## I affirm, Resolved: Appropriation of outer space by private entities is unjust.

## FW

#### Pleasure and pain are intrinsically valuable.

Moen 16 [(Ole Martin Moen, Research Fellow in Philosophy at University of Oslo) “An Argument for Hedonism,” Journal of Value Inquiry (Springer), 50 (2) 2016: 267–281, <https://link.springer.com/article/10.1007/s10790-015-9506-9>] TDI

Let us start by observing, empirically, that **a widely shared judgment about intrinsic value and disvalue is that pleasure is intrinsically valuable and pain is intrinsically disvaluable.** **On virtually any proposed list of intrinsic values and disvalues (we will look at some of them below), pleasure is included among the intrinsic values and pain among the intrinsic disvalues.** This inclusion makes intuitive sense, moreover, for **there is something undeniably good about the way pleasure feels and something undeniably bad about the way pain feels, and neither the goodness of pleasure nor the badness of pain seems to be exhausted by the further effects that these experiences might have.** “Pleasure” and “pain” are here understood inclusively, as encompassing anything hedonically positive and anything hedonically negative.2 **The special value statuses of pleasure and pain are manifested in how we treat these experiences in our everyday reasoning about values.** If you tell me that you are heading for the convenience store, **I might ask: “What for?” This is a reasonable question, for when you go to the convenience store you usually do so**, not merely for the sake of going to the convenience store, but **for the sake of achieving something further that you deem to be valuable.** You might answer, for example: “To buy soda.” This answer makes sense, for soda is a nice thing and you can get it at the convenience store. I might further inquire, however: “What is buying the soda good for?” This further question can also be a reasonable one, for it need not be obvious why you want the soda. You might answer: “Well, I want it for the pleasure of drinking it.” **If I then proceed by asking “But what is the pleasure of drinking the soda good for?” the discussion is likely to reach an awkward end. The reason is that the pleasure is not good for anything further; it is simply that for which going to the convenience store and buying the soda is good.**3 As Aristotle observes**: “We never ask [a man] what his end is in being pleased, because we assume that pleasure is choice worthy in itself.**”4 Presumably, a similar story can be told in the case of pains, for if someone says “This is painful!” we never respond by asking: “And why is that a problem?” We take for granted that if something is painful, we have a sufficient explanation of why it is bad. If we are onto something in our everyday reasoning about values, it seems that **pleasure and pain are both places where we reach the end of the line in matters of value.**

#### Moral uncertainty means preventing extinction should be our highest priority.

Bostrom 12 [(Nick Bostrom, Faculty of Philosophy & Oxford Martin School University of Oxford) “Existential Risk Prevention as Global Priority.” Global Policy, 2012] TDI

These reflections on moral uncertainty suggest an alternative, complementary way of looking at existential risk; they also suggest a new way of thinking about the ideal of sustainability. Let me elaborate.¶ Our present understanding of axiology might well be confused. We may not now know — at least not in concrete detail — what outcomes would count as a big win for humanity; we might not even yet be able to imagine the best ends of our journey. If we are indeed profoundly uncertain about our ultimate aims, then we should recognize that there is a great option value in preserving — and ideally improving — our ability to recognize value and to steer the future accordingly. Ensuring that there will be a future version of humanity with great powers and a propensity to use them wisely is plausibly the best way available to us to increase the probability that the future will contain a lot of value. To do this, we must prevent any existential catastrophe.

### Advocacy

#### We defend that private appropriation is unjust- instead, outer space ought to be recognized as a global commons as per the Goehring card.

Goehring 6/3 - John S. Goehring [B.A., University of California, Berkeley; J.D., Tulane Law School; LL.M., McGill University, Institute of Air and Space Law) is a space and international law attorney for the Department of Defense and a judge advocate in the United States Air Force Reserve], “Why Isn’t Outer Space a Global Commons?” *Journal of National Security Law and Policy*. Vol. 11:573. (June 3, 2021).<https://jnslp.com/wp-content/uploads/2021/09/Why\_Isnt\_Outer\_Space\_a\_Global\_Commons\_2.pdf> AT

B. Global Commons as a Constraining Concept In an economic context, as opposed to a military or geopolitical context, “global commons” is typically used to convey a constraining concept. The concept of a “commons” may be thought of as constraining because it is often associated with notions of shared ownership, public governance, or limitations on use. Whether these constraints are viewed positively or negatively is a subjective assessment. The constraining concept is more complicated than the enabling concept because it can reflect two distinct meanings. This is likely a function of its history. “The ‘commons,’ of course, has a long historical and intellectual lineage ranging from the enclosure movement in England, to Garret Hardin’s famous Tragedy of the Commons parable, to Elinor Ostrom’s Nobel-prize winning work on governing common pool resources,” observe Professors Foster and Iaione.30 Applying rational-choice theory, Hardin postulated that individual actors “automatically tend to over-exploit and plunder common-pool resources that are freely available to everyone.”31 The only possible solution to this dilemma, according to Hardin, was “the enclosure of resources through private property, or, failing that, public regulation.”32 Ostrom’s work later “turned [Hardin’s] conventional wisdom upside down: complex socio-ecological systems (in which goods are extractable and beneficiaries are hard to exclude) can prove to be sustainable resource domains granted that its stakeholders adopt a polycentric and self-regulated mode of governance.”33 As this brief summary suggests, one meaning of “commons” is simply to describe a category of goods.34 This usage was typical prior to Ostrom’s influence.35 In this meaning, a common is a resource to which access is shared, such as an open hunting ground. Some common resources may offer more than one type of benefit. For example, a hunting ground may offer open space for recreation, game to hunt, and trees for building. Some common resources may be subtractable, meaning that use of the resource subtracts from the ability of others to use the resource, while others remain plentiful. Describing a resource in this manner, as a common resource, does not necessarily imply any particular property regime or use limitations.36 A common hunting ground, for instance, may be publicly owned or privately owned. Ostrom helped popularize the term “common pool resource” to describe this general category of resources.37 As Dr. Tepper argues, “[i]t is crucial to differentiate between resources and the legal regime that governs them.”38 This is because the term “global commons” – or simply “commons” – can also be used in an economic sense to refer to a form of collective ownership and governance rather than to the economic goods themselves.39 As Professors Cogolati and Woulters observe, “[u]nder Ostrom’s influence, the commons have become more closely connected with the collective self-governance and participatory mechanisms they imply, than with the strict category of (rivalrous and non-excludable) economic goods they used to refer to.”40 This may account for the notion held by some that “the commons is less a description of the resource and its characteristics and more of a normative claim to the resource” (emphasis original).41 Used in this way, a commons is a category of property rights based on collective ownership.42 Put simply, “commons” is sometimes used to refer to common property, meaning a resource with more than one owner, and which therefore should be governed collectively. This notion of a commons is sometimes associated with the common heritage of mankind concept, particularly in the context of outer space. As expressed in Article 11(3) of the 1979 Moon Agreement, the common heritage of mankind concept creates a new type of territorial status in which the moon and celestial bodies “are not only in themselves not subject to national appropriation in a territorial sense, but the fruits and resources of which are also deemed to be the property of mankind at large,” according to Professor Cheng.43 This principle, as characterized by Professor Christol, not only “protects the proposition what [sic] given areas and their resources are open to inclusive use and that there may not be exclusive use,” but also “goes farther: it asserts that there must be a sharing of the benefits and of the values derived from the indicated commons.”44 In other words, status as the common heritage of mankind does not permit full private property rights in space resources. It should be noted that the concept of the common heritage of mankind is not limited to the outer space domain. In 1970, the United Nations (UN) General Assembly passed a non-binding resolution declaring “[t]he sea-bed and ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction (hereinafter referred to as the area), as well as the resources of the area, are the common heritage of mankind.”45 Years later – after the completion of the Moon Agreement – this principle was codified in Article 136 of the 1982 UN Convention on the Law of the Sea (UNCLOS).46 Importantly, while the area is the common heritage of mankind according to the Convention, the high seas above the area remains free.47 Hence, some may refer to the high seas as a global commons (in the enabling sense), while others may refer to the deep sea bed as a global commons (in the constraining sense) – a clear example of why the term is fraught with misunderstanding. While the concept of common heritage of the seabed and of the Moon and other celestial bodies are linked, the Moon Agreement declares that the content of the common heritage of mankind concept as it applies to States Parties “finds its expression in the provisions of this Agreement” and nowhere else.48 In general, the concept “lacks a precise definition” but “basically wishes to convey the idea that management, exploitation and distribution of the natural resources of the area in question are matters to be decided upon by the international community and are not to be left to the initiative and discretion of individual States and their nationals.”49 The United States has not signed the Moon Agreement and rejects the notion that outer space resources are the common heritage of mankind, a position clearly reiterated in Executive Order 13914.50 The last of the five international space treaties to have been negotiated in the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), the Moon Agreement is regarded as a failed treaty with only 18 nations having signed on, none of which is China, Russia, or the United States, the three most prominent space-faring States.51 VISITED STATUS OF INTERNATIONAL AGREEMENTS RELATING TO ACTIVITIES IN OUTER SPACE, UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS, https://perma.cc/8VA5-4UW8 (last July 11, 2020). The 1967 Outer Space Treaty, by contrast, has over 100 States Parties.52 Context is essential for discerning the distinction between the constraining concept and the enabling concept. By themselves, “global commons” or “commons” do not necessarily convey one concept or the other. Describing a resource as a “global commons” in an economic context implies a focus on an open access resource and the consumption of that resource; it suggests a resource allocation problem in need of a solution and inevitably invites questions about ownership. In contrast, referring to a global commons in a military or geopolitical context implies a focus on the use of an open access domain and, when used accurately, the lack of ownership is a settled question. Indeed, the distinction between a focus on a thing (res) itself and a focus on the right to use and explore a domain is among the reasons the term “res communis” is not interchangeable with “global commons” when used in a military or geopolitical sense.53

#### Treating space as a commons solves orbital debris. States already agree to a limited regime of this type.

Silverstein & Panda ‘3/9 - Benjamin Silverstein [research analyst for the Space Project at the Carnegie Endowment for International Peace. MA, International Relations, Syracuse University Maxwell School of Citizenship and Public Affairs BA, International Affairs, George Washington University] and Ankit Panda [Stanton Senior Fellow in the Nuclear Policy Program at the Carnegie Endowment for International Peace. AB, Princeton University], “Space Is a Great Commons. It’s Time to Treat It as Such.” *Carnegie Endowment for International Peace* (Web). March 9, 2021. Accessed Dec. 13, 2021. <<https://carnegieendowment.org/2021/03/09/space-is-great-commons.-it-s-time-to-treat-it-as-such-pub-84018>> AT

The failure to manage Earth orbits as a commons undermines safety and predictability, exposing space operators to growing risks such as collisions with other satellites and debris. The long-standing debris problem has been building for decades and demands an international solution.¶ Competing states need to coalesce behind a commons-based understanding of Earth orbits to set the table for a governance system to organize space traffic and address rampant debris. New leadership in the United States can spur progress on space governance by affirming that Earth orbits are a great commons. So far, President Joe Biden and his administration have focused on major space projects, but a relatively simple policy declaration that frames Earth orbits as a great commons can support efforts to negotiate space governance models for issues like debris mitigation and remediation. The Biden administration can set the stage to pursue broad space policy goals by establishing a consensus among states, particularly those with the most invested in Earth orbits, that space is a great commons.¶ THE PRESSING NEED FOR SPACE GOVERNANCE¶ The Earth orbits that provide the majority of benefits to states and commercial ventures represent only a tiny fraction of outer space as a whole. Competition for the limited volume of these Earth orbits is especially fierce since two satellites cannot be in the same place at the same time and not all orbits are equally useful for all missions. The number of objects residing in Earth orbits is now at an all-time high, with most new objects introduced into orbits at altitudes of between 400 and 700 kilometers above sea level. Millions of pieces of debris in Earth orbits pose a threat to continuing space operations. For instance, the final U.S. space shuttle missions faced 1-in-300 odds of losing a space vehicle or crew member to orbital debris or micrometeoroid impacts.¶ Collisions with fragments of orbital litter as small as a few millimeters across can ruin satellites and end missions. Current technologies cannot track all of these tiny pieces of debris, leaving space assets at the mercy of undetectable, untraceable, and unpredictable pieces of space junk. Some researchers have determined that the debris population in low Earth orbit is already self-sustaining, meaning that collisions between space objects will produce debris more rapidly than natural forces, like atmospheric drag, can remove it from orbit.¶ States—namely the United States, Russia, China, and India—have exacerbated this debris accumulation trend by testing kinetic anti-satellite capabilities or otherwise purposefully fragmenting their satellites in orbit. These states, along with the rest of the multilateral disarmament community, are currently at an impasse on establishing future space governance mechanisms that can address the debris issue. A portion of this impasse may be attributable to disparate views of the nature of outer space in the international context. Establishing a clear view among negotiating parties that Earth orbits should be treated as a great commons would establish a basis for future agreements that reduce debris-related risks.¶ Beyond debris-generating, kinetic anti-satellite weapons tests, revolutionary operating concepts challenge existing space traffic management practices. For instance, commercial ventures are planning networks of thousands of satellites to provide low-latency connectivity on Earth and deploying them by the dozens. States are following this trend. Some are considering transitioning away from using single (or few) exquisite assets in higher orbits and toward using many satellites in low Earth orbits. These new operational concepts could lead to an increase in collision risks.¶ Without new governance agreements, problems related to debris, heavy orbital traffic, and harmful interference will only intensify. Debris in higher orbits can persist for a century or more. The costs of adapting to increasingly polluted orbits would be immense, and the opportunity costs would be even higher. For instance, all else being equal, hardening satellites against collisions increases their mass and volume, in turn raising launch costs per satellite. These costs, rooted in a failure to govern space as a commons, will be borne by all space actors, including emerging states and commercial entities.¶ EXISTING FORMS OF SPACE GOVERNANCE¶ A well-designed governance system, founded on a widespread understanding of Earth orbits as a great commons, could temper these risks. Currently, space is not wholly unregulated, but existing regulations are limited both in scope and implementation. Many operators pledge to follow national regulations and international guidelines, but decentralized accountability mechanisms limit enforcement. These guidelines also do not cover the full range of potentially risky behaviors in space. For example, while some space operators can maneuver satellites to avoid collisions, there are no compulsory rules or standards on who has the right of way.¶ At the interstate level, seminal multilateral agreements provide some more narrow guidance on what is and is not acceptable in space. Most famously, the Outer Space Treaty affirms that outer space “shall be free for exploration and use by all states without discrimination of any kind” and that “there shall be free access to all areas of celestial bodies.” Similar concepts of Earth orbits being a great commons arise in subsequent international texts. Agreements like the Liability Convention impose fault-based liability for debris-related collisions in space, but it is difficult to prove fault in this regime in part because satellite owners and operators have yet to codify a standard of care in space, and thus the regime does not clearly disincentivize debris creation in orbit. Other rules of behavior in Earth orbits have been more successful in reducing harmful interference between satellite operations, but even these efforts are limited in scope.¶ States have acceded to supranational regulations of the most limited (and thus most valuable) Earth orbits. The International Telecommunication Union (ITU) coordinates, but does not authorize, satellite deployments and operations in geosynchronous orbits and manages radiofrequency spectrum assignments in other regions of space to reduce interference between satellites. These coordination activities are underpinned by the ITU’s constitution, which reminds states “that radio frequencies and any associate orbits . . . are limited natural resources,” indicating a commons-based approach to governing the radiofrequency spectrum. However, the union’s processes are still adapting to new operational realities in low Earth orbit, and these rules were never designed to address issues like debris.

#### States can extend existing commons models to govern space, but recognition of space as a commons is key.

Silverstein & Panda ‘21 - Benjamin Silverstein [research analyst for the Space Project at the Carnegie Endowment for International Peace. MA, International Relations, Syracuse University Maxwell School of Citizenship and Public Affairs BA, International Affairs, George Washington University] and Ankit Panda [Stanton Senior Fellow in the Nuclear Policy Program at the Carnegie Endowment for International Peace. AB, Princeton University], “Space Is a Great Commons. It’s Time to Treat It as Such.” *Carnegie Endowment for International Peace* (Web). March 9, 2021. Accessed Dec. 13, 2021. <<https://carnegieendowment.org/2021/03/09/space-is-great-commons.-it-s-time-to-treat-it-as-such-pub-84018>> AT

BUILDING ON PRIOR MODELS FOR MANAGING COMMONS¶ The histories of other great commons provide lessons on how to manage shared space resources meaningfully and effectively. Efforts to minimize damage to other great commons—like the Convention on Long-Range Transboundary Air Pollution and subsequent protocols—offer guidance on how to resolve compliance issues. Notably, the negotiations on the original convention on air pollution involved, among others, the United States and the Soviet Union. This suggests that states can pursue mutual benefits in areas considered great commons even under competitive conditions. More recent negotiations on the convention’s accompanying protocols show that these competing states can even agree on financing a monitoring regime to support progress.¶ Existing conventions and implementing agreements indicate that states can reach valuable commitments to manage the Earth’s great commons. These governance models protect state interests and preserve the commons themselves. These principles apply to space, but progress on establishing more encompassing space governance principles, enforcement mechanisms, and dispute resolution procedures hinges on states sharing the fundamental view that space is a great commons. Reaching such a consensus is an important first step.¶ New leadership in prominent spacefaring states can revitalize efforts to recognize space as a commons and can build on established legal standards to pursue commons-related principles for governing Earth orbits. Space actors do not have to resolve all their competing interests based on the debris problem. But negligence, mismanagement, or poorly designed rules may spell disaster for Earth orbits. As a more diverse range of actors with space-based interests emerges, no single actor will be able to unilaterally impose universal rules. States can, however, negotiate agreements to manage commons areas to better pursue national objectives. The only way to effectively govern state and commercial space activities is to settle on and abide by common norms or rules.¶ New conventions or regulatory mechanisms for governing Earth orbits will not appear overnight, but states can build toward these goals by clarifying their commitments to treat space as a commons and pursuing governance arrangements that reflect this commitment. New policies in the United States should reflect that Earth orbits are a great commons.

### Contention 1: Exploitation

#### Private appropriation of space instead of treating it as a global commons re-entrenches inequality on Earth. Stockwell 20

Samuel Stockwell, 7-20-2020, "Legal ‘Black Holes’ in Outer Space: The Regulation of Private Space Companies," E-International Relations, <https://www.e-ir.info/2020/07/20/legal-black-holes-in-outer-space-the-regulation-of-private-space-companies/> //marlborough JH

On 30th April 2020, NASA – the US government’s space agency ­– awarded three private space companies a joint-contract worth $967m to complete a lunar mission by 2024, in what was celebrated as “the last piece that [America] need[s] in order to get to the moon” by NASA administrator Jim Brindestine (The Telegraph, 2020). Yet, whilst this development was widely covered in the media, less coverage has focused on the extent to which existing international legislation surrounding outer space endeavours appropriately applies to private entities. Indeed, the prospect of a corporate foothold within the extra-terrestrial domain has thrown up both a mixture of optimism and concern regarding the potential benefits of expanding capital projects into space (Adolph, 2006; Dickens & Ormrod, 2007). ¶By adopting the 1967 UN Outer Space Treaty (OST) as an analytical framework in relation to the rise of the so-called US ‘NewSpace’ actors, this essay argues that there are significant legal ambiguities regarding the status of private space companies in orbital space. Such loopholes allow the US government to circumvent its own obligations to the OST, whilst simultaneously undermining the notion of space as a ‘global commons’ through a commodification process. The lack of specificity within the OST [Outer Space Treaty] surrounding private property rights over extra-terrestrial resources risks the prospect of reinforcing Earth-bound wealth inequalities and US dominance in space, by restricting the potential economic benefits for the broader global citizenry in favour of a narrow class of wealthy American investors. Moreover, the OST’s weak clause regarding the regulation of space surveillance risks the incentivisation of a ‘global panopticon’ network of US satellites. The rise of dual-use technology is blurring the boundaries between military and civilian observations, raising serious ethical concerns over the nature of US space-based data collection. Finally, the increasing number of private satellite constellations is facilitating the possibility of cataclysmic space debris collisions which could exacerbate geopolitical tensions. Such developments are also contributing towards the contamination of the broader space environment in ways that the OST had never envisioned. ¶The UN Outer Space Treaty and Rise of the ‘NewSpace’ Actors ¶Although ratified into international law in 1967, the UN Outer Space Treaty (OST) is perhaps still the most relevant piece of legislation for analysing state and non-state entity activity in outer space. Designed to prevent both the militarisation of space and national appropriation of celestial bodies at the height of Cold War tensions, the UN OST holds significant influence as a form of customary international law (Hebert, 2014: 6). Ratified by over 100 nations – including major spacefaring nations such as the United States, Russia and China – the treatyis widely accepted as an authoritative document and has formed the basis for all other space treaties that have succeeded it (Kramer, 2017: 129). This is in contrast to more recent legislation such as the 1972 Moon Treaty designed to promote cooperation in Moon exploration and development, which the US and other major space superpowers have refrained from signing (Adolph, 2006: 968-969).  ¶The type of American actors becoming involved in the realm of outer space has undergone significant diversification. Despite working alongside NASA since the 1950s, commercial enterprises were largely confined to the manufacturing of parts utilised in rockets and other equipment for space activities (Lal, 2016: 63-66). However, the continuous sharp decline in NASA’s overall budget that has occurred since the Apollo 11 moon landing, and the increasing trends towards the privatisation of government functions has drastically altered both the capabilities and the outlooks of private space companies. Indeed, although the space economy is growing overall, global government spending decreased by 1.3% between 2012 and 2013 while commercial-sector growth increased by roughly 7% (Conklin, 2017: 33). Central to the impetus behind this private sector space boom has been the emergence of the so-called ‘NewSpace’ actors – “a broad range of primarily US-based entrepreneurs… who, for more than 30 years, have aimed to commercialise space” (Valentine, 2012: 1046). Driven by a libertarian outlook of economics, and critical of NASA’s historical grip on space exploration, these individuals portray themselves as the pioneers of the ‘final frontier’ who will save humanity from extinction through privately-funded extra-terrestrial missions (Kearnes & van Dooren, 2017: 182). ¶Near-Earth Object and Lunar Resource Mining: US Private Property in Space ¶Lunar rock samples from the Apollo missions containing rare Earth resources, such as Helium-3 which produces more power and less waste than traditional nuclear reactors on Earth, have since fuelled incentives for extra-terrestrial resource mining (Brearley, 2006: 44-46). This was further facilitated by suggestions that near-earth objects (NEOs) like the so-called ‘Anteros asteroid’ could comprise of over five trillion dollars’ worth of magnesium silicate and aluminium (Kramer, 2017: 131). ¶Envisaging appropriation concerns that might arise from the future extraction of space assets by spacefaring nations, Article II of the UN OST declared that: “Outer space is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means” (UN, 1967). The emphasis on claims of national sovereignty were intimately tied to the Cold War context at the time, where space activities were under the exclusive monopoly of governmental agencies and initiated for goals of military dominance or national prestige (Sachdeva, 2017: 210). However, the privatisation of the space industry that has occurred since the 1980s has meant that the legislation leaves an enormous amount of legal ambiguity and interpretation regarding the regulation of private resource mining in space. As Shaer (2016) demonstrates, the Article II provision fails to address either the exploitation of space for financial gain or the property claims of commercial enterprises (Shaer, 2016: 47). ¶Nevertheless, Article VI of the UN OST asserts that: “States shall be responsible for national space activities whether carried out by governmental or non-governmental entities” (UN, 1967; own emphasis). Some scholars have suggested that this clause significantly restrains the activities of private space corporations by incentivising states to regulate their domestic organisations for fear of liability concerns (Abeyratne, 1998: 168). However, the US government recently enacted a piece of legislation which exploited this clause, in order to circumvent its own restrictions and strengthen US economic influence in space. The passage of the 2015 SPACE Act enabled US citizens to privately “possess, own, transport, use, and sell the resources” they obtain in outer space, whilst making careful consideration to deny national sovereign claims over such materials (Leon, 2018: 500). ¶Yet, regardless of whether it is an American private company or public venture, the US is still satisfying its geopolitical interests; by exclusively siphoning off extra-terrestrial resources for American gain, the nation’s soft power is thereby extended at the expense of spacefaring adversaries such as China (Basu & Kurlekar, 2016: 65). Indeed NewSpace actors cleverly played on these strategic concerns prior to the bill’s passage, with billionaire space entrepreneur Robert Bigelow asserting that the biggest danger wasn’t private enterprises on the Moon, but that “America is asleep and does nothing, while China comes along… surveying and laying claim [to the Moon]” (Klinger, 2017: 222). ¶The US government’s support for private space companies is also likely to lead to the reinforcement of Earth-bound wealth inequalities in space. Many NewSpace actors frame their long-term ambitions in space with strong anthropogenic undertones, by offering the salvation of the human race from impending extinction through off-world colonial developments (Kearnes & Dooren: 2017: 182). Yet, this type of discourse disguises the highly exclusive nature of these missions. Whilst they seem to suggest that there is a stake for ordinary citizens in the vast space frontier, the reality is that these self-described space pioneers are a member of a narrow ‘cosmic elite’ – “founders of Amazon.com, Microsoft, Pay Pal… and a smattering of games designers and hotel magnates” (Parker, 2009: 91). ¶Indeed, private space enterprises have themselves suggested that they have no obligation to share mineral resources extracted in space with the global community (Klinger, 2017: 208). This is reflected in the speeches of individuals such as Nathan Ingraham, a senior editor at the tech site EngadAsteroid mining, who claimed that asteroid mining was “how [America is] going to move into space and develop the next Vegas Strip” (Shaer, 2016: 50). Such comments highlight a form of what Beery (2016) defines as ‘scalar politics’. In similar ways to the ‘scaling’ of unequal international relations that has constituted our relationship with outer space under the guise of the ‘global commons’ (Beery, 2016: 99), private companies – through their anthropogenic discourse – are scaling existing Earth-bound wealth inequalities and social relations into space by siphoning off extra-terrestrial resources. By constructing their endeavours in ways that appeal to the common good, NewSpace actors are therefore concealing the reality of how commercial resource extraction serves the exclusive interests of their private shareholders at the expense of the vast majority of the global population.

#### Private control of space inevitably leads to exploitation- that’s intrinsically violent against disadvantaged communities. Spencer ‘20

Spencer, Keith A. [senior editor at Salon]“Against Mars-a-Lago: Why SpaceX's Mars Colonization Plan Should Terrify You.” Salon, Salon.com, 7 Jan. 2020, https://www.salon.com/2017/10/08/against-mars-a-lago-why-spacexs-mars-colonization-plan-should-terrify-you/.

When CEO Elon Musk announced last month that his aerospace company SpaceX would be [sending cargo missions](https://www.washingtonpost.com/news/the-switch/wp/2017/09/29/elon-musk-says-his-next-spaceship-could-not-only-take-to-you-the-moon-and-mars-but-from-n-y-to-london-in-29-minutes/?utm_term=.85279aa2076a) to Mars by 2022 — the first step in his tourism-driven colonization plan — a small cheer went up among space and science enthusiasts. Writing in the New York Post, Stephen Carter [called](http://nypost.com/2017/10/07/elon-musks-inspiring-vision-for-reaching-mars-and-the-stars/) Musk’s vision “inspiring,” a salve for politically contentious times. “Our species has turned its vision inward; our image of human possibility has grown cramped and pessimistic,” Carter wrote: "We dream less of reaching the stars than of winning the next election; less of maturing as a species than of shunning those who are different; less of the blessings of an advanced technological tomorrow than of an apocalyptic future marked by a desperate struggle to survive. Maybe a focus on the possibility of reaching our nearest planetary neighbor will help change all that." The Post editorial reflected a growing media consensus that humankind’s ultimate destiny is the colonization of the solar system — yet on a private basis. American government leaders generally agree with this vision. Obama egged on the [privatization of NASA](http://blogs.discovermagazine.com/80beats/2010/02/01/obamas-nasa-budget-so-long-moon-missions-hello-private-spaceflight/) by legislating a policy shift to private commercial spaceflight, awarding government contracts to private companies like SpaceX to shuttle supplies to the International Space Station. “Governments can develop new technology and do some of the exciting early exploration but in the long run it's the private sector that finds ways to make profit, finds ways to expand humanity,” [said](http://www.theregister.co.uk/2012/03/08/nasa_private_space_nasa/) Dr. S. Pete Worden, the director of the NASA Ames Research lab, in 2012. And in a Wall Street Journal [op-ed](https://www.wsj.com/articles/america-will-return-to-the-moonand-go-beyond-1507158341?mod=e2fb) this week, Vice President Mike Pence wrote of his ambitions to bring [American-style capitalism to the stars](https://www.salon.com/2017/08/06/tacoma-the-next-video-game-from-gone-home-creators-imagines-the-gig-economy-in-space/): “In the years to come, American industry must be the first to maintain a constant commercial human presence in low-Earth orbit, to expand the sphere of the economy beyond this blue marble,” Pence wrote. One wonders if these luminaries know their history. There has be no instance in which a private corporation became a colonizing power that did not end badly for everyone besides the shareholders. The East India Company is perhaps the finest portent of Musk’s Martian ambitions. In 1765, the East India Company forced the Mughal emperor to sign a legal agreement that would essentially permit their company to become the de facto rulers of Bengal. The East India Company then collected taxes and used its private army, which was over 200,000 strong by the early 19th century, to repress those who got in the way of its profit margins. “It was not the British government that seized India at the end of the 18th century, but a dangerously unregulated private company headquartered in one small office, five windows wide, in London, and managed in India by an unstable sociopath,” [writes](https://www.theguardian.com/world/2015/mar/04/east-india-company-original-corporate-raiders) William Dalrymple in the Guardian. “It almost certainly remains the supreme act of corporate violence in world history.” The East India Company came to colonize much of the Indian subcontinent. In the modern era, an era in which the right of corporations to do what they want, unencumbered, has become a [sacrosanct](https://www.salon.com/2017/09/19/trumps-interior-secretary-on-national-monuments-sell-em-and-strip-em/) [right](https://www.salon.com/2016/12/15/exxonmobil-ceo-and-trump-pick-rex-tillerson-my-philosophy-is-to-make-money_partner/) in the eyes of many politicians, the lessons of the East India Company seem to have been all but forgotten. As Dalrymple writes: Democracy as we know it was considered an advance over feudalism because of the power that it gave the commoners to share in collective governance. **To privately colonize a** nation, much less a planet, **means ceding governance and control** back **to corporations whose interest is not ours, and** indeed, is always at odds with workers and residents — **particularly in a resource-limited environment** like a spaceship or the red planet. Even if, as Musk suggests, a private foundation is [put in charge](https://www.jacobinmag.com/2017/02/mars-elon-musk-space-exploration-nasa-colonization) of running the show on Mars, their interests will inherently be at [odds with the workers](http://www.dailykos.com/story/2015/5/5/1372730/-Skylab-and-the-Sit-Down-Strike-in-Space) and employees involved. After all, a private foundation [is not a democracy](https://www.jacobinmag.com/2015/11/philanthropy-charity-banga-carnegie-gates-foundation-development); and as major philanthropic organizations like the Bill and Melinda Gates Foundation [illustrate](https://www.jacobinmag.com/2015/11/philanthropy-charity-banga-carnegie-gates-foundation-development), often [do the bidding](http://www.peterfrase.com/2011/08/the-decay-of-the-capitalist-class/) of their rich donors, and take an [important role in ripening industries](https://www.salon.com/2016/02/21/corporate_reformers_wreck_public_schools_billionaire_foundations_and_wall_street_financiers_are_not_out_to_help_your_kids_learn/) and regions for exploitation by Western corporations. Yet Mars’ colonization is a bit different than Bengal, namely in that it is not merely underdeveloped; it is undeveloped. How do you start an entirely new economy on a virgin world with no industry? After all, Martian resource extraction and trade with Earth is not feasible; the cost of transporting material across the solar system is astronomical, and there are no obvious minerals on Mars that we don’t already have in abundance on Earth. The only basis for colonization of Mars that Musk can conceive of is one based on tourism: the rich pay an amount — Musk quotes the ticket price at [$200,000 if he can get 1 million tourists](https://www.recode.net/2016/9/27/13081488/elon-musk-spacex-mars-colony-space-travel-funding-rocket-nasa) to pay that — that entitles them to a round-trip ticket. And while they’re on Mars and traveling to it, they luxuriate: Musk has [assured](http://www.telegraph.co.uk/science/2017/06/21/elon-musk-create-city-mars-million-inhabitants/) that the trip would be “fun.” This is what makes Musk’s Mars vision so different than, say, the Apollo missions or the International Space Station. This isn’t really exploration for humanity’s sake — there’s not that much science assumed here, as there was in the Moon missions. Musk wants to build the ultimate luxury package, exclusively for the richest among us. Musk isn’t trying to build something akin to Matt Damon’s spartan research base in "The Martian." He wants to build Mars-a-Lago. And an economy based on tourism, particularly high-end tourism, needs employees — even if a high degree of automation is assumed. And as I’ve written about [before](https://www.jacobinmag.com/2017/02/mars-elon-musk-space-exploration-nasa-colonization), that means a lot of labor at the lowest cost possible. Imagine signing away years of your life to be a housekeeper in the Mars-a-Lago hotel, with your communications, water, food, energy usage, even oxygen tightly managed by your employer, and no government to file a grievance to if your employer cuts your wages, harasses you, cuts off your oxygen. Where would Mars-a-Lago's employees turn if their rights were impinged upon? Oh wait, this planet is run privately? You have no rights. Musk's vision for Mars colonization is inherently authoritarian. The potential for the existence of the employees of the Martian tourism industry to slip into something resembling indentured servitude, even slavery, cannot be underestimated. We have government regulations for a reason on Earth — to protect us from the fresh horror Musk hopes to export to Mars. If he's considered these questions, he doesn't seem to care; for Musk, the devil's in the technological and financial details. The social and political are pretty uninteresting to him. This is unsurprising; accounts from those who have worked closely with him hint that he, like many CEOs, [may be a sociopath](http://www.businessinsider.com/working-with-elon-musk-tesla-2015-5). Even as a space enthusiast, I cannot get excited about the private colonization of Mars. You shouldn’t be either. This is not a giant leap for mankind; this is the next great leap in plutocracy. The mere notion that global wealth is so unevenly distributed that a small but sufficient sum of rich people could afford this trip is unsettling, indicative of the era of astonishing economic inequality in which we suffer. Thomas Frank, writing in Harpers, once [wrote of](https://harpers.org/archive/2011/11/the-bleakness-stakes/) a popular t-shirt he sighted while picnicking in a small West Virginia coal town: “Mine it union or keep it in the ground.” The idea, of course, is that the corporations interested in resource extraction do not care whatsoever about their workers’ health, safety, or well-being; the union had their interests at heart, and was able to negotiate for safety, job security, and so on. I’d like to see a similar t-shirt or bumper sticker emerge among scientists and space enthusiasts: “Explore Mars democratically, or keep it in the sky.”

#### And, private appropriation and commodification of space is connected to the historical legacy and present day practices of colonialism- squo space expansion proves

Tavares ‘20, Frank. “Ethical Exploration And The Role Of Planetary Protection In Disrupting Colonial Practices.” Planetary Science and Astrobiology Decadal Survey 2023-2032. October 25, 2020. Web. December 11, 2021.<https://arxiv.org/ftp/arxiv/papers/2010/2010.08344.pdf>.

Commodification and Appropriation of Land and Resource Extraction: **The commodification of land through extractive practices has led to significant disruption of the ecosystems that Indigenous communities rely upon** for their livelihoods. Examples of extractive exploitation and colonialism abound; while many people in the US think only of the gold rush, mining of rare minerals in Central and South America and Africa incentivize and continue to accelerate colonial expansion even today. Agricultural practices throughout the colonial world have been and continue to be damaging, transforming environments and destroying human lives and cultures. 19 From cotton fields in the American south to sugar plantations and rubber tappers in Brazil, the combination of land and people as property was key to the generation of wealth that built up the Western world. 20 The field of planetary science and space exploration in the present day is not divorced from these practices, and both existing and planned space infrastructure continue to encroach upon Indigenous land. This is often justified by falsely framing opposition to such encroachments as “obstructions” to “the future.” 21 For example, **construction of the Thirty Meter Telescope atop Mauna Kea has begun despite opposition from** many Kanaka ??iwi (**Native Hawaiians**), **who note that previous astronomy development atop Mauna Kea has already had substantial adverse effects**. 22 Current structures for in-situ resource utilization on other worlds are analogous to some of these past and current practices on Earth. Most immediately, lunar resource maps seek to enable **public and private sector mining actors** to **plan for extraction of water ice and other resources.** **Similar proposals exist for asteroid mining**. **This is presented under a guise of “sustainability,” but in actuality replicates the practices of extractive capitalism that** have **contributed to** the **environmental degradation** of Earth. In the long-term, this exploitative approach to extraterrestrial exploration will be similarly detrimental, and recommendations provided in the white paper “Asteroid Resource Utilization: Ethical Concerns and Progress” address these issues in more depth. 23 Public-Private Partnerships as a Colonial Structure: **Private individuals and institutions, in collaboration with governments, are a key aspect of the colonial structure**. For example, **the East India Company** was fundamental to British expansion across the Eastern hemisphere and took a central role in colonial domination and political control as well as trade. 24 More recent examples include the influence of American fruit companies in the United States’ interventions into Latin American politics during the Cold War. 25 In the United States, treaties signed with Native American nations have repeatedly been broken, often by settler colonialist individuals working in tandem with the US government and military. The Dakota Access Pipeline, a modern reframing of the ongoing Indigenous demand to honor the Black Hills Treaty, 26 illustrates how capitalist interest intersects with colonialism today. These examples are mirrored in the active role private industry is currently taking in space exploration. Presently, there is little to no oversight by national governments or international structures. Private partnerships are **encouraged to plan missions to the Moon and Mars, often supported by state funding.** However, **there is a lack of concrete and effective policy to guide their actions, and no consequences are levied when existing policies are violated**. 27 For example, the privately-funded and state-operated Beresheet lunar lander crashed on the Moon and accidentally released thousands of tardigrades. 28 At present, bodies like the Moon and Mars are in practice free reign for private entities. An unfortunately accurate euphemism is that we are in a “wild west” of space policy in this regard. When faced with complex and nuanced ethical questions like the ones we will face in space exploration, private actors, by their very structure, will prioritize economic considerations above moral ones. History, through the examples above and others, shows us that they will.

### Contention 2: Space Exploration

#### Incoming mega-constellations of satellites ensure unmanageable space debris, triggering the Kessler Syndrome.

Boley & Byers 21 [Aaron C., Department of Physics and Astronomy @ The University of British Columbia\*, and Michael, Department of Political Science @ The University of British Columbia; Published: 20 May 2021; Scientific Reports; “Satellite mega-constellations create risks in Low Earth Orbit, the atmosphere and on Earth,” <https://www.nature.com/articles/s41598-021-89909-7>] brett

**Companies** are placing satellites into orbit at an unprecedented frequency to **build** ‘mega-constellations’ **of** communications **satellites** in Low Earth Orbit (LEO). In two years, **the number** of active and defunct satellites **in** LEO [Lower Earth Orbit] **has increased by** over **50%,** to about 5000 (as of 30 March 2021). SpaceX alone is on track to **add 11,000** more as it builds its Starlink mega-constellation **and** has already **filed for** permission for **another** **30,000** satellites with the Federal Communications Commission (FCC)1. Others have similar plans, including OneWeb, Amazon, Telesat, and GW, which is a Chinese state-owned company2. The current governance system for LEO, while slowly changing, is ill-equipped to handle large satellite systems. Here, we outline how applying the consumer electronic model to satellites could lead to multiple tragedies of the commons. Some of these are well known, such as impediments to astronomy and an **increased risk of** space debris, while others have received insufficient attention, including changes to the chemistry of Earth’s upper atmosphere and increased dangers on Earth’s surface from re-entered debris. The heavy use of certain orbital regions might also result in a de facto exclusion of other actors from them, violating the 1967 Outer Space Treaty. All of these challenges could be addressed in a coordinated manner through multilateral law-making, whether in the United Nations, the Inter-Agency Debris Committee (IADC), or an ad hoc process, rather than in an uncoordinated manner through different national laws. Regardless of the law-making forum, mega-constellations require a shift in perspectives and policies: from looking at single satellites, to evaluating systems of thousands of satellites, and doing so within an understanding of the limitations of Earth’s environment, including its orbits. **Thousands of** satellites and 1500 rocket bodies provide considerable mass in LEO, which can **break** **into debris** **upon** collisions, explosions, **or** degradation in the harsh space environment. Fragmentations **increase** the cross-section of orbiting material, and with it, the collision probability per time. Eventually, **collisions** **could dominate** on-orbit evolution, **a situation called the** Kessler Syndrome3. There are already over 12,000 trackable debris pieces in LEO, with these being typically 10 cm in diameter or larger. Including sizes down to 1 cm, there are about a million inferred debris pieces, all of which threaten satellites, spacecraft and astronauts due to their orbits crisscrossing at high relative speeds. Simulations of the long-term evolution of debris suggest that **LEO is already in the** protracted initial stages of the Kessler Syndrome, but that this could be managed through active debris removal4. The **addition of** satellite mega-constellations and the general proliferation of low-cost satellites in LEO stresses the environment further5,6,7,8. Results The overall setting The rapid development of the space environment through mega-constellations, predominately by the ongoing construction of Starlink, is shown by the cumulative payload distribution function (Fig. 1). From an environmental perspective, the slope change in the distribution function defines NewSpace, an era of dominance by commercial actors. Before 2015, changes in the total on-orbit objects came principally from fragmentations, with effects of the 2007 Chinese anti-satellite test and the 2009 Kosmos-2251/Iridium-33 collisions being evident on the graph. Figure 1 [Figure 1 omitted] Cumulative on-orbit distribution functions (all orbits). Deorbited objects are not included. The 2007 and 2009 spikes are a Chinese anti-satellite test and the Iridium 33-Kosmos 2251 collision, respectively. The recent, rapid rise of the orange curve represents NewSpace (see "Methods"). Full size image Although the volume of space is large, individual satellites and satellite systems have specific functions, with associated altitudes and inclinations (Fig. 2). This increases congestion and requires active management for station keeping and collision avoidance9, with automatic collision-avoidance technology still under development. Improved space situational awareness is required, with data from operators as well as ground- and space-based sensors being widely and freely shared10. Improved communications between satellite operators are also necessary: in 2019, the European Space Agency moved an Earth observation satellite to avoid colliding with a Starlink satellite, after failing to reach SpaceX by e-mail. Internationally adopted ‘right of way’ rules are needed10 to prevent games of ‘chicken’, as companies seek to preserve thruster fuel and avoid service interruptions. SpaceX and NASA recently announced11 a cooperative agreement to help reduce the risk of collisions, but this is only one operator and one agency. Figure 2 [Figure 2 omitted] Orbital distribution and density information for objects in Low Earth Orbit (LEO). (Left) Distribution of payloads (active and defunct satellites), binned to the nearest 1 km in altitude and 1° in orbital inclination. The centre of each circle represents the position on the diagram, and the size of the circle is proportional to the number of satellites within the given parameter space. (Right) Number density of different space resident objects (SROs) based on 1 km radial bins, averaged over the entire sky. Because SRO objects are on elliptical orbits, the contribution of a given object to an orbital shell is weighted by the time that object spends in the shell. Despite significant parameter space, satellites are clustered in their orbits due to mission requirements. The emerging Starlink cluster at 550 km and 55° inclination is already evident in both plots (Left and Right). Full size image When completed, Starlink will include about as many satellites as there are trackable debris pieces today, while its total mass will equal all the mass currently in LEO—over 3000 tonnes. The satellites will be placed in narrow orbital shells, creating unprecedented congestion, with 1258 already in orbit (as of 30 March 2021). OneWeb has already placed an initial 146 satellites, and Amazon, Telesat, GW and other companies, operating under different national regulatory regimes, are soon likely to follow. Enhanced collision risk Mega-constellations are composed of mass-produced satellites with few backup systems. This consumer electronic model allows for short upgrade cycles and rapid expansions of capabilities, but also considerable discarded equipment. SpaceX will actively de-orbit its satellites at the end of their 5–6-year operational lives. However, this process takes 6 months, so roughly 10% will be de-orbiting at any time. If other companies do likewise, thousands of de-orbiting satellites will be slowly passing through the same congested space, posing collision risks. Failures will increase these numbers, although the long-term failure rate is difficult to project. Figure 3 is similar to the righthand portion of Fig. 2 but includes the Starlink and OneWeb mega-constellations as filed (and amended) with the FCC (see “Methods”). The large density spikes show that some shells will have satellite number densities in excess of n=10−6 km−3. Figure 3 [Figure 3 omitted] Satellite density distribution in LEO with the Starlink and OneWeb mega-constellations as filed (and amended) with the FCC. Provided that the orbits are nearly circular, the number densities in those shells will exceed 10–6 km−3. Because the collisional cross-section in those shells is also high, they represent regions that have a high collision risk whenever debris is too small to be tracked or collision avoidance manoeuvres are impossible for other reasons. Full size image Deorbiting satellites will be tracked and operational satellites can manoeuvre to avoid close conjunctions. However, this depends on ongoing communication and cooperation between operators, which at present is ad hoc and voluntary. A recent letter12 to the FCC from SpaceX suggests that some companies might be less-than-fully transparent about events13 in LEO. Despite the congestion and traffic management challenges, FCC filings by SpaceX suggest that collision avoidance manoeuvres can in fact maintain collision-free operations in orbital shells and that the probability of a collision between a non-responsive satellite and tracked debris is negligible. However, the filings do not account for untracked debris6, including untracked debris decaying through the shells used by Starlink. Using simple estimates (see “Methods”), the probability that a single piece of untracked debris will hit any satellite in the Starlink 550 km shell is about 0.003 after one year. Thus, if at any time there are 230 pieces of untracked debris decaying through the 550 km orbital shell, there is a 50% chance that there will be one or more collisions between satellites in the shell and the debris. As discussed further in “Methods”, such a situation is plausible. Depending on the balance between the de-orbit and the collision rates, if subsequent fragmentation events lead to similar amounts of debris within that orbital shell, a runaway cascade of collisions could occur. Fragmentation events are not confined to their local orbits, either. The India 2019 ASAT test was conducted at an altitude below 300 km in an effort to minimize long-lived debris. Nevertheless, debris was placed on orbits with apogees in excess of 1000 km. As of 30 March 2021, three tracked debris pieces remain in orbit14. Such long-lived debris has high eccentricities, and thus can cross multiple orbital shells twice per orbit. A major fragmentation event from a single satellite could affect all operators in LEO. Even if debris collisions were avoidable, meteoroids are always a threat. The cumulative meteoroid flux15 for masses m > 10–2 g is about 1.2 × 10–4 meteoroids m−2 year−1 (see “Methods”). Such masses could cause non-negligible damage to satellites16. Assuming a Starlink constellation of 12,000 satellites (i.e. the initial phase), there is about a 50% chance of 15 or more meteoroid impacts per year at m > 10–2 g. Satellites will have shielding, but events that might be rare to a single satellite could become common across the constellation. One partial response to these congestion and collision concerns is for operators to construct mega-constellations out of a smaller number of satellites. But this does not, individually or collectively, eliminate the need for an all-of-LEO approach to evaluating the effects of the construction and maintenance of any one constellation.

#### It collapses satellite networks and kills other space development- keeping space clean is a pre-req to using it.

Kessler et al., 18 [Donald J. Kessler\* American astrophysicist and former NASA scientist known for his studies regarding space debris. Kessler has received numerous awards for his pioneering work, the most recent being the 2010 Dirk Brower Award for his half-century career in astrodynamics. Dr. Holder Krag\*\* Head of the Space Debris Office at the European Space Agency and has been a Space Debris Analyst in the Space Debris Office since 2006. Asher Isbrucker\*\*\*, Writer & Video Producer; 11-2-2018; "Kessler Syndrome: What Happens When Satellites Collide," Medium, <https://asherkaye.medium.com/kessler-syndrome-what-happens-when-satellites-collide-1b571ca3c47e>] brett

Donald Kessler: The worst case scenario is that you end up creating enough debris that it’s not cost-effective to depend on space. Now, that may take a long time, but because it’s a non-reversible process, once you’ve reached a certain threshold where you’re generating debris from these collisions faster than it can be cleaned out, it’ll just continually get worse unless you can do something drastic. Holger Krag: If we continue operating the way we do today, we will have a disaster in 50 years, in 100 years. It compares quite nicely to the CO2 issue, and the climate on ground, so it’s not our generation suffering from all the CO2 released into the atmosphere, it is future generations, but it is our generation that has to take the action. And the space debris problem is quite similar. DK: My name’s Don Kessler, I worked for NASA till 1996 as the senior researcher for orbital debris. I started the program back in 1979, and the program is still very active today. In the 1960s my main job was to define the interplanetary meteoroid environment. At the time, the only space debris NASA had to be concerned about were meteoroids, many of which are generated from collisions in the asteroid belt. These asteroid collisions are a cascading phenomenon, meaning every collision creates more ammunition for future collisions. It’s a positive feedback loop. Don was studying this phenomenon when he started to consider an interesting question: DK: When will the same phenomenon start happening in the Earth’s orbit? When will this same kind of cascading occur with satellites? And it was just a matter of curiosity as to what that number may be, and actually when I did the calculations, I was really shocked at the answer that it would happen so soon. Don published a paper in 1978 proposing this scenario, predicting that we’d start to see satellite collisions in Earth orbit by the year 2000. Just like in the asteroid belt, these satellite collisions would trigger a domino effect: creating a whole bunch of debris which causes more collisions, creating more debris, and so on. His main point: once the process starts, it’ll be nearly impossible to stop. This self-perpetuating phenomenon, this domino effect, became known as Kessler Syndrome. The first accidental collision occurred in 1996, when a French satellite was struck by a piece of a rocket thruster that had exploded ten years earlier, severing its stabilization boom and, for the first time, demonstrating how entangled the orbital environment has become. HK: In 2009 a collision happened that was by far more dramatic. The event he’s referring to was the first collision between two intact satellites: the Russian satellite Kosmos and an American Iridium. And that was the first catastrophic accidental collision that got everybody’s attention because not only did they realize how much debris is generated when something like that occurs but that we are now entering this phase of what we’re calling the Kessler Syndrome. Just two years earlier the Chinese military conducted a controversial anti-satellite test, intercepting one of their own defunct weather satellites with a kinetic kill vehicle — a non-explosive missile which relies on sheer speed of impact to destroy its target. It blew the satellite to smithereens and created just a huge mess, it was really bad. DK: And unfortunately it was something they should have known not to do. Yeah, that’s because the US did the same thing back in 1985 — the first anti-satellite test, with more or less the same results. DK: We at NASA tried to delay that or stop that because, we said it’s going to create enough debris that we’ll have to add more shielding to the space station which was planned to be launched a few years later. And nobody believed it would make that much debris, but it did. All of these collisions, accidental or otherwise, make a big mess of junk zipping around the Earth called space debris. It accounts for 95% of the objects in Low Earth orbit, and comes in all shapes and sizes. It’s technically defined as any nonfunctional object in orbit, so there’s big stuff like rocket thrusters and defunct satellites, but the vast majority are little bits and pieces called fragmentation debris. Many of these fragments come from explosions caused by residual fuel and other explosive energy sources self-igniting under the extreme conditions of space. These explosions happen more often than you might think, and as catastrophic and messy as these explosions are, collisions are even worse due to the incredible amount of kinetic energy involved. At the velocities objects travel in Lower Earth Orbit (speeds known as hypervelocity) even an object as tiny as a screw can deliver an incapacitating strike to a satellite. In fact, NASA has repeatedly had to replace shuttle windows due to hypervelocity impacts by flecks of paint. HK: These are velocities, we have no example nor anything that compares to that on ground. So the energy involved in these collisions is extremely high. A 1 cm object that size like a cherry hitting a satellite with 10 km/s, the energy released by this corresponds roughly to an exploding grenade. You can imagine what the satellite looks like after that. DK: Yes, let me know show you something. This is something that was shot in the lab, it’s a projectile about the size of a BB, and it makes a crater into, this is solid aluminum, and this was only going about 5 km/s, about half the speed of what you would expect in space. Most of this is happening in Low Earth Orbit, the 2000 km strip of space above our heads where we’ve packed the vast majority of our satellites, including the International Space Station and the Hubble Space Telescope. The most crowded section is between 500 and 1000 km up. It’s the densest region, it’s the Highway 401 of space. DK: And that’s what’s creating the problem because we’ve crowded so much stuff in that small region. And the probability of collision goes as the square of the spatial density. So you double the number of satellites, you get four times as many collisions. Now, the space station usually flies around 300 km but the debris that’s generated at that higher altitude is being thrown down and drifting down to the lower altitudes. HK: If you look at the space station surface you will find craters everywhere, impact craters caused by debris everywhere. Whenever you bring hardware down and inspect it on ground you find craters of all sizes. What do we do with this? How do you protect the life of the astronauts? The only thing you can do is shielding. And to protect against a hypervelocity impact you need a special type of lightweight shielding, called Whipple shielding. DK: Let me show you something else. The same particle that caused this kind of damage [image below, left] only caused this kind of damage [image below, right]on a surface with a very minor amount of shielding on it. And that’s, it’s almost a liquid splattered onto that. Most spacecraft utilize this type of shielding, which can withstand impacts from objects up to about one centimeter. Objects larger than a softball are catalogued and tracked by the US Space Surveillance Network. Tracking is imprecise, but allows spacecraft to dodge some of the debris that comes too close. This only works for objects larger than 10 cm or so. Anything smaller can’t be reliably tracked. For that reason, the most concerning objects are those between 1 and 10 cm; too large for shielding to withstand and too small to be tracked. These objects could incapacitate any spacecraft in their path, or worse. And with every future explosion and collision there will be more and more of these invisible projectiles going around. The problem gets worse when you consider how long objects can remain in orbit. Depending on altitude, debris in Low Earth Orbit may remain there for years, decades, or centuries before their orbit naturally decays enough to re-enter the Earth’s atmosphere. For example, look no further than ENVISAT; a defunct 8-tonne satellite operated by the European Space Agency until it lost contact in 2012, becoming a massive piece of space junk in the densest region of Earth orbit. ENVISAT will remain in orbit for 200 years if not removed. Experts hope to avoid an encore of ENVISAT and to mitigate Kessler Syndrome through the international adoption of two clean space policies. The first will prevent explosions by requiring so-called passivation of onboard energy sources. HK: Meaning, residual fuel must be either depleted, burned, released through a valve, whatever. That’s number one: no more explosions. DK: And the other is what we call a 25 year rule. Once you put something in orbit, after you finish using it you have 25 years to get it out. Either by moving up to a designated “graveyard orbit” where it will pose minimal risk to active spacecraft or more ideally, lowering its altitude so it will burn up in the atmosphere sooner. These policies aren’t difficult to follow and are beginning to be adopted internationally. HK: When we do these two things that would already make space flight pretty safe for the future. It would mean, if we do this systematically, the risk in the future would be almost the same as it is today. The mitigation measures they help to dampen the effect of the Kessler Syndrome, we are not talking about stopping it, we are talking about maintaining it on an acceptable level, the growth. But it will grow, even if we implement these two measures strictly. If we want to even prevent this growth, then we need to do active removal. DK: We’ve already concluded that it’s going to take something like removing 500 intact objects over the next 100 years in order to stabilize the Low Earth Orbit environment again. That works out to five objects per year for the next century, which at least seems achievable, right? The challenge though is that there’s no easy way to remove space debris. HK: We need to approach the object that are not under control anymore, and attach to them, dock with them, rendezvous them, capture them somehow, and then get rid of them in a controlled way. You can imagine this is not so easy. Experts are working on ways to remove debris, and there are several promising ideas in early development. There are reusable concepts like tethers and space tugs which can grab multiple objects per launch, which saves money. There are ground- or space-based lasers which can deorbit objects by kind of shooting them down, but these face political challenges. There are actually active satellites in space right now, the University of Surrey is controlling a spacecraft called RemoveDEBRIS which will use a harpoon to grab on to debris, that’s promising. And there’s another single-use option like ESA’s e.Deorbit, currently planned to retrieve and deorbit ENVISAT in 2023. Many of these ideas aren’t scalable, though, that’s the problem, they’re expensive and complicated, and missions like these are almost completely unprecedented. The pressure is on, though, because Kessler Syndrome isn’t waiting, and the consequences for space infrastructure are dire. HK: Today only half of the satellites actually disappear from space within the 25 years that are recommended as the maximum on orbit time. We still have five explosions every year. If we continue and not improve the way we do spaceflight, then in a few decades some regions of space might not be useable anymore for spaceflight, or it might be much too risky to go there. And that might mean that we either lose services from space that we rely on today, or they get more expensive. AI: Do you think something like Kessler Syndrome is inevitable? Are you optimistic that this can be managed properly, or do you think this is an inevitable issue for a spacefaring society? HK: I think it can be managed, it can be managed. I do believe it’s time for young people to take charge and there’s a lot of work to be done, and there’s enough people involved today that I’m confident that it’s going to be done. Much like other environmental and generational problems, Kessler Syndrome is invisible to us. When you look up at the night sky, you don’t see collisions and explosions and fragments of debris. If you’re lucky and the conditions are right, you might see one white speck drifting across the sky, a tiny testament to humankind’s highest collective ambitions. But that speck is at risk, along with all it represents, if we don’t address this invisible problem — because Kessler Syndrome isn’t waiting.

#### No alt causes or thumpers---absent privatization, LEO debris would increase slowly for decades, eventually stabilizing after 200 years. Prefer NASA studies that assume our plan.

---1 collision a decade is hardly enough to trigger Kessler syndrome.

Liou et al. 18 [Dr. J.-C. Liou is the NASA Chief Scientist for Orbital Debris; Matney M., NASA Johnson Space Center; Vavrin A., GeoControl Systems – Jacobs JETS Contract; Manis A., HX5 – Jacobs JETS Contract, NASA Johnson Space Center; Gates D., Jacobs Technology, NASA Johnson Space Center, Orbital Debris Quarterly News, 2018; “NASA ODPO's Large Constellation Study,” <https://www.orbitaldebris.jsc.nasa.gov/quarterly-news/pdfs/odqnv22i3.pdf>] brett

In recent years, several commercial companies have proposed telecommunications constellations consisting of hundreds to thousands of 100-to-300-kg class spacecraft in low Earth orbit (LEO, the region below 2000-km altitude). If deployed, such large constellations (LCs) will dramatically change the landscape of satellite operations in LEO. Fig. 1 shows the current mass distribution in LEO. The top blue histogram shows the total and the three curves below show a breakdown by object type (spacecraft, rocket bodies, or other). The mass distribution is dominated by spacecraft and upper stages (i.e., rocket bodies). The yellow bars from 1100 km to 1300 km altitudes show the notional mass distribution from 8000 150 kg LC spacecraft or, equivalently, 4000 300 kg LC spacecraft. From the large amount of mass involved, it is clear that the deployment, operations, and frequent de-orbit and replenishment of the proposed LCs could significantly contribute to the existing orbital debris problem.

To better understand the nature of the problem, the NASA Orbital Debris Program Office (ODPO) recently completed a parametric study on LCs. The objective was to quantify the potential negative debris-generation effects from LCs to the LEO environment and provide recommendations for mitigation measures. The tool used for the LC study was the ODPO’s LEO-to-GEO Environment Debris (LEGEND) numerical simulation model, which has been used for various mitigation and remediation studies in the past [1, 2]. For the LC study, more than 300 scenarios based on different user-specified assumptions and parameters were defined. Selected results from key scenarios are summarized in this article.

The LEO Environment without Large Constellations

To establish a benchmark to assess the effects from LCs, several baseline scenarios were completed first. Fig. 2 shows the environment projection without LCs. The historical curve reflects the documented launches and breakup events between 1957 and 2015. The antisatellite test conducted by China and the accidental collision between Iridium 33 and Cosmos 2251 were the reasons for the jump in 2007 and 2009, respectively. Future launch traffic is a repeat of the launches over the last 8 years of the historical space activities (2008-2015). The environment is projected 200 years into the future, through the year 2215.

Each future projection curve is the average of 100 LEGEND Monte Carlo (MC) simulation runs. The top red curve is the result of a non-mitigation scenario where LEO-crossing upper stages and spacecraft are left at mission altitudes at the end of mission operations rather than conducting postmission disposal (PMD) maneuvers to lower their orbits to follow the 25-year decay rule. Upper stages and spacecraft are also assumed to explode in the future with accidental explosion probabilities derived from the historical explosion events. The middle black-dashed curve is the result of a scenario where LEO-crossing upper stages and spacecraft are assumed to follow the 25-year decay rule at the end of their missions with a PMD reliability of 90%. The bottom blue-dotted curve is the result of a scenario where, in addition to the 90% PMD success rate, no explosions occur in the future.

As expected, the non-mitigation scenario leads to a rapid LEO population increase over time, with an approximately 330% increase in 200 years, i.e., from the beginning of 2016 to the end of 2215. The non-linear increase is also an indication of the collision feedback effect in the environment. With a global 90% PMD implementation of the 25-year decay rule, however, the debris population growth is reduced to about a 110% linear increase in 200 years. If explosions can be eliminated, the population growth is further reduced to 40% in 200 years.

Fig. 3 shows the cumulative numbers of catastrophic collisions involving 10 cm and larger objects over time. A catastrophic collision occurs when the ratio of impact kinetic energy to target mass exceeds 40 J/g. The outcome of a catastrophic [FIGURES OMITTED] collision is the total fragmentation of the target, whereas a non-catastrophic collision only results in minor damage to the target and generates a small amount of debris that should have negligible contribution to the long-term debris population increase. Again, the non-mitigation scenario leads to a non-linear increase of catastrophic collisions, a total of 61 in 200 years, whereas the effective implementation of PMD and additionally, elimination of future explosions can reduce the numbers of catastrophic collisions to 27 and 21, respectively, in 200 years. The increases in effective number of objects and catastrophic collisions for the 90% PMD scenarios, with future explosions, are used to benchmark the effects when LCs are added to the simulated environment as described in the sections below.

#### Impacts-

#### Conflict

#### Increasing debris triggers miscalculated war. Space debris causes nuclear miscalc – countries interpret collisions as pre-emptive strikes. The internal link is linear---any reduction in debris reduces the risk

Dockrill 16 [Peter; 2016; Award-winning science & technology journalist. “Space Junk Accidents Could Trigger Armed Conflict, Study Finds.” <https://www.sciencealert.com/space-junk-accidents-could-trigger-armed-conflict-expert-warns>] brett

The increasingly crowded space in Earth's low orbit could set the stage for an international armed conflict, says a new study. Researchers from the Russian Academy of Sciences warn that accidents stemming from the steady rise in space junk floating around the planet could incite political rows and even warfare, with nations potentially mistaking debris-caused incidents as the results of intentional aggressive acts by others. In a paper published in Acta Astronautica, the team suggests that space debris in the form of spent rocket parts and other fragments of hardware hurtling at high speed pose a "special political danger" that could dangerously escalate tensions between nations. According to the study, destructive impacts caused by random space junk cannot easily be told apart from military attacks. "The owner of the impacted and destroyed satellite can hardly quickly determine the real cause of the accident," the authors write. The risks of such an event occurring are compounded by the sheer volume of debris now orbiting Earth. Recent figures from NASA indicate that there are more than 500,000 pieces of space junk currently being tracked in orbit, travelling at speeds up to 28,160 km/h (17,500 mph). The majority of those objects are small – around the size of a marble – but some 20,000 of them are bigger than a softball. In addition to these 500,000 or so fragments – which are big enough for scientists to know about them – NASA estimates that there are millions of undetectable pieces of debris in orbit that are too small to be monitored. But even extremely small fragments such as these pose a threat – in fact, they're considered a greater risk than trackable debris, as their invisible status means spacecraft and satellites can't do anything to avoid them until it's too late. As NASA observed in 2013: "Even tiny paint flecks can damage a spacecraft when travelling at these velocities. In fact a number of space shuttle windows have been replaced because of damage caused by material that was analysed and shown to be paint flecks… With so much orbital debris, there have been surprisingly few disastrous collisions." While we may have been lucky in the past, we can't rely on that to continue. The study by the Russian team cites the repeated sudden failures of defence satellites in past decades that were never explained. The researchers attribute two possible causes: either unrecorded collisions with space junk, or aggressive actions from adversaries. "This is a politically dangerous dilemma," the authors write.

#### **It goes nuclear.**

Johnson 14 [Les, Baen science fiction author, popular science writer, and NASA technologist. “Living without satellites”. <https://www.baen.com/living_without_satellites>.] brett

Satellite imagery is used by the military and our political leaders to maintain the peace. When your potential adversaries can’t hide what they’re doing, where their armies are moving and what they are doing with their civilian and military infrastructure, then the danger of surprise attack is diminished. In our nuclear age with instant death only minutes away by missile attack, the doctrine of Mutual Assured Destruction (MAD) only works if both sides know whether or not they are being attacked. The launch of missiles or a bomber fleet can easily be seen from space far in advance of either reaching their potential targets halfway around the globe. The danger of surprise attack is therefore small, making an accidental war far less likely. So what does all this mean? And what do we do about it? First of all, it means that the advocates of space development, exploration and commercialization have succeeded far beyond their initial expectations and dreams. The economies and security of countries in the developed world are now dependent on space satellites. We space advocates should celebrate our success and be terrified of it at the same time. Should we lose these fragile assets in space, our economy would experience a disruption like no other: ship, air and train travel would stop and only restart/operate in a much-reduced capacity for years (GPS loss). Many banking and retail transactions would cease (VSAT loss). Distribution of news and vital national information would be crippled (communications satellite loss). Lives would be put at risk and the productivity of our farming would dramatically decrease (weather satellite loss). The risk of war, including nuclear war, would increase (loss of spy satellites) and our military’s ability to react to crises would be significantly reduced (loss of military logistics and intelligence gathering satellites).

#### Nuclear war causes extinction.

Trevithick and Rogoway ’19 [Joseph and Tyler; February 27; Military Analyst, M.A. in Conflict Resolution from Georgetown University, B.A. in the History and Policy of International Relations at Carnegie-Mellon University; Defense Journalist; The Drive, “Yes, India And Pakistan Could End The World As We Know It Through A Nuclear Exchange,” <https://www.thedrive.com/the-war-zone/26674/yes-india-and-pakistan-could-end-the-world-as-we-know-it-through-a-nuclear-exchange>]

A global threat India and Pakistan's nuclear arsenals are tiny compared to those of the [United States and Russia](http://thedrive.com/the-war-zone/26013/russia-says-its-own-new-weapons-are-exempt-after-accusing-u-s-of-violating-nuclear-arms-deal), and these weapons are focused primarily on deterring each other, but that does not mean they're purely regional threats. Unlike conventional weapons, nuclear weapons create lasting and far-reaching effects that scientists have posited could upend life on Earth if warring parties were to use them in sufficient numbers. [In 2012](http://climate.envsci.rutgers.edu/pdf/RobockToonSAD.pdf), Alan Robock, a distinguished professor in the Department of Environmental Sciences and Associate Director of the Center for Environmental Prediction at Rutgers University, and Owen Brian Toon, a professor in the Department of Atmospheric and Oceanic Sciences and a research associate at the Laboratory for Atmospheric and Space Physics at the University of Colorado, Boulder, argued that it might not take a large amount of nuclear weapons to create a scenario commonly known as "[Nuclear Winter](https://en.wikipedia.org/wiki/Nuclear_winter)." In general, this hypothesized event occurs when smoke and soot from nuclear explosions block significant amounts of sunlight from reaching the earth's surface, leading to a precipitous drop in temperatures that results in mass crop failure and widespread famine. Robcock and Toon summarized their findings, which were based in part on their previous work, in an article in the Bulletin of The Atomic Scientists, [writing](http://climate.envsci.rutgers.edu/pdf/RobockToonSAD.pdf): "Even a 'small' nuclear war between India and Pakistan, with each country detonating 50 Hiroshima-size atom bombs – only about 0.03 percent of the global nuclear arsenal's explosive power – as airbursts in urban areas, could produce so much smoke that temperatures would fall below those of the [Little Ice Age](https://en.wikipedia.org/wiki/Little_Ice_Age) of the fourteenth to nineteenth centuries, shortening the growing season around the world and threatening the global food supply. Furthermore, there would be massive ozone depletion, allowing more ultraviolet radiation to reach Earth's surface. Recent studies predict that agricultural production in parts of the United States and China would decline by about 20 percent for four years, and by 10 percent for a decade. The bomb the United States dropped on Hiroshima Japan, known as [Little Boy](https://en.wikipedia.org/wiki/Little_Boy), was an inefficient and essentially experimental design with a yield of around 15 kilotons. The reported results from [Indian](https://en.wikipedia.org/wiki/List_of_nuclear_weapons_tests_of_India) and Pakistani nuclear testing indicate that both countries can meet this threshold and both countries' weapons programs have almost certainly matured in the decades since. In previous studies, Robcock, working with others, postulated that temperature changes could begin within 10 days of a limited nuclear exchange and the effects from the detonations of 100 nuclear weapons in the 15-kiloton class would directly result in the deaths of [at least 20 million people](http://www.nucleardarkness.org/warconsequences/fivemilliontonsofsmoke/). The second order impacts would be even worse in the years that followed. In 2014, Michael Mills and Julia Lee-Taylor, both then working at the federally-funded National Center for Atmospheric Research's (NCAR) Earth System Laboratory, authored another paper with Robcock and Toon. This [study concluded](https://web.archive.org/web/20140308191334/http:/acd.ucar.edu/~mmills/pubs/2014_EarthsFuture_Mills_et_al.pdf) again that detonation of 100 15-kiloton yield bombs in a purely regional conflict would result in "multi-decadal global cooling" and "would put significant pressures on global food supplies and could trigger a global nuclear famine." It is important to note that [critics have questioned](https://en.wikipedia.org/wiki/Nuclear_winter#Critical_response_to_the_more_modern_papers) whether the Nuclear Winter concept relies on too many assumptions and would ever actually occur. At the center of many of these rebuttals are debates about whether the nuclear explosions would truly create the amount of smoke and soot necessary for major climate change, as well as the specific conditions for those particles to remain in the atmosphere for a prolonged period of time. The studies here do indicate significant impacts based on a relatively limited number of nuclear detonations of smaller yield devices, though. But even if the impacts are less pronounced than projected in this particular scenario, they could be far more severe if India and Pakistan were to use a larger number weapons and/or ones of higher yields, which both belligerents readily have. In addition, Nuclear Winter is just one of the potential things that might happen following a nuclear exchange between the longtime foes. A detonation of dozens of nuclear weapons, even small ones, would throw hazardous nuclear fallout [into the air](http://thedrive.com/the-war-zone/19450/u-s-training-for-arctic-nuclear-satellite-disaster-amid-russian-weapons-developments) that, depending on the weather pattern, could carry that material [far and wide](https://futureoflife.org/background/us-nuclear-targets/?cn-reloaded=1#nukemap), causing both near- and short-term health impacts. The various [ground zeroes](https://nuclearsecrecy.com/nukemap/) themselves would be irritated and potentially hazardous for many years to come. Depending on where the detonations occur, a nuclear exchange could potentially cut people off from critical water and food supplies, putting increased and potentially unsustainable strains on uncontaminated areas. After the Chernobyl nuclear power plant, situated in Ukraine, [melted down and exploded](https://en.wikipedia.org/wiki/Chernobyl_disaster) in 1986, authorities established a 1,000 square mile restricted access "[exclusion zone](https://en.wikipedia.org/wiki/Chernobyl_Exclusion_Zone)" that remains in place today. There would also be a major danger of second-order "spillover" effects, as individuals fled affected areas, putting economic and political strains on neighboring regions. This could inflame existing tensions not directly related to the inter-state conflict between India or Pakistan or lead to all new and potentially violent competition for what might already be limited resources. India has already threatened to [weaponize water access](https://www.nytimes.com/2019/02/21/world/asia/india-pakistan-water-kashmir.html) in its latest spat with the Pakistanis. Any serious impacts on food and water supplies, or other economic upheavals as a direct or indirect result of the conflict, would have cascading impact across South Asia and beyond, as well. The very threat of a potential India-Pakistan war of any kind already caused [some negative reactions](https://www.cnbc.com/2019/02/27/indian-air-force-plane-crashes-in-kashmir-says-indian-police-official.html) in regional financial markets. Those markets would certainly collapse after an unprecedented nuclear exchange actually occurred, and that is before the long-term physical impacts of such an event would even manifest themselves. Overall, we are talking about a sudden and dramatic geopolitical, financial, and environmental shift that would change our reality in a matter of hours. Even then, the darkness, both figuratively and literally, that could propagate over the weeks, months, and years would be far more damaging. How great is the risk? So far, India and Pakistan have not made any clear indications that the fighting is close to crossing their nuclear thresholds. Pakistan's warnings about the [risks of escalation](http://thedrive.com/the-war-zone/26642/pakistan-promises-retaliation-makes-nuclear-threats-after-indian-jets-bomb-its-territory) seem more calculated to try and prompt India to back down. India itself has a so-called "no first use" policy, which means it has publicly pledged to use its nuclear weapons only in retaliation to a nuclear strike. However, experts have increasingly called into question whether this is truly the case and whether India might be developing delivery systems more suited to a first strike should there be a need to shift policies. Pakistan, however, does not have a no first use policy and has insisted on its right to employ nuclear weapons to defend itself even in the face of purely conventional threat. Pakistani officials have, in the past, [specifically cited this policy](https://www.cfr.org/event/promoting-us-pakistan-relations-future-challenges-and-opportunities) as way of deterring India, which has a much larger and in some cases more advanced conventional force, and preventing larger wars. The concern, then, is that this policy appears to have failed, at least to some degree, with India's strike on undisputed Pakistani territory on Feb. 26, 2019. India, however, did not target Pakistani forces in that instance and exchanges between the two countries have been limited, at least so far, to the disputed Jammu and Kashmir region, where violent skirmishes occur semi-regularly without precipitating a larger confrontation. We can only hope that the two countries will find a diplomatic solution to this latest conflict and avoid any further escalation. If things were to spiral out of control and lead to the use of nuclear weapons, it would be something that would threaten all of humanity.

#### Climate

#### Government satellites are key to biodiversity conservation- both detection and mitigation.

Pettorelli ‘19 [Dr. Nathalie Pettorelli; a Senior Research Fellow at the Institute of Zoology, Zoological Society of London, the editor-in-chief of Remote Sensing in Ecology and Conservation and a senior editor for Journal of Applied Ecology; 09-25-2019; “Satellite Remote Sensing’s role in Biodiversity Conservation”; Medium; https://medium.com/science-uncovered/satellite-remote-sensings-role-in-biodiversity-conservation-fbce22a7133c; Accessed 12-26-2021] AK

Regional to global land cover products derived from the information captured by sensors onboard long-term satellite missions, such as Landsat, the Terra and Aqua Earth Observing System satellites, and the Polar­orbiting Operational Environmental Satellite series, are widely accessible and offer a relatively inexpensive and veriﬁable means of deriving complete spatial coverage of environmental information for large areas in a consistent manner that may be updated regularly. Very high spatial resolution commercial optical sensors have provided new opportunities for habitat mapping at a ﬁner spatial scale than previously possible. Hyperspectral imagery has improved opportunities for plant species identiﬁcation, soil properties monitoring, and habitat mapping, as well as plant condition assessment. Instruments such as synthetic aperture radar (SAR) and light detection and ranging (LiDAR) are increasingly being used in ecology and natural resource management, and provide signiﬁcant opportunities for estimating aboveground biomass and the structure of woody vegetation.

Today, the archive of terrestrial satellite imagery from the Landsat system spans more than four decades at spatial resolutions of 15–82 m. Spatial resolutions across all sensors range from roughly 50 cm to 10 km, with bimonthly information available for several sensors. Developments in satellite and sensor technology, as well as progress in techniques and algorithms to process satellite remote sensing images, are relatively rapid and continuous. New combinations of satellite remote sensing data with methodologies such as support vector machines and multisensor image fusion are constantly tested for application, while investigations for developing new indices to monitor vegetation have been occurring for decades. Satellite remote sensing has moreover been successfully applied to address a variety of questions relevant to environmental management, including, but not limited to: landscape change monitoring; representativeness assessment; fragmentation assessment and monitoring; and climate change impact analysis. In recent decades, numerous studies have also highlighted the key role of satellite data in wildlife management, with success stories reported in macroecology, plant ecology, animal population dynamics, habitat selection and habitat use studies, movement ecology, and palaeoecology.

The role of satellites in providing critical information for improving the design and implementation of mitigation and adaptation tools to reduce the current rate of biodiversity loss is clear, with satellite remote sensing data now being used to help identify new protected areas, to inform translocation planning, and to monitor and predict potential invasions. Satellite remote sensing has also proven key to track anthropogenic pressures on biodiversity and our natural capital, in both the terrestrial and marine realms: oil exploration activities, eutrophication, illegal fishing, and oil spills and run­offs are among the many threats that can be detected from space. Satellite remote sensing has thus literally opened up the possibility of addressing questions on scales inaccessible to ground based methods alone, facilitating the development of an integrated approach to natural resource management, where both threats and consequences can be evaluated.

#### Biodiversity loss poses an existential risk and is a threat multiplier.

Torres ‘16 [Phil Biologist, conservationist, science advocate & educator. 2 years based in Amazon rainforest, now exploring science around the world. “[Biodiversity Loss: An Existential Risk Comparable to Climate Change](http://futureoflife.org/2016/05/20/biodiversity-loss/)” <http://futureoflife.org/2016/05/20/biodiversity-loss/>]

The repercussions of biodiversity loss are potentially as severe as those anticipated from climate change, or even a nuclear conflict. For example, according to a 2015 [study](http://www.ncbi.nlm.nih.gov/pubmed/26601195) published in Science Advances, the best available evidence reveals “an exceptionally rapid loss of biodiversity over the last few centuries, indicating that a sixth mass extinction is already under way.” This conclusion holds, even on the most optimistic assumptions about the background rate of species losses and the current rate of vertebrate extinctions. The group classified as “vertebrates” includes mammals, birds, reptiles, fish, and all other creatures with a backbone.

The article argues that, using its conservative figures, the average loss of vertebrate species was 100 times higher in the past century relative to the background rate of extinction. (Other scientists have suggested that the current extinction rate could be as much as 10,000 times higher than normal.) As the authors write, “The evidence is incontrovertible that recent extinction rates are unprecedented in human history and highly unusual in Earth’s history.” Perhaps the term “Big Six” should enter the popular lexicon—to add the current extinction to the previous “Big Five,” the last of which wiped out the dinosaurs 66 million years ago.

But the concept of biodiversity encompasses more than just the total number of species on the planet. It also refers to the size of different populations of species. With respect to this phenomenon, multiple studies have confirmed that wild populations around the world are dwindling and disappearing at an alarming rate. For example, the 2010 [Global Biodiversity Outlook](https://www.cbd.int/gbo3) report found that the population of wild vertebrates living in the tropics dropped by 59 percent between 1970 and 2006.

The report also found that the population of farmland birds in Europe has dropped by 50 percent since 1980; bird populations in the grasslands of North America declined by almost 40 percent between 1968 and 2003; and the population of birds in North American arid lands has fallen by almost 30 percent since the 1960s. Similarly, 42 percent of all amphibian species (a type of vertebrate that is sometimes called an “ecological indicator”) are undergoing population declines, and 23 percent of all plant species “are estimated to be threatened with extinction.” [Other studies](http://commondreams.org/views/2016/02/10/biodiversity-loss-and-doomsday-clock-invisible-disaster-almost-no-one-talking-about) have found that some 20 percent of all reptile species, 48 percent of the world’s primates, and 50 percent of freshwater turtles are threatened. Underwater, about 10 percent of all coral reefs are now dead, and another 60 percent are in danger of dying.

Consistent with these data, the 2014 [Living Planet Report](http://bit.ly/1ssxx5m) shows that the global population of wild vertebrates dropped by 52 percent in only four decades—from 1970 to 2010. While biologists often avoid projecting historical trends into the future because of the complexity of ecological systems, it’s tempting to extrapolate this figure to, say, the year 2050, which is four decades from 2010. As it happens, a 2006[study](http://science.sciencemag.org/content/314/5800/787) published in Science does precisely this: It projects past trends of marine biodiversity loss into the 21st century, concluding that, unless significant changes are made to patterns of human activity, there will be virtually no more wild-caught seafood by 2048.

48% of the world’s primates are threatened with extinction.

Catastrophic consequences for civilization.

The consequences of this rapid pruning of the evolutionary tree of life extend beyond the obvious. There could be surprising effects of biodiversity loss that scientists are unable to fully anticipate in advance. For example, prior research has shown that localized ecosystems can undergo abrupt and irreversible shifts when they reach a tipping point. According to a 2012 [paper](http://www.nature.com/nature/journal/v486/n7401/full/nature11018.html) published in Nature, there are reasons for thinking that we may be approaching a tipping point of this sort in the global ecosystem, beyond which the consequences could be catastrophic for civilization.

As the authors write, a planetary-scale transition could precipitate “substantial losses of ecosystem services required to sustain the human population.” An ecosystem service is any ecological process that benefits humanity, such as food production and crop pollination. If the global ecosystem were to cross a tipping point and substantial ecosystem services were lost, the results could be “widespread social unrest, economic instability, and loss of human life.” According to Missouri Botanical Garden ecologist Adam Smith, one of the paper’s co-authors, this could occur in a matter of decades—far more quickly than most of the expected consequences of climate change, yet equally destructive.

Biodiversity loss is a “threat multiplier” that, by pushing societies to the brink of collapse, will exacerbate existing conflicts and introduce entirely new struggles between state and non-state actors. Indeed, it could even fuel the rise of terrorism. (After all, climate change has been [linked](http://thebulletin.org/climate-change-and-syrian-uprising) to the emergence of ISIS in Syria, and multiple high-ranking US officials, such as former US Defense Secretary [Chuck Hagel](http://www.defense.gov/News-Article-View/Article/603441)and CIA director [John Brennan](http://www.cnsnews.com/news/article/cnsnewscom-staff/cia-director-cites-impact-climate-change-deeper-cause-global), have affirmed that climate change and terrorism are connected.)

The reality is that we are entering the sixth mass extinction in the 3.8-billion-year history of life on Earth, and the impact of this event could be felt by civilization “in as little as three human lifetimes,” as the aforementioned 2012 Nature paper notes. Furthermore, the widespread decline of biological populations could plausibly initiate a dramatic transformation of the global ecosystem on an even faster timescale: perhaps a single human lifetime.

The unavoidable conclusion is that biodiversity loss constitutes an existential threat in its own right. As such, it ought to be considered alongside climate change and nuclear weapons as one of the most significant contemporary risks to human prosperity and survival.

#### The modern food system relies on satellites. Collapse triggers global shocks to supply.

Tompkins 19 [Steven, Inmarsat’s Director of Sector Development for Agriculture. Head of Resilient and Sustainable Supply Chains Team at ADAS. Entrepreneurial manager with a sustained track record of building new profitable business streams for science-based organizations in the agri-food sector.; 3-18-2019; "Enabling the connected farm – the importance of satellite communications," Inmarsat, <https://www.inmarsat.com/blog/enabling-the-connected-farm-the-importance-of-satellite-communications/>] brett

The Agri-Tech Revolution, Agriculture 4.0, the smart and connected farm. There is no shortage of buzzwords hinting at a digitalised future, or solutions being touted as game-changing for the global agricultural industry. Commonly claimed benefits include increasing crop yields, and a reduction in input costs and the reliance on manual labour. Many of these solutions rely on reliable internet connectivity in the field to push data from one place to another, but there are still vast swathes of agricultural land that suffer from unreliable or non-existent connectivity, either lacking cellular or broadband connectivity. If we are to take advantage of the huge possibilities available to us, overcoming our connectivity challenges will be crucial. This is where satellite communications can help. When I tell people that I am an agriculturalist working for a satellite company, almost always the response is related to an experience of using space imagery (known as Earth Observation) to help automate processes such as crop scouting. But there is another breed of satellites that don’t produce images but do provide fast and reliable internet and voice communications across the world in areas that cellular and fibre connectivity cannot reach. Ubiquitous connectivity from satellites opens up huge possibilities for farmers in remote areas to take advantage of the Agri-Tech Revolution. In some cases, this is as simple as connecting frontline worker teams in large plantations to operations centres to prioritise workload and create efficiencies. Taking it one step further, satellite communications can be a bridge to enable farmers to connect data producing devices in the field (such as weather stations, sensors, data from farm machinery) to business applications. Known by the tech world as the ‘Internet of Things’ or IoT, this approach collects data from the field and harnesses it to support intelligent decision-making. For instance: obtaining real-time data on nutrient status in the field from NPK (Nitrogen Phosphorous and Potassium) sensors, alongside crop monitoring data and hyper-local weather that would allow you to make completely objective risk-based decisions on when and where to apply fertiliser. We know the industry is taking this proposition seriously – our own research told us that on average agriculture respondents expect to spend close to $1million on IoT solutions in the next three years and 72% of respondents would use satellite technology to support their projects. Of course, satellite isn’t the answer to everything and should be used in tandem with other connectivity types, and the good news is it’s easy to integrate with other connectivity technologies. With increasing demand to connect the physical world to the digital world, in some of the world’s remotest locations think of satellite not just as a series of images taken from space but an enabler to the Agri-Tech Revolution.

#### Food shortages go nuclear.

FDI 12 [FDI; a Research institute providing strategic analysis of Australia’s global interests; citing Lindsay Falvery, PhD in Agricultural Science and former Professor at the University of Melbourne’s Institute of Land and Environment (Future Directions International, , “Food and Water Insecurity: International Conflict Triggers & Potential Conflict Points,” <http://www.futuredirections.org.au/workshop-papers/537-international-conflict-triggers-and-potential-conflict-points-resulting-from-food-and-water-insecurity.html>] brett

There is a growing appreciation that the conflicts in the next century will most likely be fought over a lack of resources. Yet, in a sense, this is not new. Researchers point to the French and Russian revolutions as conflicts induced by a lack of food. More recently, Germany’s World War Two efforts are said to have been inspired, at least in part, by its perceived need to gain access to more food. Yet the general sense among those that attended FDI’s recent workshops, was that the scale of the problem in the future could be significantly greater as a result of population pressures, changing weather, urbanisation, migration, loss of arable land and other farm inputs, and increased affluence in the developing world. In his book, Small Farmers Secure Food, Lindsay Falvey, a participant in FDI’s March 2012 workshop on the issue of food and conflict, clearly expresses the problem and why countries across the globe are starting to take note. . He writes (p.36), “…if people are hungry, especially in cities, the state is not stable – riots, violence, breakdown of law and order and migration result.” “Hunger feeds anarchy.” This view is also shared by Julian Cribb, who in his book, The Coming Famine, writes that if “large regions of the world run short of food, land or water in the decades that lie ahead, then wholesale, bloody wars are liable to follow.” He continues: “An increasingly credible scenario for World War 3 is not so much a confrontation of super powers and their allies, as a festering, self-perpetuating chain of resource conflicts.” He also says: “The wars of the 21st Century are less likely to be global conflicts with sharply defined sides and huge armies, than a scrappy mass of failed states, rebellions, civil strife, insurgencies, terrorism and genocides, sparked by bloody competition over dwindling resources.” As another workshop participant put it, people do not go to war to kill; they go to war over resources, either to protect or to gain the resources for themselves. Another observed that hunger results in passivity not conflict. Conflict is over resources, not because people are going hungry. A study by the International Peace Research Institute indicates that where food security is an issue, it is more likely to result in some form of conflict. Darfur, Rwanda, Eritrea andthe Balkans experienced such wars. Governments, especially in developed countries, are increasingly aware of this phenomenon. The UK Ministry of Defence, the CIA, the US Center for Strategic and International Studies and the Oslo Peace Research Institute, all identify famine as a potential trigger for conflicts and possibly even nuclear war.

### UV

#### Aff gets 1AR theory- it’s key to reciprocity and otherwise the neg could be infinitely abusive. It’s DTD for norm-setting

#### No RVI or 2NR paradigm issues bc they could dump in the nr and skews the aff further

#### Policy education is key to advocacy – that outweighs on portable skills.

Nixon 2KMakani Themba-Nixon, Executive Director of The Praxis Project. “Changing the Rules: What Public Policy Means for Organizing.” Colorlines 3.2, 2000. Getting It in Writing Much of the work of framing what we stand for takes place in the shaping of demands. By getting into the policy arena in a proactive manner, we can take our demands to the next level. Our demands can become law, with real consequences if the agreement is broken. After all the organizing, press work, and effort, a group should leave a decision maker with more than a handshake and his or her word. Of course, this work requires a certain amount of interaction with "the suits," as well as struggles with the bureaucracy, the technical language, and the all-too-common resistance by decision makers. Still, if it's worth demanding, it's worth having in writing-whether as law, regulation, or internal policy. From ballot initiatives on rent control to laws requiring worker protections, organizers are leveraging their power into written policies that are making a real difference in their communities. Of course, policy work is just one tool in our organizing arsenal, but it is a tool we simply can't afford to ignore. Making policy work an integral part of organizing will require a certain amount of retrofitting. We will need to develop the capacity to translate our information, data, stories that are designed to affect the public conversation [and]. Perhaps most important, we will need to move beyond fighting problems and on to framing solutions that bring us closer to our vision of how things should be. And then we must be committed to making it so.