importantly, this program can also provide incentives to landowners to make the changes necessary to comply with SGMA sooner and in a way that minimizes economic and social impacts.

#### Industrial ag collapses insect populations---extinction

Dr. Liz Kimbrough 21, Ph.D. in Ecology and Evolutionary Biology from Tulane University, BS in Botany from Humboldt State University, Journalist at Monga Bay, “Are Major Insect Losses Imperiling Life on Earth?”, Monga Bay, 1/28/2021, https://india.mongabay.com/2021/01/are-major-insect-losses-imperiling-life-on-earth/

* New studies assessing insect declines around the planet find that on average, the decline in insect abundance, seen on nearly every continent, is thought to be around 1-2% per year or 10-20% per decade.
* Precipitous insect declines are being escalated by humanity as soaring population and advanced technology push us closer to overshooting several critical planetary boundaries including biodiversity, climate change, nitrification, and pollution.
* Action on a large scale (international, national, and public/private policymaking), and on a small scale (replacing lawns with insect-friendly habitat, for example) are desperately needed to curb and reverse insect decline.

Chances are, the works of the world’s insects touch your lips every day. The coffee or tea you savor, both are pollinated by insects. Apples, oranges, cabbages, cashews, cherries, carrots, broccoli, watermelon, garlic, cinnamon, basil, sunflower seeds, almonds, canola oil — all are insect-pollinated. Honey, dyes, even some vaccines require insects to come to fruition.

Vital to the world’s food web, nested in nutrient cycling, and embedded in industries — the closer we look, the more we see insects as vital to maintaining life’s frameworks. Referring to this fact, famed biologist E.O. Wilson wrote in 1987, “[I]f invertebrates were to disappear, I doubt the human species could last more than a few months.”

Which is why the precipitous decline of insects is raising alarms.

Insect populations are being reduced at varying rates across space and time, but on average, the decline in their abundance is thought to be around 1-2% per year, or 10-20% per decade.

“Think of a landowner with a million-dollar house on a river that’s a little bit wild. And they’re losing 10% to 20% of their land every decade, and it’s horrifying. It means that after even a century, you really don’t have anything left,” David Wagner, an entomologist with the University of Connecticut told Mongabay in an interview. That, he says of this comparison, is the danger we now face.

Wagner has just edited a newly released in-depth feature in the Proceedings of the National Academy of Science, Global Decline of Insects in the Anthropocene, in which 56 researchers present scientific studies, opinions and news on insect declines. The journal offers perspectives on the ecological, taxonomic, geographical and sociological dimensions of insect declines, along with suggestions on how we move forward to study and reverse this drain on global biodiversity.

Insect “death by a thousand cuts”

In a perspective piece that leads off the special issue, Wagner and his co-authors address the likely causes of insect decline. The main stressors to insects, they write, are changes in land use (particularly deforestation), agriculture, climate change, nitrification, pollution and introduced species. However, the importance of each stressor and how they interact still puzzles scientists.

“There are so many good scientists that can’t figure out what the cause is,” Wagner said. He poses the well-known honeybee as an example. “I mean, this thing is worth billions upon billions of dollars and we don’t know why it’s having such a hard time. And I think the reason is, it’s death by a thousand cuts… most of these things are hit by four or five pretty important stressors, and they’re acting synergistically.”

The articles that follow that opening essay zero in on the key causes for some of the biggest known losses:

A study by Wagner and Peter Raven, president emeritus of the Missouri Botanical Garden, concludes that declines in insect biodiversity and biomass are linked to the intensification of agriculture over the past 50 years.

Research by Dan Janzen and Winnie Hallwachs — both biologists from the University of Pennsylvania who describe themselves as “intense observers of caterpillars, their parasites, and their associates” — focuses on climate change as a stressor. Since the late 1970s, they write, they’ve watched as insect declines came to the dry forests, cloud forests, and rainforests of Costa Rica’s Guanacaste Conservation Area, as the region was plagued by rising temperatures, increasingly erratic seasons and inconsistent rainfall.

Another study in the special feature, titled, Insects and recent climate change, argues that climate may be playing even more of a role in declines than land-use change — which is massive around the planet mostly due to agribusiness expansion. The authors base their climate findings on a Northern California butterflies case study, where declines were severe even in areas suffering little habitat loss. Similar losses within well-protected areas have been detected in Germany and Puerto Rico.

Likewise, butterfly populations in Europe face challenges. In the UK, butterfly numbers have declined by around 50% over the past 50 years, with 8% of known resident species considered extinct. In the Netherlands, upwards of 20% of species have been lost and in Belgium 29%. Researchers suggest habitat loss, habitat degradation and chemical pollution as the primary causes. The authors offer conservation solutions and recommend policy changes to conserve butterflies and other insects — but so far political will has been lacking.

Moving from the winged creatures of the day to night fliers, Wagner and colleagues give an overview of the global state of moth declines. Moths are extremely diverse and cosmopolitan. “For every butterfly that Mongabay readers see during the daytime, there are 19 species of moths flying around at night,” Wagner revealed.

Although moth numbers have declined in some areas, such as in parts of Europe and Central America, in other, mostly temperate areas, many moth taxa are increasing in abundance. Another study found that the overall abundance of arthropods in the Arctic has increased in recent years. Researchers attribute these increases in insect abundance to climate change, which scientists say has both its species winners and losers. As warmer temperatures march northward, new suitable habitats open up for insects. The consequences of this range expansion — and the conflicts which may occur with plant and insect species already occupying those ranges — have yet to be analysed.

Insect declines are emblematic of a larger problem: the earth is in the midst of what some call the “sixth mass extinction.” Birds, amphibians, freshwater mussels, large mammals, all have seen dwindling numbers. The question for entomologists, Wagner said, is whether or not the decline of insects is actually occurring faster than for some other groups, especially because insects are often the direct target of destruction by human, due to pesticide and herbicide use.

Sarah Cornell, a scientist at the Stockholm Resilience Centre (SRC), raises an insect-related question relevant to our time: “There might have been many more mass extinctions. It’s just that we only see extinctions with the things that leave a record… things with skeletons… When people [say], ‘we’re entering the sixth mass extinction.’ Okay, well, how do we know that? We might be entering the 17th?… We might make ourselves extinct before we even reach these hallowed glories of the sixth.”

Overshooting planetary boundaries

Clearly, the loss of insect abundance — depending on where and how fast it occurs — could have far more dire, unforeseen impacts than the loss of coffee or cashews. The wholesale transformation of global ecosystems, triggering mass insect declines, could be pushing the Earth past what scientists have dubbed as a “planetary boundary.”

#### Probably back on actual aff sheet –

#### Pandemics dont cause extinction – o/w on scope & recenccy.

Halstead 19 John Halstead, doctorate in political philosophy. [Cause Area Report: Existential Risk, Founders Pledge, https://founderspledge.com/research/Cause%20Area%20Report%20-%20Existential%20Risk.pdf]//BPS

However, there are some reasons to think that naturally occurring pathogens are unlikely to cause human extinction. Firstly, Homo sapiens have been around for 200,000 years and the Homo genus for around six million years without being exterminated by an infectious disease, which is evidence that the base rate of extinction-risk natural pathogens is low.82 Indeed, past disease outbreaks have not come close to rendering humans extinct. Although bodies were piled high in the streets across Europe during the Black Death,83 human extinction was never a serious possibility, and some economists even argue that it was a boon for the European economy.84 Secondly, infectious disease has only contributed to the extinction of a small minority of animal species.85 The only confirmed case of a mammalian species extinction being caused by an infectious disease is a type of rat native only to Christmas Island. Having said that, the context may be importantly different for modern day humans, so it is unclear whether the risk is increasing or decreasing. On the one hand, due to globalisation, the world is more interconnected making it easier for pathogens to spread. On the other hand, interconnectedness could also increase immunity by increasing exposure to lower virulence strains between subpopulations.87 Moreover, advancements in medicine and sanitation limit the potential damage an outbreak might do.

#### No nuke winter – rainout.

**Reisner et al. 18** [Jon Reisner – Climate and atmospheric scientist at the Los Alamos National Laboratory. Gennaro D’Angelo – Climate scientist at the Los Alamos National Laboratory, Research scientist at the SETI institute, Associate specialist at the University of California, Santa Cruz, NASA Postdoctoral Fellow at the NASA Ames Research Center, UKAFF Fellow at the University of Exeter. Eunmo Koo - Scientist at Applied Terrestrial, Energy, and Atmospheric Modeling (ATEAM) Team, in Computational Earth Science Group (EES-16) in Earth and Environmental Sciences Division and Co-Lead of Parallel Computing Summer Research Internship (PCSRI) program at the Los Alamos National Laboratory, former Staff research associate at UC Berkeley. Wesley Even - Computational scientist in the Computational Physics and Methods Group at Los Alamos National Laboratory. Matthew Hecht – Atmospheric scientist at the Los Alamos National Laboratory. Elizabeth Hunke - Lead developer for the Los Alamos Sea Ice Model (CICE) at the Los Alamos National Laboratory responsible for development and incorporation of new parameterizations, model testing and validation, computational performance, documentation, and consultation with external model users on all aspects of sea ice modeling, including interfacing with global climate and earth system models. Darin Comeau – Climate scientist at the Los Alamos National Laboratory, Randy Bos - Project leader at the Los Alamos National Laboratory, former Weapons Effects program manager at Tech-Source, James Cooley – Computational scientist at the Los Alamos National Laboratory specializing in weapons physics, emergency response, and computational physics, “Climate impact of a regional nuclear weapons exchange:An improved assessment based on detailed source calculations,” March 16, 2018, <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017JD027331>]

To quantitatively account for natural and forced variability in the climate system, we created two ensembles, one for the natural, unforced system and a second ensemble using a range of realistic vertical profiles for the BC aerosol forcing, consistent with our detailed fire simulation. The control ensemble was generated using small atmospheric temperature perturbations (Kay et al., 2015). Notably, the overall spread of anomalies in both ensembles is very similar. These ensembles were then used to create “super ensembles” using a statistical emulator, which allows a robust statistical comparison of our simulated results with and without the carbon forcing. Our primary result is the **decreased impact on global climate indices**, such as global average surface temperature and precipitation, relative to standard scenarios considered in previous work (e.g., Robock et al., 2007a; Stenke et al., 2013; Mills et al., 2014; Pausata et al., 2016). With our finding of **substantially less BC aerosol being lofted to stratospheric heights** (e.g., over a factor of four less than in most of the scenarios considered by previous studies), these globally averaged anomalies drop to **statistically insignificant levels** after the first several years (Figures 14 and 16). Our results are generally comparable to those predicted by other studies that considered exchange scenarios in which only about 1 Tg of soot is emitted in the upper troposphere (Robock et al., 2007a; Mills et al., 2008; Stenke et al., 2013). There are more subtle suggestions of regional effects, notably in the extent of the region over which sea surface temperature differences between ensembles remain significant in the final years of simulation (Figure 17). Further work is required to adequately analyze these and other potential regional effects. Historical analysis of several large volcanic eruptions and a recent large fire also supports this result. For example, Timmreck et al. (2010) claim that nonlinear aerosol effects of the Toba Tuff eruption 74,000 years ago helped **limit significant global cooling** impacts to a **two-year time period** and that any cooling beyond this time period could be due to other effects. It should be noted that this eruption was estimated to have produced **106 Tg** of ash and comparable amounts of other gases, such as sulfur dioxide (SO2), while the estimated amount of soot produced by a regional exchange is on the order of **10 Tg**, or **5 orders of magnitude smaller than the ash** (not including gases) **produced by the Toba eruption**. Noting that a nuclear exchange is not identical to volcanic events, it has been asserted that BC particles produced by fires should have a **greater impact on absorbing solar radiation** than even has the significantly larger amounts of ash and various gases produced by large eruptions (e.g., Robock and Toon 2010). Likewise, recent work in analyzing BC emissions from large fires suggests that in such fires, similar to large volcanic eruptions, **coating of soot particles with other particles** in convective eddies **tends to increase their size and hence increase their subsequent rainout** (China et al., 2013) before they can reach the stratosphere. In fact, the recent study of Pausata et al. (2016) found that growth of BC aerosol via coagulation with organic carbon significantly reduce the particles’ lifetime in the atmosphere