## 1NC – Warming Good

#### No Extinction from Warming – new studies prove over-hype and tech solves.

* Extinction Tipping Point is implausible – we’re on track for 3 degrees, not 4-5 degrees
* Tech and Energy Modernization Solve – Renewable Energy is replacing Fossil Fuels which reduces Climate Mortality by a rate of 5.

Nordhaus 20 Ted Nordhaus 1-23-2020 “Ignore the Fake Climate Debate” <https://www.wsj.com/articles/ignore-the-fake-climate-debate-11579795816>, found by BPS, (American author, environmental policy expert, and the director of research at The Breakthrough Institute, citing new climate change forecasts)//Re-cut by Elmer

Beyond the headlines and social media, where Greta Thunberg, Donald Trump and the online armies of climate “alarmists” and “deniers” do battle, there is a real climate debate bubbling along in scientific journals, conferences and, occasionally, even in the halls of Congress. It gets a lot less attention than the boisterous and fake debate that dominates our public discourse, but it is much more relevant to how the world might actually address the problem. In the real climate debate, no one denies the relationship between human emissions of greenhouse gases and a warming climate. Instead, the disagreement comes down to different views of climate risk in the face of multiple, cascading uncertainties. On one side of the debate are optimists, who believe that, with improving technology and greater affluence, our societies will prove quite adaptable to a changing climate. On the other side are pessimists, who are more concerned about the risks associated with rapid, large-scale and poorly understood transformations of the climate system. But most pessimists do not believe that runaway climate change or a hothouse earth **are plausible** scenarios, much less that human extinction is imminent. And most optimists recognize a need for policies to address climate change, even if they don’t support the radical measures that Ms. Thunberg and others have demanded. In the fake climate debate, both sides agree that economic growth and reduced emissions vary inversely; it’s a zero-sum game. In the real debate, the relationship is much more complicated. Long-term economic growth is associated with both rising per capita energy consumption and slower population growth. For this reason, as the world continues to get richer, higher per capita energy consumption is likely to be offset by a lower population. A richer world will also likely be more technologically advanced, which means that energy consumption should be less carbon-intensive than it would be in a poorer, less technologically advanced future. In fact, a number of the high-emissions scenarios produced by the United Nations Intergovernmental Panel on Climate Change involve futures in which the world is relatively poor and populous and less technologically advanced. Affluent, developed societies are also much better equipped to respond to climate extremes and natural disasters. That’s why natural disasters kill and displace many more people in poor societies than in rich ones. It’s not just seawalls and flood channels that make us resilient; it’s air conditioning and refrigeration, modern transportation and communications networks, early warning systems, first responders and public health bureaucracies. New research published in the journal Global Environmental Change finds that global economic growth over the last decade has reduced climate mortality by a factor of five, with the **greatest benefits documented in the poorest nations.** In low-lying Bangladesh, 300,000 people died in Cyclone Bhola in 1970, when 80% of the population lived in extreme poverty. In 2019, with less than 20% of the population living in extreme poverty, Cyclone Fani killed just five people. “Poor nations are most vulnerable to a changing climate. The fastest way to reduce that vulnerability is through economic development.” So while it is true that poor nations are most vulnerable to a changing climate, it is also true that the fastest way to reduce that vulnerability is through economic development, which requires infrastructure and industrialization. Those activities, in turn, require cement, steel, process heat and chemical inputs, all of which are impossible to produce today without fossil fuels. For this and other reasons, the world is unlikely to cut emissions fast enough to stabilize global temperatures at less than 2 degrees above pre-industrial levels, the long-standing international target, much less 1.5 degrees, as many activists now demand. But recent forecasts also suggest that many of the worst-case climate scenarios produced in the last decade, which assumed unbounded economic growth and fossil-fuel development, are also very unlikely. There is still substantial uncertainty about how sensitive global temperatures will be to higher emissions over the long-term. But the best estimates now suggest that the world is on track for 3 degrees of warming by the end of this century, not 4 or 5 degrees as was once feared. That is due in part to slower economic growth in the wake of the global financial crisis, but also to decades of technology policy and energy-modernization efforts. “We have better and cleaner technologies available today because policy-makers in the U.S. and elsewhere set out to develop those technologies.” The energy intensity of the global economy continues to fall. **Lower-carbon natural gas has displaced coal as the primary source of new fossil energy**. The **falling cost of wind and solar energy** has begun to have an effect on the growth of fossil fuels. Even **nuclear energy** has made a modest comeback in Asia.

#### [Aff] studies about CO2 impact are exaggerated

* peer-reviewed journal shows IPCC exaggeration
* history proves resilience
* no extinction- warming under Paris goals
* rock breaking strategy could offset warming

IBD 18 Investors Business Daily 4-25-2018 “Here's One Global Warming Study Nobody Wants You To See” <https://www.investors.com/politics/editorials/global-warming-computer-models-co2-emissions/> (Citing Study from Peer reviewed journal by Lewis and Curry)//Re-cut by Elmer

Settled Science: A new study published in a peer-reviewed journal finds that climate models exaggerate the global **warming from CO2** emissions by as much as 45%. If these findings hold true, it's huge news. No wonder the mainstream press is ignoring it. In the study, authors Nic Lewis and Judith Curry looked at actual temperature records and compared them with climate change computer models. What they found is that the planet has shown itself to be far less sensitive to increases in CO2 than the climate models say. As a result, they say, the planet will warm less than the models predict, even if we continue pumping CO2 into the atmosphere. As Lewis explains: "Our results imply that, for any future emissions scenario, future warming is likely to be substantially lower than the central computer model-simulated level projected by the (United Nations Intergovernmental Panel on Climate Change), and highly unlikely to exceed that level. How much lower? Lewis and Curry say that their findings show temperature increases will be 30%-45% lower than the climate models say. If they are right, then there's little to worry about, even if we don't drastically reduce CO2 emissions. The planet will warm from human activity, but not nearly enough to cause the sort of end-of-the-world calamities we keep hearing about. In fact, the resulting warming would be below the target set at the Paris agreement. This would be tremendously good news. The fact that the Lewis and Curry study appears in the peer-reviewed American Meteorological Society's Journal of Climate lends credibility to their findings. This is the same journal, after all, that recently published widely covered studies saying the Sahara has been growing and the climate boundary in central U.S. has shifted 140 miles to the east because of global warming. The Lewis and Curry findings come after another study, published in the prestigious journal Nature, that found the long-held view that a doubling of CO2 would boost global temperatures as much as 4.5 degrees Celsius was wrong**.** The most temperatures would likely climb is 3.4 degrees. It also follows a study published in Science, which found that **rocks** contain vast amounts of nitrogen that plants could use to grow and absorb more CO2, potentially **offsetting** at least some of the effects of CO2 emissions and reducing future temperature increases.

#### Variations natural and CO2 effects are overstated.

* 10,000 years prove natural range of warming
* No Co2 effect on Warming – No Net Warming despite 8 Percent increase of Co2
* Solar Radiation has net greater effect – close correlation over past 150 years

Carter et al. 15 Robert M Carter 4-12-2015 “Why Scientists Disagree About Global Warming The NIPCC Report on Scientific Consensus” (Craig D. Idso, Ph.D. Robert M. Carter, Ph.D. S. Fred Singer, Ph. D. Chairman Emeritus Fellow Chairman Center for the Study Institute of Public Affairs Science and of Carbon Dioxide Australia) Environmental Policy and Global Change Project (USA) (USA))//Elmer

Modern Warming Is Not Unprecedented IPCC’s second false postulate is that the late twentieth century warm peak was of greater magnitude than previous natural peaks. Comparison of modern and ancient rates of natural temperature change is difficult because of the lack of direct measurements available prior to 1850. However, high-quality proxy temperature records from the Greenland ice core for the past 10,000 years demonstrate a **natural range of warming** and cooling rates between +2.5 and -2.5 °C/century (Alley, 2000; Carter, 2010, p. 46, figure7), significantly greater than rates measured for Greenland or the globe during the twentieth century. Glaciological and recent geological records contain numerous examples of ancient temperatures up to 3°C or more warmer than the peak reported at the end of the twentieth century. During the Holocene, such warmer peaks included the Egyptian, Minoan, Roman, and Medieval warm periods (Alley, 2000). During the Pleistocene, warmer peaks were associated with interglacial oxygen isotope stages 5, 9, 11, and 31 (Lisiecki and Raymo, 2005). During the Late Miocene and Early Pliocene (6–3 million years ago) temperature consistently attained values 2–3°C above twentieth century values (Zachos et al., 2001). Figure 10 summarizes these and other findings about surface temperatures that appear in Chapter 4 of Climate Change Reconsidered-II: Physical Science. Figure 10 Key Facts about Surface Temperature # Whether today’s global surface temperature is seen to be part of a warming trend depends upon the time period considered. # Over (climatic) time scales of many thousand years, temperature is cooling; over the historical (meteorological) time scale of the past century temperature has warmed. Over the past 18 years, there has been no net warming despite an increase in atmospheric CO2 of 8 percent – which represents 34 percent of all human-related CO2 emissions released to the atmosphere since the industrial revolution. # Given an atmospheric mixing time of ~1 year, the facts just related represent a test of the dangerous warming hypothesis, which test it fails. # Based upon the HadCRUT dataset favored by IPCC, two phases of warming occurred during the twentieth century, between 1910–1940 and 1979–2000, at similar rates of a little over 1.5°C/century. The early twentieth century warming preceded major industrial carbon dioxide emissions and must be natural; warming during the second (prima facie, similar) period might incorporate a small human-related carbon dioxide effect, but warming might also be inflated by urban heat island effects. # Other temperature datasets fail to record the late twentieth century warming seen in the HadCRUT dataset. # There was nothing unusual about either the magnitude or rate of the late twentieth century warming pulses represented on the HadCRUT record, both falling well within the envelope of known, previous natural variations. # No empirical evidence exists to support the assertion that a planetary warming of 2°C would be net ecologically or economically damaging. Source: “Chapter 4. Observations: Temperatures,” Climate Change Reconsidered II: Physical Science (Chicago, IL: The Heartland Institute, 2013). **CO2 Does Not Lead Temperature** IPCC’s third false postulate is that increases in atmospheric CO2 precede, and then force, parallel increases in temperature. The remarkable (and at first blush, synchronous) parallelism that exists between rhythmic fluctuations in ancient atmospheric temperature and atmospheric CO2 levels was first detected in polar ice core samples analyzed during the 1970s. From the early 1990s onward, however, higher-resolution sampling has repeatedly shown these historic temperature changes precede the parallel changes in CO2 by several hundred years or more (Mudelsee, 2001; Monnin et al., 2001; Caillon et al., 2003; Siegenthaler et al., 2005). A similar relationship of temperature change leading CO2 change (in this case by several months) also characterizes the much shorter seasonal cyclicity manifest in Hawaiian and other meteorological measurements (Kuo et al., 1990). In such circumstances, changing levels of CO2 cannot be driving changes in temperature, but must either be themselves stimulated by temperature change, or be co-varying with temperature in response to changes in another (at this stage unknown) variable. Solar Influence Is Not Minimal IPCC’s fourth false postulate is that solar forcings are too small to explain twentieth century warming. Having concluded solar forcing alone is inadequate to account for twentieth century warming, IPCC authors infer CO2 must be responsible for the remainder. Nonetheless, observations indicate variations occur in total ocean–atmospheric meridional heat transport and that these variations are driven by changes in solar radiation rooted in the intrinsic variability of the Sun’s magnetic activity (Soon and Legates, 2013). Incoming solar radiation is most often expressed as Total Solar Insolation (TSI), a measure derived from multi-proxy measures of solar activity (Hoyt and Schatten, 1993; extended and re-scaled by Willson, 2011; Scafetta and Willson, 2013). The newest estimates, from satellite-borne ACRIM-3 measurements, indicate TSI ranged between 1360 and 1363 Wm-2 between 1979 and 2011, the variability of ~3 Wm-2 occurring in parallel with the 11-year sunspot cycle. Larger changes in TSI are also known to occur in parallel with climatic change over longer time scales. For instance, Shapiro et al. (2011) estimated the TSI change between the Maunder Minimum and current conditions may have been as large as 6 Wm-2. Temperature records from circum-Arctic regions of the Northern Hemisphere show a close correlation with TSI over the past 150 years, with both measures conforming to the ~60–70 year multidecadal cycle. In contrast, the measured steady rise of CO2 emissions over the same period shows little correlation with the strong multidecadal (and shorter) ups and downs of surface temperature around the world. Finally, **IPCC ignores x-ray, ultraviolet, and magnetic flux variation, the latter having particularly important implications for the modulation of galactic cosmic ray influx and low cloud formation** (Svensmark, 1998; Kirkby, et al., 2011). Figure 11 summarizes these and other findings about solar forcings from Chapter 3 of Climate Change Reconsidered II: Physical Science.Figure 11 Key Facts about Solar Forcing # Evidence is accruing that changes in Earth’s surface temperature are largely driven by variations in solar activity. Examples of solar-controlled climate change epochs include the Medieval Warm Period, Little Ice Age, and Early Twentieth Century (1910–1940) Warm Period. # The Sun may have contributed as much as 66 percent of the observed twentieth century warming, and perhaps more. # Strong empirical correlations have been reported from around the world between solar variability and climate indices including temperature, precipitation, droughts, floods, streamflow, and monsoons. # IPCC models do not incorporate important solar factors such as fluctuations in magnetic intensity and overestimate the role of human-related CO2 forcing. # IPCC fails to consider the importance of the demonstrated empirical relationship between solar activity, the ingress of galactic cosmic rays, and the formation of low clouds. # The respective importance of the Sun and CO2 in forcing Earth’s climate remains unresolved; current climate models fail to account for a plethora of known Sun-climate connections. # The recently quiet Sun and extrapolation of solar cycle patterns into the future suggest a planetary cooling may occur over the next few decades. Source: “Chapter 3. Solar Forcing of Climate,” Climate Change Reconsidered II: Physical Science (Chicago, IL: The Heartland Institute, 2013). Warming Would Not Be Harmful IPCC’s fifth false postulate is that warming of 2°C above today’s temperature would be harmful. The suggestion that 2°C of warming would be harmful was coined at a conference organized by the British Meteorological Office in 2005 (DEFRA, 2005). The particular value of 2°C is entirely arbitrary and was proposed by the World Wildlife Fund, an environmental advocacy group, as a political expediency rather than as an informed scientific opinion. The target was set in response to concern that politicians would not initiate policy actions to reduce CO2 emissions unless they were given a specific (and low) quantitative temperature target to aim for. Multiple lines of evidence suggest a 2°C rise in temperature would not be harmful to the biosphere. The period termed the Holocene Climatic Optimum (c. 8,000 ybp) was 2–3°C warmer than today (Alley, 2000), and the planet attained similar temperatures for several million years during the Miocene and Pliocene (Zachos et al., 2001). Biodiversity is encouraged by warmer rather than colder temperatures (Idso and Idso, 2009), and higher temperatures and elevated CO2 greatly stimulate the growth of most plants (Idso and Idso, 2011). Despite its widespread adoption by environmental NGOs, lobbyists, and governments, no empirical evidence exists to substantiate the claim that 2°C of warming presents a threat to planetary ecologies or human well-being. Nor can any convincing case be made that a warming will be more economically costly than an equivalent cooling (either of which could occur for natural reasons), since any planetary change of 2°C magnitude in temperature would result in complex local and regional changes, some being of economic or environmental benefit and others being harmful. \* \* \* We conclude neither the rate nor the magnitude of the reported late twentieth century surface warming (1979–2000) lay outside normal natural variability, nor was it in any way unusual compared to earlier episodes in Earth’s climatic history. Furthermore, solar forcings of temperature change are likely more important than is currently recognized, and evidence is lacking that a 2°C increase in temperature (of whatever cause) would be globally harmful.

#### Their models are wrong – adaptations solve

* peer-reviewed journal shows IPCC exaggeration
* social cost estimates are overblown
* historical records are wrong- using physically realistic measures proves decreased impact
* climate cost estimates are inflated by neglecting adaptation

Lau 18 [Matthew Lau, contributing writer to Canadians for Affordable Energy, citing peer reviewed studies from journal nature climate change and Journal of Climate, “Climate change data is wildly overestimated”, 8/14, https://torontosun.com/opinion/columnists/guest-column-climate-change-data-is-wildly-over-estimated]

A study last year by Thorsten Mauritsen and Robert Pincus in the journal Nature Climate Change and another one this year by Nicholas Lewis and Judith Curry in the Journal of Climate, produced median estimates suggesting that a doubling in atmospheric carbon dioxide would increase global temperatures by only about half of what Intergovernmental Panel on Climate Change (IPCC) models predict.

Recently, two Heritage Foundation scholars and Canadian economist Ross McKitrick re-estimated the social cost of carbon dioxide emissions using earlier empirical estimates from Lewis and Curry, instead of relying on simulated estimates of the sensitivity of temperature to carbon dioxide concentration in the atmosphere. In one model, the social cost of carbon fell 40-50% and in another the costs dropped a staggering 80%.

In addition to future warming and its associated costs likely being over-predicted by climate models, historical warming might also be less than what most temperature records suggest. That is because some techniques for producing temperature records systematically display more warming than actually occurred.

According to Patrick J. Michaels and Ryan Maue, scientists with the Cato Institute, one of the most reliable temperature data sets is from the Japan Meteorological Office. This record also shows the least amount of warming. “The fact of the matter is,” the Cato researchers write, “that what should be the most physically realistic measure of global average surface temperature is also our coolest.”

Not only is the amount of warming often exaggerated, but climate cost estimates are often inflated by assuming that humans will not adapt to the warmer climate. This assumption makes no sense when we consider how long the warming is supposed to take and how creative our society is when it comes to solving complex problems.

Adding all this up suggests that climate change probably won’t be anywhere near as disastrous as many people imagine. This has profound policy implications – it means that the drastic and expensive tax and regulatory actions taken by governments in the name of saving the climate are increasingly difficult to justify.

#### Extinction from warming requires 12 degrees, far greater than their internal link, and intervening actors will solve before then

Sebastian Farquhar 17, master’s degree in Physics from the University of Oxford, leads the Global Priorities Project (GPP) at the Centre for Effective Altruism, et al., 2017, “Existential Risk: Diplomacy and Governance,” https://www.fhi.ox.ac.uk/wp-content/uploads/Existential-Risks-2017-01-23.pdf

The most likely levels of global warming are very unlikely to cause human extinction.15 The existential risks of climate change instead stem from tail risk climate change – the low probability of extreme levels of warming – and interaction with other sources of risk. It is impossible to say with confidence at what point global warming would become severe enough to pose an existential threat. Research has suggested that warming of 11-12°C would render most of the planet uninhabitable,16 and would completely devastate agriculture.17 This would pose an extreme threat to human civilisation as we know it.18 Warming of around 7°C or more could potentially produce conflict and instability on such a scale that the indirect effects could be an existential risk, although it is extremely uncertain how likely such scenarios are.19 Moreover, the timescales over which such changes might happen could mean that humanity is able to adapt enough to avoid extinction in even very extreme scenarios. The probability of these levels of warming depends on eventual greenhouse gas concentrations. According to some experts, unless strong action is taken soon by major emitters, it is likely that we will pursue a medium-high emissions pathway.20 If we do, the chance of extreme warming is highly uncertain but appears non-negligible. Current concentrations of greenhouse gases are higher than they have been for hundreds of thousands of years,21 which means that there are significant unknown unknowns about how the climate system will respond. Particularly concerning is the risk of positive feedback loops, such as the release of vast amounts of methane from melting of the arctic permafrost, which would cause rapid and disastrous warming.22 The economists Gernot Wagner and Martin Weitzman have used IPCC figures (which do not include modelling of feedback loops such as those from melting permafrost) to estimate that if we continue to pursue a medium-high emissions pathway, the probability of eventual warming of 6°C is around 10%,23 and of 10°C is around 3%.24 These estimates are of course highly uncertain. It is likely that the world will take action against climate change once it begins to impose large costs on human society, long before there is warming of 10°C. Unfortunately, there is significant inertia in the climate system: there is a 25 to 50 year lag between CO2 emissions and eventual warming,25 and it is expected that 40% of the peak concentration of CO2 will remain in the atmosphere 1,000 years after the peak is reached.26 Consequently, it is impossible to reduce temperatures quickly by reducing CO2 emissions. If the world does start to face costly warming, the international community will therefore face strong incentives to find other ways to reduce global temperatures.

#### CO2 is key to agriculture – stops extinction

Ferrera 14 Peter Ferrera 2-24-2014 “The Period Of No Global Warming Will Soon Be Longer Than the Period of Actual Global Warming” <http://www.forbes.com/sites/peterferrara/2014/02/24/the-period-of-no-global-warming-will-soon-be-longer-than-the-period-of-actual-global-warming/#42cc9ebf8bf0> (J.D. Harvard Law, contributor to Forbes on climate and public policy, Director of Entitlement and Budget Policy for the Heartland Institute, Senior Advisor for Entitlement Reform and Budget Policy at the National Tax Limitation Foundation, General Counsel for the American Civil Rights Union, and Senior Fellow at the National Center for Policy Analysis, served in the White House Office of Policy Development under President Reagan, and as Associate Deputy Attorney General of the United States under President George H.W. Bush)//Elmer

In addition, CO2 is actually essential to all life on the planet. Plants need CO2 to grow and conduct photosynthesis, which is the natural process that creates **food for animals and fish** at the bottom of the food chain. The increase of CO2 in the atmosphere that has occurred due to human emissions has actually increased agricultural growth and output as a result, causing actually an increased greening of the planet. So has any warming caused by such human emissions, as minor warming increases agricultural growth. The report states, “CO2 is a vital nutrient used by plants in photosynthesis. Increasing CO2 in the atmosphere ‘greens’ the planet and helps feed the growing human population.”

#### Best studies prove

Ballonoff 14, Paul. "A fresh look at climate change." Cato J. 34 (2014): 113. (consultant, international energy development)//Elmer

While in fact heating has not occurred as the IPCC forecasted, greatly increased global biomass is indeed demonstrated. Well documented evidence shows that concurrently with the **increased CO2** levels, extensive, large, and continuing increase in **biomass is taking place globally**—reducing deserts, turning grasslands to savannas, savannas to forests, and expanding existing forests (Idso 2012). That survey covered 400 peer-reviewed empirical studies, many of which included surveys of dozens to hundreds of sources. Comprehensive study of global and regional relative greening and browning using NOAA data showed that shorter-term trends in specific locations may reflect either greening or browning, and also noted that the rapid pace of greening of the Sahel is due in part to the end of the drought in that region. Nevertheless, in nearly all regions and globally, the overall effect in recent decades is **decidedly toward greening** (de Jong et al. 2012). This result is also the opposite of what the IPCC expected.

#### Extinction.

Cribb 19 [Julian; Author, journalist, editor and science communicator. He is principal of Julian Cribb & Associates who provide specialist consultancy in the communication of science, agriculture, food, mining, energy and the environment. His career includes appointments as newspaper editor, scientific editor for director of national awareness for Australia’s science agency CSIRO, member of numerous scientific boards and advisory panels, and president of national professional bodies for agricultural journalism and science communication. His published work includes over 8000 articles, 3000 media releases and eight books. He has received 32 awards for journalism. His internationally-acclaimed book, The Coming Famine explores the question of whether we can feed humanity through the mid-century peak in numbers and food demand; “6 - Food as an Existential Risk,” Cambridge; August 2019; <https://www.cambridge.org/core/books/food-or-war/food-as-an-existential-risk/8C45279588CD572FE805B7E240DE7368>] Recut Justin

Extinction and Ecological Collapse More than half of the large animals that once inhabited the Earth have been wiped from it by human action since 1970, according to the Worldwide Fund for Nature’s Living Planet Index.3 So, too, have half the fish in the sea on which humans rely for food.4 Humans are, in the words of the great biologist E. O. Wilson, ‘tearing down the biosphere’, demolishing the very home that keeps us alive.5 Extinction, it should be noted, is a part of life: 99.9 per cent of all species ever to evolve on this planet have disappeared, and new ones like ourselves have arisen to replace them. But extinction rates like today’s – a hundred to a thousand times faster than normal – are a freak occurrence that usually takes tens of millions of years, not mere decades. Animal, plant and marine species are presently vanishing so fast that scientists have dubbed our time “the Sixth Extinction” – the sixth such megadeath in the geological history of the Earth.6 By the end of the present century, Wilson says, it is possible that up to half of the eight million species thought to exist here will be gone. Furthermore, in all previous extinctions, natural events like asteroid strikes and vast volcanic outbursts have been to blame. This will be the only time in the Earth’s history when the wipe-out was caused by a single species. Us.7 [Ommited 178-180] Oxfam, illustrates how just one tenth of humanity consumes five times as much in the way of material resources (expressed here in the form of their carbon footprint) as the poorest half of the world population. The affluent are chiefly responsible for the destruction taking place on a global scale as they seek to sustain lifestyles that the planet can no longer afford or support. The significance of this blind spot around consumption for global food security is very great. As described in earlier chapters, the world food system depends critically on soil, water, nutrients and a stable climate, to supply humanity’s daily need for nutriment – and all of these essential resources are in increasingly short supply, chiefly because of our own mismanagement of them and our collective failure to appreciate that they are finite. On current trends, the existing food system will tend to break down, first regionally and then globally, owing to resource scarcity from the 2020s onward, and especially towards the mid century – unless there is radical change in the world diet and the means by which we feed ourselves. This will lead to increasing outbreaks of violence and war. Nobody, neither rich nor poor, will escape the consequences. It remains an open question whether panicking regimes in Russia, the USA or even France would be ruthless enough to deploy atomic weapons in an attempt to quell invasion by tens of millions of desperate refugees, fleeing famine and climate chaos in their own homelands – but the possibility ought not to be ignored. That nuclear war is at least a possible outcome of food and climate crises was first flagged in the report The Age of Consequences by Kurt Campbell and the US-based Centre for Strategic and International Studies, which stated ‘it is clear that even nuclear war cannot be excluded as a political consequence of global warming’. 15 Food insecurity is therefore a driver in the preconditions for the use of nuclear weapons, whether limited or unlimited. A global famine is a likely outcome of limited use of nuclear weapons by any country or countries – and would be unavoidable in the event of an unlimited nuclear war between America and Russia, making it unwinnable for either. And that, as the mute hands of the ‘Doomsday Clock’ so eloquently admonish, is also the most likely scenario for the premature termination of the human species. Such a grim scenario can be alleviated by two measures: the voluntary banning by the whole of humanity of nuclear weapons, their technology, materials and stocks – and by a global effort to secure food against future insecurity by diverting the funds now wasted on nuclear armaments into building the sustainable food and water systems of the future (see Chapters 8 and 9). Food Security Our demand for food is set to double by the 2060s – potentially the decade of ‘peak people’, the moment in history when the irresistible human population surge may top out at around 10 billion. However, as we have seen, many of the resources needed to supply it agriculturally could halve and the climate for the growing of food outdoors become far more hostile. Why food insecurity is an existential threat to humanity should, by now, be abundantly clear from the earlier chapters of this book: present systems are unsustainable and, as they fail, will pose risks both to civilization and, should these spiral into nuclear conflict, to the future of the human species. The important thing to note in this chapter is that food insecurity plays into many, if not all, of the other existential threats facing humanity. The food sector’s role in extinction, resource scarcity, global toxicity and potential nuclear war has already been explained. Its role in the suppression of conflict is discussed in the next chapter. Its role in securing the future of the megacities, and of a largely urbanised humanity, is covered in Chapter 8. And its role in sustaining humanity through the peak in population and into a sustainable world beyond is covered in Chapter 9. Food clearly has a pivotal role in the future of human population – both as a driver of population growth when supplies are abundant and as a potential driver of population decline, should food chains collapse. It is no exaggeration to state that the fate of civilisation depends on it. Food insecurity affects the progression of pandemic diseases, often in ways that are not entirely obvious. First, new pandemics of infectious disease tend to originate in developing regions where nutritional levels are poor or agricultural practices favour the evolution of novel pathogens such as, for example, the new flu strains seen every year – which arise mainly from places where people, pigs and poultry live side-by-side and shuffle viruses between them – and also novel diseases like SARS and MERS. Second, because totally unknown diseases tend to arise first in places where rainforests are being cut down for farming and viruses hitherto confined to wild animals and birds make an enforced transition into humans. Examples of novel human diseases escaping from the rainforest and tropical savannah in recent times include HIV/AIDS, Hendra, Nipah, Ebola, Marburg, Lassa and Hanta, Lujo, Junin, Machupo, Rift Valley, Congo and Zika.29 And thirdly, because the loss of vital micronutrients from heavily farmed soils and from food itself predisposes many populations to various deficiency diseases – for example, a lack of selenium in the diet has been linked with increased risk from both HIV/AIDS and bowel cancer.30 A key synergy is the way **hunger** and **malnourishment** **exacerbate** the **spread** **of** **disease**, classic examples being the 1918 Global Flu Pandemic which spread rapidly among war-starved populations, or the more recent cholera outbreak in war-torn Yemen. In a fresh twist, Dr Melinda Beck of North Carolina University has demonstrated that obesity – itself a form of malnutrition – may cause increased deaths from influenza by both aiding the virus and suppressing the patient’s immune response.31

#### Ag Solves – Plants act as carbon sinks which offsets Warming

Harris and Gibbs 21 Nancy Harris and David Gibbs 1-21-2021 "Forests Absorb Twice As Much Carbon As They Emit Each Year" <https://www.wri.org/insights/forests-absorb-twice-much-carbon-they-emit-each-year> (Nancy is Research Manager for Global Forest Watch (GFW) within the Food, Forests and Water program. GFW is an international initiative originated by WRI to provide improved data and information about the world’s forests by merging the latest technology with on-the-ground partnerships. Nancy works to identify thematic and geographic research priorities for GFW and leads the acquisition and generation of new data and analytical content. She also supports in-country capacity building efforts and collaborates with GFW staff and partners to produce and communicate original, policy-relevant research that further advances global understanding of critical drivers and dynamics of forest change. Prior to joining WRI, Nancy worked as a Carbon and Land Use Specialist in the Ecosystem Services unit of Winrock International, where she managed Winrock’s spatial analysis team, published several peer-reviewed papers on forest carbon cycling and spatial modeling of land cover change, and provided technical guidance to multiple stakeholders on climate change mitigation options in the land sector.)//Elmer

The world is getting a better understanding of just how important forests are in the global **fight against climate change**. New research, published in Nature Climate Change and available on Global Forest Watch, found that the world’s forests **sequestered** about **twice as much carbon** dioxide **as they emitted** between 2001 and 2019. In other words, forests provide a “carbon sink” that absorbs a net **7.6 billion metric tonnes** of CO2 per year, **1.5 times more carbon than the United States** emits annually. Before now, scientists estimated these global “carbon fluxes” from the sum of country-reported data, creating a coarse picture of the role forests play in both carbon emissions and sequestration. With these new data that combine ground measurements with satellite observations, we can now quantify carbon fluxes consistently over any area, from small local forests to countries to entire continents. Using this more granular information, we found that the world’s forests emitted an average of 8.1 billion metric tonnes of carbon dioxide into the atmosphere each year due to deforestation and other disturbances, and absorbed 16 billion metric tonnes of CO2 per year. Here’s a look at what else the new maps tell us about forests and carbon: Only One Major Tropical Rainforest Remains a Strong Carbon Sink Tropical rainforests are far and away the most important ecosystems for mitigating climate change. Tropical rainforests collectively sequester more carbon from the atmosphere than temperate or boreal forests, but they’re also increasingly destroyed for agricultural expansion. The world’s three largest tropical rainforests are located in the Amazon, Congo River basin and Southeast Asia. Over the past 20 years, forests across Southeast Asia have collectively become a net source of carbon emissions due to clearing for plantations, uncontrolled fires and drainage of peat soils. The Amazon River basin, which stretches across nine countries in South America, is still a net carbon sink, but teeters on the edge of becoming a net source if forest loss continues at current rates. The Amazon basin has experienced heightened deforestation in the last four years due to clearing for cattle pasture and degradation from fires. Of the world’s three largest tropical rainforests, only the Congo has enough standing forest left to remain a strong net carbon sink. The Congo’s tropical rainforest **sequesters 600 million metric tonnes** more carbon dioxide per year than it emits, equivalent to about one-third of the CO2 emissions from all U.S. transportation. Protecting the remaining forests in all three regions **is critical to mitigating climate change**.

#### Co2 solves ice age – extinction

Marsh 12 Gerald Marsh 2012 “The Coming of a New Ice Age” <http://www.winningreen.com/site/epage/59549_621.htm> (Retired Physicist from the Argonne National Laboratory and a former consultant to the Department of Defense on strategic nuclear technology and policy in the Reagan, Bush, and Clinton Administration)//Re-cut by Elmer

CHICAGO — Contrary to the conventional wisdom of the day, the real danger facing humanity is not global warming, but more likely the coming of a new Ice Age. What we live in now is known as an interglacial, a relatively brief period between long ice ages. Unfortunately for us, most interglacial periods last only about ten thousand years, and that is how long it has been since the last Ice Age ended. How much longer do we have before the ice begins to spread across the Earth’s surface? Less than a hundred years or several hundred? We simply don’t know. Even if all the temperature increase over the last century is attributable to human activities, the rise has been relatively modest one of a little over one degree Fahrenheit — an increase well within natural variations over the last few thousand years. While an enduring temperature rise of the same size over the next century would cause humanity to make some changes, it would undoubtedly be within our ability to adapt. Entering a new ice age, however, would be catastrophic for the continuation of modern civilization. One has only to look at maps showing the extent of the great ice sheets during the last Ice Age to understand what a return to ice age conditions would mean. Much of Europe and North-America were covered by thick ice, thousands of feet thick in many areas and the world as a whole was much colder. The last “little” Ice Age started as early as the 14th century when the Baltic Sea froze over followed by unseasonable cold, storms, and a rise in the level of the Caspian Sea. That was followed by the extinction of the Norse settlements in Greenland and the loss of grain cultivation in Iceland. Harvests were even severely reduced in Scandinavia And this was a mere foreshadowing of the miseries to come. By the mid-17th century, glaciers in the Swiss Alps advanced, wiping out farms and entire villages. In England, the River Thames froze during the winter, and in 1780, New York Harbor froze. Had this continued, history would have been very different. Luckily, the decrease in solar activity that caused the Little Ice Age ended and the result was the continued flowering of modern civilization. There were very few Ice Ages until about 2.75 million years ago when Earth’s climate entered an unusual period of instability. Starting about a million years ago **cycles of ice ages** lasting about 100,000 years, separated by relatively short **interglacial periods,** like the one we are now living in became the rule. Before the onset of the Ice Ages, and for most of the Earth’s history, it was far warmer than it is today. Indeed, the Sun has been getting brighter over the whole history of the Earth and large land plants have flourished. Both of these had the effect of dropping carbon dioxide concentrations in the atmosphere to the lowest level in Earth’s long history. Five hundred million years ago, carbon dioxide concentrations were over 13 times current levels; and not until about 20 million years ago did carbon dioxide levels dropped to a little less than twice what they are today. It is possible that moderately increased carbon dioxide concentrations could extend the current interglacial period. But we have not reached the level required yet, nor do we know the optimum level to reach. So, rather than call for arbitrary limits on carbon dioxide emissions, perhaps the best thing the UN’s Intergovernmental Panel on Climate Change and the climatology community in general could do is spend their efforts on determining the optimal range of carbon dioxide needed to extend the current interglacial period indefinitely. NASA has predicted that the solar cycle peaking in 2022 could be one of the weakest in centuries and should cause a very significant cooling of Earth’s climate. Will this be the trigger that initiates a new Ice Age? We ought to carefully consider this possibility before we wipe out our current prosperity by spending trillions of dollars to combat a perceived global warming threat that may well prove to be only a will-o-the-wisp.

#### Yes impending Ice Age – best studies about solar variability

Rohrabacher 12 Dana Rohrabacher 2-1-2012 “Forget Global Warming – It’s Cycle 25 We Need to Worry About” (US Representative)//Elmer

The supposed "consensus' on man-made global warming is facing an inconvenient challenge after the release of new temperature data showing the planet has not warmed for the past 15 years. The figures suggest that we could even be **heading for a mini ice age** to rival the 70-year temperature drop that saw frost fairs held on the Thames in the 17th Century. Based on readings from more than 30,000 measuring stations, the data was issued last week without fanfare by the Met Office and the University of East Anglia Climatic Research Unit. It confirms that the rising trend in world temperatures ended in 1997. Meanwhile, leading climate scientists yesterday told The Mail on Sunday that, after emitting unusually high levels of energy throughout the 20th Century, the sun is now heading towards a "grand minimum' in its output, threatening cold summers, bitter winters and a shortening of the season available for growing food. Solar output goes through 11-year cycles, with high numbers of sunspots seen at their peak. We are now at what should be the peak of what scientists call "Cycle 24' - which is why last week's solar storm resulted in sightings of the aurora borealis further south than usual. But sunspot numbers are running at less than half those seen during cycle peaks in the 20th Century. Analysis by experts at NASA and the University of Arizona - derived from magnetic-field measurements 120,000 miles beneath the sun's surface - suggest that Cycle 25, whose peak is due in 2022, will be a great deal weaker still. According to a paper issued last week by the Met Office, there is a **92 per cent chance** that both **Cycle 25** and those taking place in the following decades will be as weak as, or weaker than, the "**Dalton minimum'** of 1790 to 1830. In this period, named after the meteorologist John Dalton, average temperatures in parts of Europe fell by 2C. However, it is also possible that the new solar energy slump could be as deep as the "Maunder minimum' (after astronomer Edward Maunder), between 1645 and 1715 in the coldest part of the "Little Ice Age' when, as well as the Thames frost fairs, the canals of Holland froze solid.

#### Mathematical equations confirm our impacts outweigh.

MacAskill 14 [William, Oxford Philosopher and youngest tenured philosopher in the world, Normative Uncertainty, 2014]

The human race might go extinct from a number of causes: asteroids, supervolcanoes, runaway climate change, pandemics, nuclear war, and the development and use of dangerous new technologies such as synthetic biology, all pose risks (even if very small) to the continued survival of the human race.184 And different moral views give opposing answers to question of whether this would be a good or a bad thing. It might seem obvious that human extinction would be a very bad thing, both because of the loss of potential future lives, and because of the loss of the scientific and artistic progress that we would make in the future. But the issue is at least unclear. The continuation of the human race would be a mixed bag: inevitably, it would involve both upsides and downsides. And if one regards it as much more important to avoid bad things happening than to promote good things happening then one could plausibly regard human extinction as a good thing.For example, one might regard the prevention of bads as being in general more important that the promotion of goods, as defended historically by G. E. Moore,185 and more recently by Thomas Hurka.186 One could weight the prevention of suffering as being much more important that the promotion of happiness. Or one could weight the prevention of objective bads, such as war and genocide, as being much more important than the promotion of objective goods, such as scientific and artistic progress. If the human race continues its future will inevitably involve suffering as well as happiness, and objective bads as well as objective goods. So, if one weights the bads sufficiently heavily against the goods, or if one is sufficiently pessimistic about humanity’s ability to achieve good outcomes, then one will regard human extinction as a good thing.187 However, even if we believe in a moral view according to which human extinction would be a good thing, we still have strong reason to prevent near-term human extinction. To see this, we must note three points. First, we should note that the extinction of the human race is an extremely high stakes moral issue. Humanity could be around for a very long time: if humans survive as long as the median mammal species, we will last another two million years. On this estimate, the number of humans in existence in the The future, given that we don’t go extinct any time soon, would be 2×10^14. So if it is good to bring new people into existence, then it’s very good to prevent human extinction. Second, human extinction is by its nature an irreversible scenario. If we continue to exist, then we always have the option of letting ourselves go extinct in the future (or, perhaps more realistically, of considerably reducing population size). But if we go extinct, then we can’t magically bring ourselves back into existence at a later date. Third, we should expect ourselves to progress, morally, over the next few centuries, as we have progressed in the past. So we should expect that in a few centuries’ time we will have better evidence about how to evaluate human extinction than we currently have. Given these three factors, it would be better to prevent the near-term extinction of the human race, even if we thought that the extinction of the human race would actually be a very good thing. To make this concrete, I’ll give the following simple but illustrative model. Suppose that we have 0.8 credence that it is a bad thing to produce new people, and 0.2 certain that it’s a good thing to produce new people; and the degree to which it is good to produce new people, if it is good, is the same as the degree to which it is bad to produce new people, if it is bad. That is, I’m supposing, for simplicity, that we know that one new life has one unit of value; we just don’t know whether that unit is positive or negative. And let’s use our estimate of 2×10^14 people who would exist in the future, if we avoid near-term human extinction. Given our stipulated credences, the expected benefit of letting the human race go extinct now would be (.8-.2)×(2×10^14) = 1.2×(10^14). Suppose that, if we let the human race continue and did research for 300 years, we would know for certain whether or not additional people are of positive or negative value. If so, then with the credences above we should think it 80% likely that we will find out that it is a bad thing to produce new people, and 20% likely that we will find out that it’s a good thing to produce new people. So there’s an 80% chance of a loss of 3×(10^10) (because of the delay of letting the human race go extinct), the expected value of which is 2.4×(10^10). But there’s also a 20% chance of a gain of 2×(10^14), the expected value of which is 4×(10^13). That is, in expected value terms, the cost of waiting for a few hundred years is vanishingly small compared with the benefit of keeping one’s options open while one gains new information.

#### It's the only static category – even if life is bad now.

Tännsjö 11 (Torbjörn, the Kristian Claëson Professor of Practical Philosophy at Stockholm University, “Shalt Thou Sometimes Murder? On the Ethics of Killing,” <http://people.su.se/~jolso/HS-texter/shaltthou.pdf>) //BS 1-27-2018

\*\*Bracketed to avoid triggers

I suppose it is correct to say that, if Schopenhauer is right, if life is never worth living, then according to utilitarianism we should all [die] commit suicide and put an end to humanity. But this does not mean that, each of us should commit suicide. I commented on this in chapter two when I presented the idea that utilitarianism should be applied, not only to individual actions, but to collective actions as well.¶ It is a well-known fact that people rarely commit suicide. Some even claim that no one who is mentally sound commits suicide. Could that be taken as evidence for the claim that people live lives worth living? That would be rash. Many people are not utilitarians. They may avoid suicide because they believe that it is morally wrong to kill oneself. It is also a possibility that, even if people lead lives not worth living, they believe they do. And even if some may believe that their lives, up to now, have not been worth living, their future lives will be better. They may be mistaken about this. They may hold false expectations about the future.¶ From the point of view of evolutionary biology, it is natural to assume that people should rarely commit suicide. If we set old age to one side, it has poor survival value (of one’s genes) to kill oneself. So it should be expected that it is difficult for ordinary people to kill themselves. But then theories about cognitive dissonance, known from psychology, should warn us that we may come to believe that we live better lives than we do.¶ My strong belief is that most of us live lives worth living. However, I do believe that our lives are close to the point where they stop being worth living. But then it is at least not very far-fetched to think that they may be worth not living, after all. My assessment may be too optimistic.¶ Let us just for the sake of the argument assume that our lives are not worth living, and let us accept that, if this is so, we should all kill ourselves. As I noted above, this does not answer the question what we should do, each one of us. My conjecture is that we should not [die] commit suicide. The explanation is simple. If I [die] kill myself, many people will suffer. Here is a rough explanation of how this will happen: ¶ ... suicide “survivors” confront a complex array of feelings. Various forms of guilt are quite common, such as that arising from (a) the belief that one contributed to the suicidal person's anguish, or (b) the failure to recognize that anguish, or (c) the inability to prevent the suicidal act itself. Suicide also leads to rage, loneliness, and awareness of vulnerability in those left behind. Indeed, the sense that suicide is an essentially selfish act dominates many popular perceptions of suicide. ¶ The fact that all our lives lack meaning, if they do, does not mean that others will follow my example. They will go on with their lives and their false expectations — at least for a while devastated because of my suicide. But then I have an obligation, for their sake, to go on with my life. It is highly likely that, by committing suicide, I create more suffering (in their lives) than I avoid (in my life).

#### Existential risks are non-linear and irreversible – peer-reviewed science proves they’re probable – psychological and social biases skew impact calculus to threat deflation.

Pamlin and Armstrong 15 (Dennis, Executive Project Manager of Global Risks @ Global Challenges Foundation, and Stuart, James Martin Research Fellow @ Oxford, “Global Challenges: 12 Risks that threaten human civilization: The case for a new risk category,” <https://api.globalchallenges.org/static/wp-content/uploads/12-Risks-with-infinite-impact.pdf>) //BS 4-1-2018 [brackets for] ~~ableist language~~

2. Risks with infinite impact: A new category of risks “Most risk management is really just advanced contingency planning and disciplining yourself to realise that, given enough time, very low probability events not only can happen, but they absolutely will happen.” Lloyd Blankfein, Goldman Sachs CEO, July 2013 1 Risk = Probability × Impact Impacts where civilisation collapses to a state of great suffering and do not recover, or a situation where all human life end, are defined as infinite as the result is irreversible and lasts forever. A new group of global risks This is a report about a limited number of global risks – that can be identified through a scientific and transparent process – with impacts of a magnitude that pose a threat to human civilisation, or even possibly to all human life. With such a focus it may surprise some readers to find that the report’s essential aim is to inspire action and dialogue as well as an increased use of the methodologies used for risk assessment. The real focus is not on the almost unimaginable impacts of the risks the report outlines. Its fundamental purpose is to encourage global collaboration and to use this new category of risk as a driver for innovation. The idea that we face a number of global challenges threatening the very basis of our civilisation at the beginning of the 21st century is well accepted in the scientific community, and is studied at a number of leading universities.2 But there is still no coordinated approach to address this group of challenges and turn them into opportunities for a new generation of global cooperation and the creation of a global governance system capable of addressing the greatest challenges of our time. This report has, to the best of our knowledge, created the first science-based list of global risks with a potentially infinite impact and has made the first attempt to provide an initial overview of the uncertainties related to these risks as well as rough quantifications for the probabilities of these impacts. What is risk? Risk is the potential of losing something of value, weighed against the potential to gain something of value. Every day we make different kinds of risk assessments, in more or less rational ways, when we weigh different options against each other. The basic idea of risk is that an uncertainty exists regarding the outcome and that we must find a way to take the best possible decision based on our understanding of this uncertainty.3 To calculate risk the probability of an outcome is often multiplied by the impact. The impact is in most cases measured in economic terms, but it can also be measured in anything we want to avoid, such as suffering. At the heart of a risk assessment is a probability distribution, often described by a probability density function4; see figure X for a graphic illustration. The slightly tilted bell curve is a common probability distribution, but the shape differs and in reality is seldom as smooth as the example. The total area under the curve always represents 100 percent, i.e. all the possible outcomes fit under the curve. In this case (A) represents the most probable impact. With a much lower probability it will be a close to zero impact, illustrated by (B). In the same way as in case B there is also a low probability that the situation will be very significant, illustrated by (C). Figure 1: Probability density function The impacts (A), (B) and (C) all belong to the same category, normal [common] impacts: the impacts may be more or less serious, but they can be dealt with within the current system. The impacts in this report are however of a special kind. These are impacts where everything will be lost and the situation will not be reversible, i.e challenges with potentially infinite impact. In insurance and finance this kind of risk is called “risk of ruin”, an impact where all capital is lost.5 This impact is however only infinite for the company that is losing the money. From society’s perspective, that is not a special category of risk. In this report the focus is on the “risk of ruin” on a global scale and on a human level, in the worst case this is when we risk the extinction of our own species. On a probability curve the impacts in this report are usually at the very far right with a relatively low probability compared with other impacts, illustrated by (D) in Figure 2. Often they are so far out on the tail of the curve that they are not even included in studies. For each risk in this report the probability of an infinite impact is very low compared to the most likely outcome. Some studies even indicate that not all risks in this report can result in an infinite impact. But a significant number of peer-reviewed reports indicate that those impacts not only can happen, but that their probability is increasing due to unsustainable trends. The assumption for this report is that by creating a better understanding of our scientific knowledge regarding risks with a potentially infinite impact, we can inspire initiatives that can turn these risks into drivers for innovation. Not only could a better understanding of the unique magnitude of these risks help address the risks we face, it could also help to create a path towards more sustainable development. The group of global risks discussed in this report are so different from most of the challenges we face that they are hard to comprehend. But that is also why they can help us to build the collaboration we need and drive the development of further solutions that benefit both people and the planet. As noted above, none of the risks in this report is likely to result directly in an infinite impact, and some are probably even physically incapable of doing so. But all are so significant that they could reach a threshold impact able to create social and ecological instability that could trigger a process which could lead to an infinite impact. For several reasons the potentially infinite impacts of the risks in this report are not as well known as they should be. One reason is the way that extreme impacts are often masked by most of the theories and models used by governments and business today. For example, the probability of extreme impacts is often below what is included in studies and strategies. The tendency to exclude impacts below a probability of five percent is one reason for the relative “invisibility” of infinite impacts. The almost standard use of a 95% confidence interval is one reason why low-probability high-impact events are often ignored.6 Figure 2: Probability density function with tail highlighted Climate change is a good example, where almost all of the focus is on the most likely scenarios and there are few studies that include the low-probability high-impact scenarios. In most reports about climate impacts, the impacts caused by warming beyond five or six degrees Celsius are even omitted from tables and graphs even though the IPCC’s own research indicates that the probability of these impacts are often between one and five percent, and sometimes even higher.7 Other aspects that contribute to this relative invisibility include the fact that extreme impacts are difficult to translate into monetary terms, they have a global scope, and they often require a time-horizon of a century or more. They cannot be understood simply by linear extrapolation of current trends, and they lack historical precedents. There is also the fact that the measures required to significantly reduce the probability of infinite impacts will be radical compared to a business-as-usual scenario with a focus on incremental changes. The exact probability of a specific impact is difficult or impossible to estimate.8 However, the important thing is to establish the current magnitude of the probabilities and compare them with the probabilities for such impacts we cannot accept. A failure to provide any estimate for these risks often results in strategies and priorities defined as though the probability of a totally unacceptable outcome is zero. An approximate number for a best estimate also makes it easier to understand that a great uncertainty means the actual probability can be both much higher and much lower than the best estimate. It should also be stressed that uncertainty is not a weakness in science; it always exists in scientific work. It is a systematic way of understanding the limitations of the methodology, data, etc.9 Uncertainty is not a reason to wait to take action if the impacts are serious. Increased uncertainty is something that risk experts, e.g. insurance experts and security policy experts, interpret as a signal for action. A contrasting challenge is that our cultural references to the threat of infinite impacts have been dominated throughout history by religious groups seeking to scare society without any scientific backing, often as a way to discipline people and implement unpopular measures. It should not have to be said, but this report is obviously fundamentally different as it focuses on scientific evidence from peer-reviewed sources. Infinite impact The concept infinite impact refers to two aspects in particular; the terminology is not meant to imply a literally infinite impact (with all the mathematical subtleties that would imply) but to serve as a reminder that these risks are of a different nature. Ethical These are impacts that threaten the very survival of humanity and life on Earth – and therefore can be seen as being infinitely negative from an ethical perspective. No positive gain can outweigh even a small probability for an infinite negative impact. Such risks require society to ensure that we eliminate these risks by reducing the impact below an infinite impact as a top priority, or at least do everything we can to reduce the probability of these risks. As some of these risks are impossible to eliminate today it is also important to discuss what probability can right now be accepted for risks with a possible infinite impact. Economic Infinite impacts are beyond what most traditional economic models today are able to cope with. The impacts are irreversible in the most fundamental way, so tools like cost-benefit assessment seldom make sense. To use discounting that makes infinite impacts (which could take place 100 years or more from now and affect all future generations) close to invisible in economic assessments, is another example of a challenge with current tools. So while tools like cost-benefit models and discounting can help us in some areas, they are seldom applicable in the context of infinite impacts. New tools are needed to guide the global economy in an age of potential infinite impacts. See chapter 2.2.2 for a more detailed iscussion. Roulette and Russian roulette When probability and normal risks are discussed the example of a casino and roulette is often used. You bet something, then spin the wheel and with a certain probability you win or lose. You can use different odds to discuss different kinds of risk taking. These kinds of thought experiment can be very useful, but when it comes to infinite risks these gaming analogies become problematic. For infinite impact a more appropriate analogy is probably Russian roulette. But instead of “normal” Russian roulette where you only bet your own life you are now also betting everyone you know and everyone you don’t know. Everyone alive will die if you lose. There will be no second chance for anyone as there will be no future generations; humanity will end with your loss. What probability would you accept for different sums of money if you played this version of Russian roulette? Most people would say that it is stupid and – no matter how low the probability is and no matter how big the potential win is – this kind of game should not be played, as it is unethical. Many would also say that no person should be allowed to make such a judgment, as those who are affected do not have a say. You could add that most of those who will lose from it cannot say anything as they are not born and will never exist if you lose. The difference between ordinary roulette and “allhumanity Russian roulette” is one way of illustrating the difference in nature between a “normal” risk that is reversible, and a risk with an infinite impact. An additional challenge in acknowledging the risks outlined in this report is that many of the traditional risks including wars and violence have decreased, even though it might not always looks that way in media.10 So a significant number of experts today spend a substantial amount of time trying to explain that much of what is discussed as dangerous trends might not be as dangerous as we think. For policy makers listening only to experts in traditional risk areas it is therefore easy to get the impression that global risks are becoming less of a problem. The chain of events that could result in infinite impacts in this report also differ from most of the traditional risks, as most of them are not triggered by wilful acts, but accidents/mistakes. Even the probabilities related to nuclear war in this report are to a large degree related to inadvertent escalation. As many of the tools to analyse and address risks have been developed to protect nations and states from attacks, risks involving accidents tend to get less attention. This report emphasises the need for an open and democratic process in addressing global challenges with potentially infinite impact. Hence, this is a scientifically based invitation to discuss how we as a global community can address what could be considered the greatest challenges of our time. The difficulty for individual scientists to communicate a scientific risk approach should however not be underestimated. Scientists who today talk about low-probability impacts, that are serious but still far from infinite, are often accused of pessimism and scaremongering, even if they do nothing but highlight scientific findings.11 To highlight infinite impacts with even lower probability can therefore be something that a scientist who cares about his/her reputation would want to avoid. In the media it is still common to contrast the most probable climate impact with the probability that nothing, or almost nothing, will happen. The fact that almost nothing could happen is not wrong in most cases, but it is unscientific and dangerous if different levels of probability are presented as equal. The tendency to compare the most probable climate impact with the possibility of a low or no impact also results in a situation where low-probability high-impact outcomes are often totally ignored. An honest and scientific approach is to, whenever possible, present the whole probability distribution and pay special attention to unacceptable outcomes. The fact that we have challenges that with some probability might be infinite and therefore fundamentally irreversible is difficult to comprehend, and physiologically they are something our brains are poorly equipped to respond to, according to evolutionary psychologists.12 It is hard for us as individuals to grasp that humanity for the first time in its history now has the capacity to create such catastrophic outcomes. Professor Marianne Frankenhaeuser, former head of the psychology division, Karolinska Institute, Stockholm, put it this way: “Part of the answer is to be found in psychological defence mechanisms. The nuclear threat is collectively denied, because to face it would force us to face some aspects of the world’s situation which we do not want to recognise.” 13 This psychological denial may be one reason why there is a tendency among some stakeholders to confuse “being optimistic” with denying what science is telling us, and ignoring parts of the probability curve.14 Ignoring the fact that there is strong scientific evidence for serious impacts in different areas, and focusing only on selected sources which suggest that the problem may not be so serious, is not optimistic. It is both unscientific and dangerous.15 A scientific approach requires us to base our decisions on the whole probability distribution. Whether it is possible to address the challenge or not is the area where optimism and pessimism can make people look at the same set of data and come to different conclusions. Two things are important to keep in mind: first, that there is always a probability distribution when it comes to risk; second, that there are two different kinds of impacts that are of interest for this report. The probability distribution can have different shapes but in simplified cases the shape tends to look like a slightly modified clock (remember figure 1). In the media it can sound as though experts argue whether an impact, for example a climate impact or a pandemic, will be dangerous or not. But what serious experts discuss is the probability of different oucomes. They can disagree on the shape of the curve or what curves should be studied, but not that a probability curve exists. With climate change this includes discussions about how sensitive the climate is, how much greenhouse gas will be emitted, and what impacts that different warmings will result in. Just as it is important not to ignore challenges with potentially infinite impacts, it is also important not to use them to scare people. Dramatic images and strong language are best avoided whenever possible, as this group of risks require sophisticated strategies that benefit from rational arguments. Throughout history we have seen too many examples when threats of danger have been damagingly used to undermine important values. The history of infinite impacts: The LA-602 document The understanding of infinite impacts is very recent compared with most of our institutions and laws. It is only 70 years ago that Edward Teller, one of the greatest physicists of his time, with his back-of-the-envelope calculations, produced results that differed drastically from all that had gone before. His calculations indicated that the explosion of a nuclear bomb – a creation of some of the brightest minds on the planet, including Teller himself – could result in a chain reaction so powerful that it would ignite the world’s atmosphere, thereby ending human life on Earth.16 Robert Oppenheimer, who led the Manhattan Project to develop the nuclear bomb, halted the project to see whether Teller’s calculations were correct.17 The resulting document, LA- 602: Ignition of the Atmosphere with Nuclear Bombs, concluded that Teller was wrong, But the sheer complexity drove them to end their assessment by writing that “further work on the subject [is] highly desirable”.18 The LA-602 document can be seen as the first scientific global risk report addressing a category of risks where the worst possible impact in all practical senses is infinite.19 Since the atomic bomb more challenges have emerged with potentially infinite impact. Allmost all of these new challenges are linked to the increased knowledge, economic and technical development that has brought so many benefits. For example, climate change is the result of the industrial revolution and development that was, and still is, based heavily on fossil fuel. The increased potential for global pandemics is the result of an integrated global economy where goods and services move quickly around the world, combined with rapid urbanisation and high population density. In parallel with the increased number of risks with possible infinite impact, our capacity to analyse and solve them has greatly increased too. Science and technology today provides us with knowledge and tools that can radically reduce the risks that historically have been behind major extinctions, such as pandemics and asteroids. Recent challenges like climate change, and emerging challenges like synthetic biology and nanotechnology, can to a large degree be addressed by smart use of new technologies, new lifestyles and institutional structures. It will be hard as it will require collaboration of a kind that we have not seen before. It will also require us to create systems that can deal with the problems before they occur. The fact that the same knowledge and tools can be both a problem and a solution is important to understand in order to avoid polarisation. Within a few decades, or even sooner, many of the tools that can help us solve the global challenges of today will come from fields likely to provide us with the most powerful instruments we have ever had – resulting in their own sets of challenges. Synthetic biology, nanotechnology and artificial intelligence (AI) are all rapidly evolving fields with great potential. They may help solve many of today’s main challenges or, if not guided in a benign direction, may result in catastrophic outcomes. The point of departure of this report is the fact that we now have the knowledge, economic resources and technological ability to reduce most of the greatest risks of our time. Conversely, the infinite impacts we face are almost all unintended results of human ingenuity. The reason we are in this situation is that we have made progress in many areas without addressing unintended low-probability high-impact consequences. Creating innovative and resilient systems rather than simply managing risk would let us focus more on opportunities. But the resilience needed require moving away from legacy systems is likely to be disruptive, so an open and transparent discussion is needed regarding the transformative solutions required. Figure 3: Probability density function with tail and threshold highlighted [FIGURE 3 OMITTED] 2.1 Report structure The first part of the report is an introduction where the global risks with potential infinite impact are introduced and defined. This part also includes the methodology for selecting these risks, and presents the twelve risks that meet this definition. Four goals of the report are also presented, under the headings “acknowledge”, “inspire”, “connect” and “deliver”. The second part is an overview of the twelve global risks and key events that illustrate some of the work around the world to address them. For each challenge five important factors that influence the probability or impact are also listed. The risks are divided into four different categories depending on their characteristics. “Current challenges” is the first category and includes the risks that currently threaten humanity due to our economic and technological development - extreme climate change, for example, which depends on how much greenhouse gas we emit. “Exogenic challenges” includes risks where the basic probability of an event is beyond human control, but where the probability and magnitude of the impact can be influenced - asteroid impacts, for example, where the asteroids’ paths are beyond human control but an impact can be moderated by either changing the direction of the asteroid or preparing for an impact. “Emerging challenges” includes areas where technological development and scientific assessment indicate that they could both be a very important contribution to human welfare and help reduce the risks associated with current challenges, but could also result in new infinite impacts.20 AI, nanotechnology and synthetic biology are examples. “Global policy challenge” is a different kind of risk. It is a probable threat arising from future global governance as it resorts to destructive policies, possibly in response to the other challenges listed above. The third part of the report discusses the relationship between the different risks. Action to reduce one risk can increase another, unless their possible links are understood. Many solutions are also able to address multiple risks, so there are significant benefits from understanding how one relates to others. Investigating these correlations could be a start, but correlation is a linear measure and non-linear techniques may be more helpful for assessing the aggregate risk. The fourth part is an overview, the first ever to our knowledge, of the uncertainties and probabilities of global risks with potentially infinite impacts. The numbers are only rough estimates and are meant to be a first step in a dialogue where methodologies are developed and estimates refined. The fifth part presents some of the most important underlying trends that influence the global challenges, which often build up slowly until they reach a threshold and very rapid changes ensue. The sixth and final part presents an overview of possible ways forward. 2.2 Goals Goal 1: Acknowledge That key stakeholders, influencing global challenges, acknowledge the existence of the category of risks that could result in infinite impact. They should also recognice that the list of risks that belong to this category should be revised as new technologies are developed and our knowledge increases. Regardless of the risks included, the category should be given special attention in all processes and decisions of relevance. The report also seeks to demonstrate to all key stakeholders that we have the capacity to reduce, or even eliminate, most of the risks in this category. Establish a category of risks with potentially infinite impact. Before anything significant can happen regarding global risks with potentially infinite impacts, their existence must be acknowledged. Rapid technological development and economic growth have delivered unprecedented material welfare to billions of people in a veritable tide of utopias.21 But we now face the possibility that even tools created with the best of intentions can have a darker side too, a side that may threaten human civilisation, and conceivably the continuation of human life. This is what all decision-makers need to recognise. Rather than succumbing to terror, we need to acknowledge that we can let the prospect inspire and drive us forward. Goal 2: Inspire That policy makers inspire action by explaining how the probabilities and impacts can be reduced and turned into opportunities. Concrete examples of initiatives should be communicated in different networks in order to create ripple effects, with the long-term goal that all key stakeholders should be inspired to turn these risks into opportunities for positive action. Show concrete action that is taking place today. This report seeks to show that it is not only possible to contribute to reducing these risks, but that it is perhaps the most important thing anyone can spend their time on. It does so by combining information about the risks with information about individuals and groups who has made a significant contribution by turning challenges into opportunities. By highlighting concrete examples the report hopes to inspire a new generation of leaders. Goal 3: Connect That leaders in different sectors connect with each other to encourage collaboration. A specific focus on financial and security policy where significant risks combine to demand action beyond the incremental is required. Support new meetings between interested stakeholders. The nature of these risks spans countries and continents; they require action by governments and politicians, but also by companies, academics, NGOs, and many other groups. The magnitude of the possible impacts requires not only leaders to act but above all new models for global cooperation and decision-making to ensure delivery. The need for political leadership is therefore crucial. Even with those risks where many groups are involved, such as climate change and pandemics, very few today address the possibility of infinite impact aspects. Even fewer groups address the links between the different risks. There is also a need to connect different levels of work, so that local, regional, national and international efforts can support each other when it comes to risks with potentially infinite impacts. Goal 4: Deliver That concrete strategies are developed that allow key stakeholders to identify, quantify and address global challenges as well as gather support for concrete steps towards a wellfunctioning global governance system. This would include tools and initiatives that can help identify, quantify and reduce risks with potentially infinite impacts. Identify and implement strategies and initiatives. Reports can acknowledge, inspire and connect, but only people can deliver actual results. The main focus of the report is to show that actual initiatives need to be taken that deliver actual results. Only when the probability of an infinite impact becomes acceptably low, very close to zero, and/or when the maximum impact is significantly reduced, should we talk about real progress. In order to deliver results it is important to remember that global governance to tackle these risks is the way we organise society in order to address our greatest challenges. It is not a question of establishing a “world government”, it is about the way we organise ourselves on all levels, from the local to the global. The report is a first step and should be seen as an invitation to all responsible parties that can affect the probability and impact of risks with potentially infinite impacts. But its success will ultimately be measured only on how it contributes to concrete results. 2.3 Global challenges and infinite impact This chapter first introduces the concept of infinite impact. It then describes the methodology used to identify challenges with an infinite impact. It then presents risks with potentially infinite impact that the methodology results in. 2.3.1 Definition of infinite impact The specific criterion for including a risk in this report is that well-sourced science shows the challenge can have the following consequences: 22 1. Infinite impact: When civilisation collapses to a state of great suffering and does not recover, or a situation where all human life ends. The existence of such threats is well attested by science.23 2. Infinite impact threshold – an impact that can trigger a chain of events that could result first in a civilisation collapse, and then later result in an infinite impact. Such thresholds are especially important to recognise in a complex and interconnected society where resilience is decreasing.24 A collapse of civilisation is defined as a drastic decrease in human population size and political/economic/social complexity, globally for an extended time.25 The above definition means the list of challenges is not static. When new challenges emerge, or current ones fade away, the list will change. An additional criterion for including risks in this report is “human influence”. Only risks where humans can influence either the probability, the impact, or both, are included. For most risks both impact and probability can be affected, for example with nuclear war, where the number/size of weapons influences the impact and tensions between countries affects the probability. Other risks, such as a supervolcano, are included as it is possible to affect the impact through various mitigation methods, even if we currently cannot affect the probability. Risks that are susceptible to human influence are indirectly linked, because efforts to address one of them may increase or decrease the likelihood of another. 2.3.2 Why use “infinite impact” as a concept? The concept of infinity was chosen as it reflects many of the challenges, especially in economic theory, to addressing these risks as well as the need to question much of our current way of thinking. The concept of a category of risks based on their extreme impact is meant to provide a tool to distinguish one particular kind of risk from others. The benefit of this new concept should be assessed based on two things. First, does the category exist, and second, is the concept helpful in addressing these risks? The report has found ample evidence that there are risks with an impact that can end human civilisation and even all human life. The report further concludes that a new category of risk is not only meaningful but also timely. We live in a society where global risks with potentially infinite impacts increase in both number and probability according to multiple studies. Looking ahead, many emerging technologies which will certainly provide beneficial results, might also result in an increased probability of infinite impacts.26 Over the last few years a greater understanding of low probability or unknown probability events has helped more people to understand the importance of looking beyond the most probable scenarios. Concepts like “black swans” and “perfect storms” are now part of mainstream policy and business language.27 Greater understanding of the technology and science of complex systems has also resulted in a new understanding of potentially disruptive events. Humans now have such an impact on the planet that the term “the anthropocene” is being used, even by mainstream media like The Economist.28 The term was introduced in the 90s by the Nobel Prize winner Paul Crutzen to describe how humans are now the dominant force changing the Earth’s ecosystems.29 The idea to establish a well defined category of risks that focus on risks with a potentially infinite impact that can be used as a practical tool by policy makers is partly inspired by Nick Bostrom’s philosophical work and his introduction of a risk taxonomy that includes an academic category called “existential risks”.30 Introducing a category with risks that have a potentially infinite impact is not meant to be a mathematical definition; infinity is a thorny mathematical concept and nothing in reality can be infinite.31 It is meant to illustrate a singularity, when humanity is threatened, when many of the tools used to approach most challenges today become problematic, meaningless, or even counterproductive. The concept of an infinite impact highlights a unique situation where humanity itself is threatened and the very idea of value and price collapses from a human perspective, as the price of the last humans also can be seen to be infinite. This is not to say that those traditional tools cannot still be useful, but with infinite impacts we need to add an additional set of analytical tools. Life Value The following estimates have been applied to the value of life in the US. The estimates are either for one year of additional life or for the statistical value of a single life. – $50,000 per year of quality life (international standard most private and government-run health insurance plans worldwide use to determine whether to cover a new medical procedure) – $129,000 per year of quality life (based on analysis of kidney dialysis procedures by Stefanos Zenios and colleagues at Stanford Graduate School of Business) – $7.4 million (Environmental Protection Agency) – $7.9 million (Food and Drug Administration) – $6 million (Transportation Department) – $28 million (Richard Posner based on the willingness to pay for avoiding a plane crash) Source: Wikipedia: Value of life http://en.wikipedia.org/wiki/Value\_of\_life US EPA: Frequently Asked Questions on Mortality Risk Valuation http://yosemite.epa.gov/EE%5Cepa%5Ceed.nsf/webpages/MortalityRiskValuation.html Posner, Richard A. Catastrophe: risk and response. Oxford University Press, 2004 Some of the risks, including nuclear war, climate change and pandemics, are often included in current risk overviews, but in many cases their possible infinite impacts are excluded. The impacts which are included are in most cases still very serious, but only the more probable parts of the probability distributions are included, and the last part of the long tail – where the infinite impact is found – is excluded.32 Most risk reports do not differentiate between challenges with a limited impact and those with a potential for infinite impact. This is dangerous, as it can mean resources are spent in ways that increase the probability of an infinite impact. Ethical aspects of infinite impact The basic ethical aspect of infinite impact is this: a very small group alive today can take decisions that will fundamentally affect all future generations. “All future generations” is not a concept that is often discussed, and for good reason. All through human history we have had no tools with a measurable global impact for more than a few generations. Only in the last few decades has our potential impact reached a level where all future generations can be affected, for the simple reason that we now have the technological capacity to end human civilisation. If we count human history from the time when we began to practice settled agriculture, that gives us about 12,000 years.33 If we make a moderate assumption that humanity will live for at least 50 million more years34 our 12,000-year history so far represents 1/4200, or 0.024%, of our potential history. So our generation has the option of risking everything and annulling 99.976% of our potential history. Comparing 0.024% with the days of a person living to 100 years from the day of conception, this would equal less than nine days and is the first stage of human embryogenesis, the germinal stage.35 Two additional arguments to treat potentially infinite impacts as a separate category are: 36 1. An approach to infinite impacts cannot be one of trial-and-error, because there is no opportunity to learn from errors. The reactive approach – see what happens, limit damage, and learn from experience – is unworkable. Instead society must be proactive. This requires foresight to foresee new types of threat and willingness to take decisive preventative action and to bear the costs (moral and economic) of such actions. 2. We cannot necessarily rely on the institutions, morality, social attitudes or national security policies that developed from our experience of other sorts of risk. Infinite impacts are in a different category. Institutions and individuals may find it hard to take these risks seriously simply because they lie outside our experience. Our collective fear-response will probably be ill-calibrated to the magnitude of threat. Economic aspects of infinite impact and discounting In today’s society a monetary value is sometimes ascribed to human life. Some experts use this method to estimate risk by assigning a monetary value to human extinction.37 We have to remember that the monetary values placed on a human life in most cases are not meant to suggest that we have actually assigned a specific value to a life. Assigning a value to a human life is a tool used in a society with a limited supply of resources or infrastructure (ambulances, perhaps) or skills. In such a society it is impossible to save every life, so some trade-off must be made.38 The US Environmental Protection Agency explains its use like this: “The EPA does not place a dollar value on individual lives. Rather, when conducting a benefit-cost analysis of new environmental policies, the Agency uses estimates of how much people are willing to pay for small reductions in their risks of dying from adverse health conditions that may be caused by environmental pollution.” 39 The fact that monetary values for human lives can help to define priorities when it comes to smaller risks does not mean that they are suitable for quite different uses. Applying a monetary value to the whole human race makes little sense to most people, and from an economic perspective it makes no sense. Money helps us to prioritise, but with no humans there would be no economy and no need for priorities. Ignoring, or discounting, future generations is actually the only way to avoid astronomical numbers for impacts that may seriously affect every generation to come. In Catastrophe: Risk and Response, Richard Posner provides a cost estimate, based on the assumption that a human life is worth $50,000, resulting in a $300 tn cost for the whole of humanity, assuming a population of six billion. He then doubles the population number to include the value of all future generations, ending up with $600 tn, while acknowledging that “without discounting, the present value of the benefits of risk-avoidance measures would often approach infinity for the type of catastrophic risk with which this book is concerned.” 40 Discounting for risks that include the possibility of an infinite impact differs from risk discounting for less serious impacts. For example the Stern Review41 prompted a discussion between its chief author, Nicholas Stern, and William Nordhaus,42 each of whom argued for different discount levels using different arguments. But neither discussed a possible infinite climate impact. An overview of the discussion by David Evans of Oxford Brookes University highlighted some of the differing assumptions.43 Two things make infinite impacts special from a discounting perspective. First, there is no way that future generations can compensate for the impact, as they will not exist. Second, the impact is something that is beyond an individual preference, as society will no longer exist. Discounting is undertaken to allocate resources in the most productive way. In cases that do not include infinite impacts, discounting “reflects the fact that there are many high-yield investments that would improve the quality of life for future generations. The discount rate should be set so that our investable funds are devoted to the most productive uses.” 44 When there is a potentially infinite impact, the focus is no longer on what investments have the best rate of return, it is about avoiding the ultimate end. While many economists shy away from infinite impacts, those exploring the potentially extreme impacts of global challenges often assume infinite numbers to make their point. Nordhaus for example writes that “the sum of undiscounted anxieties would be infinite (i.e. equal to 1 + 1 +1 + … = ∞). In this situation, most of us would dissolve in a sea of anxiety about all the things that could go wrong for distant generations from asteroids, wars, out-of-control robots, fat tails, smart dust and other disasters.” 45 It is interesting that Nordhaus himself provides very good graphs that show why the most important factor when determining actions is a possible threshold (see below Figure 4 and 5). Nordhaus was discussing climate change, but the role of thresholds is similar for most infinite impacts. The first figure is based on traditional economic approaches which assume that Nature has no thresholds; the second graph illustrates what happens with the curve when a threshold exists. As Nordhaus also notes, it is hard to establish thresholds, but if they are significant all other assumptions become secondary. The challenge that Nordhaus does not address, and which is important especially with climate change, is that thresholds become invisible in economic calculations if they occur far into the future, even if it is current actions that unbalance the system and eventually push it over the threshold.

## 1NC – Satellites Bad

### 1NC – Mining

#### Loss of satellites will shut down terrestrial mining

Les Johnson 13, Deputy Manager for NASA's Advanced Concepts Office at the Marshall Space Flight Center, Co-Investigator for the JAXA T-Rex Space Tether Experiment and PI of NASA's ProSEDS Experiment, Master's Degree in Physics from Vanderbilt University, Popular Science Writer, and NASA Technologist, Frequent Contributor to the Journal of the British Interplanetary Society and Member of the American Institute of Aeronautics and Astronautics, National Space Society, the World Future Society, and MENSA, Sky Alert!: When Satellites Fail, p. 105

Resource Location

Looking for rare minerals to be mined for our many gadgets, household appliances, and industrial machines? Soil type is often a strong indicator of whether or not underground deposits of metals and minerals are located. By using satellite data to identify promising surface structural features and different soil types, mining companies can better identify promising mining locations, wasting less time and effort in finding the best places to obtain much-needed industrial resources. Without satellite images, the finding and assessment of promising new mines would grind to a halt as the industries retooled back into the days of much slower and labor-intensive field surveys (but without GPS!).

#### Antarctic mining causes nuclear war.

David W. Floren 1, J.D. from the University of Oregon, “Antarctic Mining Regimes: An Appreciation of the Attainable”, Journal of Environmental Law and Litigation, Fall, Volume 16, Number 2, 467-513

Concern for the quality of the environment provides a great reason for a mining moratorium, but additional justifications exist. Critics of CRAMRA worry about Antarctica becoming a "scene [or] object of international discord." n221 Largely ignored in the ATS debate is the real danger an introduction of mining and fossil fuel facilities and infrastructure would pose to the integrity of the peacekeeping goals of the ATS. n222 Such facilities and their transportation mechanisms (pipelines, tankers, etc.) will be important targets for destruction or seizure during any armed conflict involving any nation reliant on Antarctic mineral and fossil fuel resources. Article I bans, "inter alia, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapons." n223 Although mining qua mining is clearly not military in nature, the simple existence of mining facilities necessarily entails certain consequences. The history of armed conflict shows the increasingly vital role played by mineral and energy resource facilities in sustaining wartime economies. n224 Such facilities have always been selected as priority targets in military planning and strategy sessions, and the absence of major civilian targets in Antarctica further emphasizes the focus on mining facilityes. Target status is inseparable from the existence of productive mining and fossil fuel facilities, n225 and target priority grows with [\*504] distance from large human population centers. n226 Compounding this problem is the possibility that nuclear weapons might be used. The remoteness and inaccessibility of targets in the AT Area, n227 combined with the tiny number of anticipated human casualties boosts the likelihood that tactical nuclear weaponry would be engaged to achieve top military priorities, despite AT obligations n228 and other international accords discouraging their use. n229

### 1NC – Drones

#### Loss of satellites shuts down drones

Daniel Ventre 11, Engineer for CNRS and Researcher for CESDIP, Cyberwar and Information Warfare, p. 198-199

The introduction of cyberspace operations is part of a specific context; a major evolution in the operation environment and the nature of the conflicts, which make irregular wars the rule, and make regular actors the exception to the rule. But the battle against unconventional, non-state governed, irregular actors raises specific problems: there are multiple actors, unpredictable at that, who do not abide by the same rules. New orders in conflicts are imposing the implementation of an ever more important need for information, and information collection and processing. Networks now have an incredible importance. The document refers to the growing threats against American heritage: the USA is a target and the increasing amount of attacks against their networks is indeed the proof of this. There are many obstacles which need to be removed before they can achieve real superiority and freedom to act, especially as vulnerable points may originate within the very operations of the armed forces. An example of this is the vulnerability of using products (software and hardware), commercial products (off-the-shelf), and sometimes even foreign products123. This brings to mind the fact that the US Air Force uses commercial, even foreign, applications for its cyberspace operations.

Information space extends to space124, particularly via communication and observation satellites125. Satellites are the keystone to the cyberspace and communication systems, but also the security system: monitoring (Echelon network is the symbol), observation, communication. These are at the heart of the C4ISR systems, without which a concept such as network-centric warfare could not exist. There would be no drones without satellites. It is even a question of extending the Internet to extra-atmospheric space. Projects in this vein (Interplanetary Networks) were being formed in the 1990s, but ran into several technical difficulties (delays in important transmissions due to high distances and costs) [GEL 06]. NASA dedicates a few pages on its website to this project126. The development of communication systems based on the infrastructures in extra-atmospheric space will also raise questions for legal, geopolitical and geostrategic domains: questions of seizing this space, questions of regulation of human activity in this space, of sovereignty, new territoriality and independence.

#### Drones escalate every hotspot.

Zenko and Kreps 14 Micah - Douglas Dillon fellow in the Center for Preventive Action at the Council on Foreign Relations, PhD in political science from Brandeis University; \*Sarah - Stanton nuclear security fellow at the Council on Foreign Relations, assistant professor in the department of government and an adjunct professor at Cornell Law School, BA from Harvard University, MSc from Oxford University, and PhD from Georgetown University; “Limiting Armed Drone Proliferation," Council on Foreign Relations, June 2014, http://aspheramedia.com/wp-content/uploads/2014/12/Limiting\_Armed\_Drone\_Proliferation\_CSR69.pdf

The inherent advantages of drones will not alone make traditional interstate warfare more likely—such conflicts are relatively rare anyway, with only one active interstate conflict in both 2012 and 2013.20 Nor will the probable type, quantity, range, and lethality of armed drones that states possess in coming decades make a government more likely to attempt to defeat an opposing army, capture or control foreign territory, or remove a foreign leader from power. However, misperceptions over the use of armed drones increase the likelihood of militarized disputes with U.S. allies, as well as U.S. military forces, which could lead to an escalating crisis and deeper U.S. involvement. Though surveillance drones can be used to provide greater stability between countries by monitoring ceasefires or disputed borders, armed drones will have destabilizing consequences. Arming a drone, whether by design or by simply putting a crude payload on an unarmed drone, makes it a weapon, and thereby a direct national security threat for any state whose border it breaches. Increased Frequency of Interstate and Intrastate Force For the United States, drones have significantly reduced the political, diplomatic, and military risks and costs associated with the use of military force, which has led to a vast expansion of lethal operations that would not have been attempted with other weapons platforms. Aside from airstrikes in traditional conflicts such as Libya, Iraq, and Afghanistan—where one-quarter of all International Security Assistance Force (ISAF) airstrikes in 2012 were conducted by drones—the United States has conducted hundreds in non-battlefield settings: Pakistan (approximately 369), Yemen (approximately 87), Somalia (an estimated 16), and the Philippines (at least 1, in 2006).21 Of the estimated 473 non-battlefield targeted killings undertaken by the United States since November 2002, approximately 98 percent were carried out by drones. Moreover, despite maintaining a “strong preference” for capturing over killing suspected terrorists since September 2011, there have been only 3 known capture attempts, compared with 194 drone strikes that have killed an estimated 1,014 people, 86 of whom were civilians.22 Senior U.S. civilian and military officials, whose careers span the pre– and post–armed drone era, overwhelmingly agree that the threshold for the authorization of force by civilian officials has been significantly reduced. Former secretary of defense Robert Gates asserted in October 2013, for example, that armed drones allow decision-makers to see war as a “bloodless, painless, and odorless” affair, with technology detaching leaders from the “inevitably tragic, inefficient, and uncertain” consequences of war.23 President Barack Obama admitted in May 2013 that the United States has come to see armed drones “as a cure-all for terrorism,” because they are low risk and instrumental in “shielding the government” from criticisms “that a troop deployment invites.”24 Such admissions from leaders of a democratic country with a system of checks and balances point to the temptations that leaders with fewer institutional checks will face. President Obama and his senior aides have stated that the United States is setting precedents with drones that other states may emulate.25 If U.S. experience and Obama’s cautionary words are any guide, states that acquire armed drones will be more willing to threaten or use force in ways they might not otherwise, within both interstate and intrastate contexts. States might undertake cross-border, interstate actions less discriminately, especially in areas prone to tension. As is apparent in the East and South China Seas, nationalist sentiments and the discovery of untapped, valuable national resources can make disputes between countries more likely. In such contested areas, drones will enable governments to undertake strike missions or probe the responses of an adversary—actions they would be less inclined to take with manned platforms. According to the Central Intelligence Agency (CIA), there are approximately 430 bilateral maritime boundaries, most of which are not defined by formal agreements between the affected states.26 Beyond the cases of East Asia, other cross-border flashpoints for conflict where the low-risk proposition of drone strikes would be tempting include Russia in Georgia or Ukraine, Turkey in Syria, Sudan within its borders, and China on its western periphery. In 2013, a Chinese counternarcotics official revealed that his bureau had considered attempting to kill a drug kingpin named Naw Kham, who was hiding in a remote region in northeastern Myanmar, by using a drone carrying twenty kilograms of dynamite. “The plan was rejected, because the order was to catch him alive,” the official recalled.27 With armed drones, China might make the same calculation that the United States has made—that killing is more straightforward than capturing—in choosing to target ostensibly high-threat individuals with drone strikes. China’s demonstrated willingness to employ armed drones against terrorists or criminals outside its borders could directly threaten U.S. allies in the region, particularly if the criterion China uses to define a terrorist does not align with that of the United States or its allies. Domestically, governments may use armed drones to target their perceived internal enemies. Most emerging drone powers have experienced recent domestic unrest. Turkey, Russia, Pakistan, and China all have separatist or significant opposition movements (e.g., Kurds, Chechens, the Taliban, Tibetans, and Uighurs) that presented political and military challenges to their rule in recent history. These states already designate individuals from these groups as “terrorists,” and reserve the right to use force against them. States possessing the lower risk—compared with other weapons platforms—capability of armed drones could use them more frequently in the service of domestic pacification, especially against time-sensitive targets that reside in mountainous, jungle, or other inhospitable terrain. Compared with typical methods used by military and police forces to counter insurgencies, criminals, or terrorists—such as ground troops and manned aircraft— unmanned drones provide significantly greater real-time intelligence through their persistent loiter time and responsiveness to striking an identified target. Increased Risk of Misperception and Escalation Pushing limits in already unstable regions is complicated by questions raised regarding rules of engagement: how would states respond to an armed drone in what they contend is their sovereign airspace, and how would opposing sides respond to counter-drone tactics? Japanese defense officials claim that shooting down Chinese drones in what Japan contends is its airspace is more likely to occur than downing manned aircraft because drones are not as responsive to radio or pilot warnings, thereby raising the possibility of an escalatory response.28 Alternatively, Japan might misidentify a Chinese manned fighter as an advanced drone and fire on it, especially if the aircraft’s radar signature is not sufficiently distinctive or if combat drones routinely fly over the disputed area. Thus, the additional risks associated with drone strikes, combined with the lack of clarity on how two countries would react to an attempted downing of a drone, create the potential for miscalculation and subsequent escalation. As U.S. Air Force commanders in South Korea noted, a North Korean drone equipped with chemical agents would not have to kill many or even any people on the peninsula to terrorize the population and escalate tensions.29 This scenario points to the spiraling escalatory dynamic that could be repeated—likely intensified in the context of armed drones—in other tension-prone areas, such as the Middle East, South Asia, and Central and East Africa, where the mix of low-risk and ambiguous rules of engagement is a recipe for escalation. Not all of these contingencies directly affect U.S. interests, but they would affect treaty allies whose security the United States has an interest in maintaining. Compared with other weapons platforms, current practice repeatedly demonstrates that drones make militarized disputes more likely due to a decreased threshold for the use of force and an increased risk of miscalculation. Increased Risk of Lethality The proliferation of armed drones will increase the likelihood of destabilizing or devastating one-off, high-consequence attacks. In March 2013, Senator Dianne Feinstein (D-CA) observed of drones: “In some respects it’s a perfect assassination weapon. . . . Now we have a problem. There are all these nations that want to buy these armed drones. I’m strongly opposed to that.”30 The worst-case contingency for the use of armed drones, albeit an unlikely circumstance, would be to deliver weapons of mass destruction. Drones are, in many ways, the perfect vehicle for delivering biological and chemical agents.31 A WMD attack, or even the assassination of a political leader, another troubling though unlikely circumstance, would have tremendous consequences for regional and international stability. Deterring such drone-based attacks will depend on the ability of the United States and other governments to accurately detect and attribute them. Technical experts and intelligence analysts disagree about the extent to which this will be possible, but the difficulties lie in the challenges of detecting drones (they emit small radar, thermal, and electron signatures, and can fly low), determining who controlled it (they can be programmed to fly to a preset GPS coordinate), or assigning ownership to a downed system (they can be composed of commercial, off-the-shelf components).32 It is equally noteworthy that civilian officials or military commanders have almost always used armed drones in ways beyond their initially intended applications. Drones do not simply fulfill existing mission requirements; they create new and unforeseen ones, and will continue to do so in the future. Furthermore, U.S. officials would be misguided to view future uses of armed drones solely through the prism of how the United States has used them—for discrete military operations in relatively benign air-defense environments. The potential for misperception is compounded by the fact that few governments seeking or acquiring armed drones have publicly articulated any strategy for how they will likely use them. Conversely, the uncertainty about how other countries will use drones provides the United States with an opportunity to shape drone doctrines, especially for U.S. allies interested in procuring drones from U.S. manufacturers.

### 1NC – 5G

#### 5G is coming online globally via satellites---extinction.

Dr. Lauraine Margaret Helen Vivian 18, Faculty of Health and Medical Sciences at the University of Copenhagen, PhD in Anthropology & Psychiatry. Girish Kumar, PhD, Professor, Electrical Engineering Department, Indian Institute of Technology Bombay. Don Maisch, PhD, Independent researcher, author of “The Procrustean Approach”, Lindisfarne, Australia. Alfonso Balmori, BSc, Master in Environmental Education, Biologist. Klaus Buchner, Dr. Rer. Nat., Professor, MEP – Member of the European Parliament. Daniel Favre, Dr. Phil. Nat., Biologist, Association Romande Alerte aux Ondes Electromagnétique. Annie Sasco – MD, DrPH, SM, HDR, Former Chief of Research Unit of Epidemiology for Cancer Prevention at the International Agency for Research on Cancer (IARC), Lyon; Former Acting Chief, Programme for Cancer Control of the World Health Organization (WHO); former Director of Research at the Institut National de la Santé et de la Recherche Médicale (INSERM). Martin Pall – Professor Emeritus of Biochemistry and Basic Medical Sciences, Washington State University. Kate B. Showers, PhD, Soil Science, Senior Research Fellow, Centre for World Environmental History, University of Sussex, Falmer, Brighton, UK, Carlos Sosa, MD, University of Antioquia, “International Appeal: Stop 5G on Earth and in Space”, 9/17/2018, https://www.5gspaceappeal.org/the-appeal

Executive summary

Telecommunications companies worldwide, with the support of governments, are poised within the next two years to roll out the fifth-generation wireless network (5G). This is set to deliver what is acknowledged to be unprecedented societal change on a global scale. We will have “smart” homes, “smart” businesses, “smart” highways, “smart” cities and self-driving cars. Virtually everything we own and buy, from refrigerators and washing machines to milk cartons, hairbrushes and infants’ diapers, will contain antennas and microchips and will be connected wirelessly to the Internet. Every person on Earth will have instant access to super-high-speed, low- latency wireless communications from any point on the planet, even in rainforests, mid-ocean and the Antarctic.

What is not widely acknowledged is that this will also result in unprecedented environmental change on a global scale. The planned density of radio frequency transmitters is impossible to envisage. In addition to millions of new 5G base stations on Earth and 20,000 new satellites in space, 200 billion transmitting objects, according to estimates, will be part of the Internet of Things by 2020, and one trillion objects a few years later. Commercial 5G at lower frequencies and slower speeds was deployed in Qatar, Finland and Estonia in mid-2018. The rollout of 5G at extremely high (millimetre wave) frequencies is planned to begin at the end of 2018.

Despite widespread denial, the evidence that radio frequency (RF) radiation is harmful to life is already overwhelming. The accumulated clinical evidence of sick and injured human beings, experimental evidence of damage to DNA, cells and organ systems in a wide variety of plants and animals, and epidemiological evidence that the major diseases of modern civilization—cancer, heart disease and diabetes—are in large part caused by electromagnetic pollution, forms a literature base of well over 10,000 peer-reviewed studies.

If the telecommunications industry’s plans for 5G come to fruition, no person, no animal, no bird, no insect and no plant on Earth will be able to avoid exposure, 24 hours a day, 365 days a year, to levels of RF radiation that are tens to hundreds of times greater than what exists today, without any possibility of escape anywhere on the planet. These 5G plans threaten to provoke serious, irreversible effects on humans and permanent damage to all of the Earth’s ecosystems.

### 1NC – Agriculture

#### Satellites are crucial for large, industrial megafarms

Les Johnson 13, Deputy Manager for NASA's Advanced Concepts Office at the Marshall Space Flight Center, Co-Investigator for the JAXA T-Rex Space Tether Experiment and PI of NASA's ProSEDS Experiment, Master's Degree in Physics from Vanderbilt University, Popular Science Writer, and NASA Technologist, Frequent Contributor to the Journal of the British Interplanetary Sodety and Member of the American Institute of Aeronautics and Astronautics, National Space Society, the World Future Society, and MENSA, Sky Alert!: When Satellites Fail, p. 106

Agriculture

To feed the Earth's growing population affordably, farming has gone from a mostly decentralized, family-owned business to corporate farming on a scale never before imagined. These industrial megafarms are a primary reason that many people in the world can enjoy plentiful and varied foods at a reasonable cost. On this scale, deciding what crop to plant in a given field is not just business - it's science. And the science relies, in large part, on data from space.

Companies such as the Satellite Imaging Corporation (SIC) provide data from space on overall crop health, soil analysis, and irrigation impacts and efficiencies. From space, you can easily map soil variations, finding areas rich in organic matter and others less so - this allows optimized planting to take advantage of crops that thrive in any given soil environment. Very large farms also use satellite images to assess the overall health of their crops by land area, spotting those that are being impacted by non-optimal soil moisture content, etc., allowing the farmer to take corrective action while there is still time to save the crop.

#### Extinction.

Alice Friedemann 17, Systems Architect and Engineer For Over 25 Years, Science, Energy, and Agriculture Writer, Investigative Journalist and Energy Expert, Founder of Energy Skeptic, Author of When Trucks Stop Running: Energy and the Future of Transportation, “Chemical Industrial Agriculture is Unsustainable. Here’s Why”, Resilience, 5-27, http://www.resilience.org/stories/2017-03-27/chemical-industrial-farming-unsustainable-heres/

We hear a lot about how we’re running out of antibiotics. But we are also doomed to run out of pesticides, because insects inevitably develop resistance, whether toxic chemicals are sprayed directly or genetically engineered into the plants. Worse yet, weeds, insects, and fungus develop resistance in just 5 years on average, which has caused the chemicals to grow increasingly lethal over the past 60 years. And it takes on average eight to ten years to identify, test, and develop a new pesticide, though that isn’t long enough to discover the long-term toxicity to humans and other organisms. And this devil’s bargain hasn’t even provided most of the gains in crop yields, which is due to natural-gas and phosphate fertilizers plus soil-crushing tractors and harvesters that can do the work of millions of men and horses quickly on farms that grow only one crop on thousands of acres. Yet before pesticides, farmers lost a third of their crops to pests, after pesticides, farmers still lose a third of their crops. Even without pesticides, industrial agriculture is doomed to fail from extremely high rates of soil erosion and soil compaction at rates that far exceed losses in the past, since soil couldn’t wash or blow away as easily on small farms that grew many crops. But pest killing chemicals are surely accelerating the day of reckoning sooner rather than later. Enormous amounts of toxic chemicals are dumped on land every year — over 1 billion pounds are used in the United State (US) every year and 5.6 billion pounds globally (Alavanja 2009). This destroys the very ecosystems that used to help plants fight off pests, and is a major factor biodiversity loss and extinction. Evidence also points to pesticides playing a key role in the loss of bees and their pollination services. Although paleo-diet fanatics won’t mind eating mostly meat when fruit, vegetable, and nut crops are gone, they will not be so happy about having to eat more carbohydrates. Wheat and other grains will still be around, since they are wind-pollinated. Agricultural chemicals render land lifeless and toxic to beneficial creatures, also killing the food chain above — fish, amphibians, birds, and humans (from cancer, chronic disease, and suicide). Surely a day is coming when pesticides stop working, resulting in massive famines. But who is there to speak for the grandchildren? And those that do speak for them are mowed down by the logic of libertarian capitalism, which only cares about profits today. Given that a political party is now in power in the U.S. that wants to get rid of the protections the Environmental Protection Agency (EPA) and other agencies provide, may make matters worse if agricultural chemicals are allowed to be more toxic, long-lasting, and released earlier, before being fully tested for health effects. Meanwhile chemical and genetic engineering companies are making a fortune, because the farmers have to pay full price, since the pests develop resistance long before a product is old enough to be made generically. Except for glyphosate, but weeds have developed resistance. Predictably. In fact, the inevitability of resistance has been known for nearly seven decades. In 1951, as the world began using synthetic chemicals, Dr. Reginald Painter at Kansas State University published “Insect Resistance in Crop Plants”. He made a case that it would be better to understand how a crop plant fought off insects, since it was inevitable that insects would develop genetic or behavioral resistance. At best, chemicals might be used as an emergency control measure. Farmers will say that we simply must carry on like this, there’s no other choice. But that’s simply not true. Consider the corn rootworm, that costs farmers about $2 billion a year in lost crops despite spending hundreds of millions on chemicals and the hundreds of millions of dollars chemical companies spend developing new chemicals. To lower the chances of corn pests developing resistance, corn crops were rotated with soybeans. Predictably, a few mutated to eat soybeans plus changed their behavior. They used to only lay eggs on nearby corn plants, now they disperse to lay eggs on soybean crops as well. Worse yet, corn is more profitable than soy and many farmers began growing continuous corn. Already the corn rootworm is developing resistance to the latest and greatest chemicals. But the corn rootworm is not causing devastation in Europe, because farms are smaller and most farmers rotate not just soy, but wheat, alfalfa, sorghum and oats with corn (Nordhaus 2017). Before planting, farmers try to get rid of pests that survived the winter and apply fumigants to kill fungi and nematodes, and pre-emergent chemicals to reduce weed seeds from emerging. Even farmers practicing no-till farming douse the land with herbicides by using GMO herbicide-resistant crops. Then over the course of crop growth, farmers may apply several rounds of additional pesticides to control different pests. For example, cotton growers apply chemicals from 12 to 30 times before harvest. Currently, the potential harm is only assessed for 2 to 3 years before a permit is issued, even though the damage might occur up to 20 years later. Although these chemicals appear to be just like antibiotics, that isn’t entirely true. We develop some immunity to a disease after antibiotics help us recover, but a plant is still vulnerable to the pests and weeds with the genetics or behavior to survive and chemical assault. Although there are thousands of chemical toxins, what matters is how they kill, their method of action (MOA). For herbicides there are only 29 MOAs, for insecticides, just 28. So if a pest develops resistance to one chemical within an MOA, it will be resistant to all of the thousands of chemicals within that MOA. The demand for chemicals has also grown due the high level of bioinvasive species. It takes a while to find native pests and make sure they won’t do more harm than good. In the 1950s there were just three main corn pests. By 1978 there were 40, and they vary regionally. For example, California has 30 arthropods and over 14 fungal diseases to cope with. When I was learning how to grow food organically back in the 90s, I remember how outraged organic farmers were that Monsanto was going to genetically engineer plants to have the Bt bacteria in them. This is because the only insecticide organic farmers can use is Bt bacteria, because it is found in the soil. It’s natural. Organic farmers have been careful to spray only in emergencies so that insects didn’t develop resistance to their only remedy. Since 1996, GMO plants have been engineered to have Bt in them, and predictably, insects have developed resistance. For example, in 2015, 81% of all corn was planted with genetically engineered Bt. But corn earworms have developed resistance, especially in North Carolina and Georgia, setting the stage for damage across the nation. Five other insects have developed resistance to Bt as well. GMO plants were also going to reduce pesticide use. They did for a while, but not for long. Chemical use has increased 7% to 202,000 tons a year in the past 10 years. Resistance can come in other ways than mutations. Behavior can change. Cockroach bait is laced with glucose, so cockroaches that developed glucose-aversion now no longer take the bait. It is worth repeating that chemicals and other practices are ruining the long-term viability of agriculture. Here is how author Dyer explains it: “Ultimately the practice of modern farming is not sustainable” because “the damage to the soil and natural ecosystems is so great that farming becomes dependent not on the land but on the artificial inputs into the process, such as fertilizers and pesticides. In many ways, our battle against the diverse array of pest species is a battle against the health of the system itself. As we kill pest species, we also kill related species that may be beneficial. We kill predators that could assist our efforts. We reduce the ecosystem’s ability to recover due to reduced diversity, and we interfere with the organisms that affect the biogeochemical processes that maintain the soils in which the plants grow. Soil is a complex, multifaceted living thing that is far more than the sum of the sand, silt, clay, fungi, microbes, nematodes, and other invertebrates. All biotic components interact as an ecosystem within the soil and at the surface, and in relation to the larger components such as herbivores that move across the land. Organisms grow and dig through the soil, aerate it, reorganize it, and add and subtract organic material. Mature soil is structured and layered and, very importantly, it remains in place. Plowing of the soil turns everything upside down. What was hidden from light is exposed. What was kept at a constant temperature is now varying with the day and night and seasons. What cannot tolerate drying conditions at the surface is likely killed. And very sensitive and delicate structures within the soil are disrupted and destroyed. Conventional tillage disrupts the entire soil ecosystem. Tractors and farm equipment are large and heavy; they compact the soil, which removes air space and water-holding capacity. Wind and water erosion remove the smallest soil particles, which typically hold most of the micronutrients needed by plants. Synthetic fertilizers are added to supplement the loss of oil nutrients but often are relatively toxic to many soil organisms. And chemicals such as pre-emergents, fumigants, herbicides, insecticides, acaricides, fungicides, and defoliants eventually kill all but the most tolerant or resistant soil organisms. It does not take long to reduce a native, living, dynamic soil to a relatively lifeless collection of inorganic particles with little of the natural structure and function of undisturbed soil”. When I told my husband all the reasons we use agricultural chemicals and the harm done, my husband got angry and said “Farmers aren’t stupid, that can’t be right!” I think there are a number of reasons why farmers don’t go back to sustainable organic farming. First, there is far too much money to be made in the chemical herbicide, pesticide, and insecticide industry to stop this juggernaut. After reading Lessig’s book “Republic, Lost”, one of the best, if not the best book on campaign finance reform, I despair of campaign financing ever happening. So chemical lobbyists will continue to donate enough money to politicians to maintain the status quo. Plus the chemical industry has infiltrated regulatory agencies via the revolving door for decades and is now in a position to assassinate the EPA, with newly appointed Scott Pruitt, who would like to get rid of the EPA. Second, about half of farmers are hired guns. They don’t own the land and care about passing it on in good health to their children. They rent the land, and their goal, and the owner’s goal is for them to make as much profit as possible. Third, renters and farmers both would lose money, maybe go out of business in the years it would take to convert an industrial monoculture farm to multiple crops rotated, or an organic farm. Fourth, it takes time to learn to farm organically properly. So even if the farmer survives financially, mistakes will be made. Hopefully made up for by the higher price of organic food, but as wealth grows increasingly more unevenly distributed, and the risk of another economic crash grows (not to mention lack of reforms, being in more debt now than 2008, etc). Fifth, industrial farming is what is taught at most universities. There are only a handful of universities that offer programs in organic agriculture. Sixth, subsidies favor large farmers, who are also the only farmers who have the money to profit from economies of scale, and buy their own giant tractors to farm a thousand acres of monoculture crops. Industrial farming has driven 5 million farmers off the land who couldn’t compete with the profits made by larger farms in the area. But farmers will have to go organic whether they like it or not It’s hard to say whether this will happen because we’ve run out of pesticides, whether from resistance or a financial crash reducing new chemical research, or whether peak oil, peak coal, and peak natural gas will cause the decline of chemical farming. Agriculture uses about 15 to 20% of fossil fuel energy, from natural gas fertilizer, oil-based chemicals, farm vehicle and equipment fuel, the agricultural cold chain, distribution, packaging, refrigeration, and cooking to name a few of the uses. At some point of fossil decline, there won’t be enough fuel or pesticides to continue business as usual. Farmers will be forced to go organic at some point. Wouldn’t it be easier to start the transition now?

### 1NC – Latin America

#### Satellite data ratchets up drug eradication efforts

Kieron Monks 14, Writer for CNN, The Guardian, and Prospect Magazine, BA from the University of Nottingham, “Spy Satellites Fighting Crime From Space”, CNN, 8/12/2014, https://www.cnn.com/2014/08/11/tech/innovation/spy-satellites-fighting-crime-from-space/index.html

The Alayed case is one of several pilot schemes the company is running with police forces and security agencies. A key focus is on organized crime, trafficking and smuggling. The satellites have been put to work on the illegal fishing industry, worth up to $23 billion a year, tracking ships to witness crimes in real time.

"We can identify a specific ship and monitor its behaviour from port to port. We can see if it meets another vessel in a strange way and offloads cargo, or fishes in water it's not allowed to," says Hilton.

In addition to improved resolution, SA Catapult is benefiting from a steady increase in the number of Earth observation satellites, with launches set to double over the next decade, making more data available as well as bringing down the cost. This progress is also enabling the growth of rivals such as U.S. firm Digital Globe, while the Asian market is also expanding.

Some experts believe space surveillance could become industry standard. "The technologies that Catapult is developing will have broad application not only for national and international police organizations but also for anyone working in international security," said Patricia Lewis, research director of International Security at think tank Chatham House. Drug trafficking and arms reduction treaties are among the priority applications, says Lewis.

Read this: Robot furniture builds itself

It will soon be cost effective for police forces to buy their own satellites, predicts Ray Purdy, expert on satellites and the law at University College London. Purdy has been able to monitor criminal activity -- such as large-scale illegal waste disposal -- through satellite surveillance, which would have allowed police to cheaply and easily strengthen existing cases.

"I've gone back and looked at crimes after a prosecution and in some cases you can see illegal activity a year before, which could have allowed a greater conviction," he said. "In other cases we found people resumed criminal activity immediately after they were prosecuted."

#### That backfires, destabilizing Latin America

Barney Lerten 19, Reporter for KTVZ News, “Computer Model: Big Cocaine Busts Backfire Big-Time”, KTVZ News 21, 4/3/2019, https://www.ktvz.com/news/osu-computer-model-big-cocaine-busts-backfire-big-time/1065357402

Efforts to curtail the flow of cocaine into the United States from South America have made drug trafficking operations more widespread and harder to eradicate, according to new research published this week in Proceedings of the National Academy of Sciences.

The National Science Foundation supported the study, which included an Oregon State University geographer and was led by Nicholas Magliocca from University of Alabama. The collaboration also included researchers from The Ohio State University, Northern Arizona University, Arizona State University, Texas State University-San Marcos, the University of Wyoming and the U.S. Fish and Wildlife Service.

“It really is surprising how the model matches our observations,” said David Wrathall of OSU’s College of Earth, Ocean and Atmospheric Sciences. “Our team consists of researchers who worked in different parts of Central America during the 2000s and witnessed a massive surge of drugs into the region that coincided with a reinvigoration of the war on drugs. We asked ourselves: did drug interdiction push drug traffickers into these places?”

The findings are important because after five decades, the United States’ war on drugs has yet to prove itself effective or cost-efficient for dealing with cocaine trafficking, the researchers note. The study comes at a time of increased attention on Central American migrants fleeing drug-related violence in their home countries.

The scientists developed a computer model named NarcoLogic that shows how drug traffickers respond to interdiction strategies and tactics. It differs from previous approaches because it models local- and network-level trafficking dynamics at the same time.

Interdiction efforts are linked to the spread and fragmentation of trafficking routes – a phenomenon known as the “balloon and cockroach effect.” When interdiction efforts are focused in one location, drug traffickers simply relocate.

“Between 1996 and 2017, the Western Hemisphere transit zone grew from 2 million to 7 million square miles, making it more difficult and costly for law enforcement to track and disrupt trafficking networks,” Wrathall said. “But as trafficking spread, it triggered a host of smuggling-related collateral damages: violence, corruption, proliferation of weapons, and extensive and rapid environmental destruction, which has been the focus of my work.”

#### Nuclear war

Dr. Andrew F. Krepinevich 14, Jr., President of the Center for Strategic and Budgetary Assessments, M.P.A. and Ph.D. from Harvard University, and Eric Lindsey, Analyst at the Center for Strategic and Budgetary Assessments, M.A. in Strategic Studies and International Economics from the Johns Hopkins School of Advanced International Studies (SAIS), “Hemispheric Defense in the 21st Century”, 1/9/2014, https://csbaonline.org/research/publications/hemispheric-defense-in-the-21st-century

As the previous chapter demonstrates, for the past two hundred years the principal cause of concern for U.S. defense policymakers and planners thinking about Latin America has been the prospect that great powers outside the Western Hemisphere could exploit the military weakness and internal security challenges of the states within it to threaten U.S. security. While there is reason for optimism about the future of Latin America,58 there is also cause for concern. The region faces enduring obstacles to economic59 and political development60 as well as signi􀂿cant internal security challenges. As General John Kelly, the commander of U.S. Southern Command (SOUTHCOM)61 noted in his March 2013 posture statement before Congress, Latin America: 􀀾I􀁀s a region of enormous promise and exciting opportunities, but it is also one of persistent challenges and complex threats. It is a region of relative peace, low likelihood of interstate con􀃀icts, and overall economic growth, yet is also home to corrosive criminal violence, permissive environments for illicit activities, and episodic political and social protests.62 The instability and non-traditional security challenges that General Kelly cites provide potential opportunities for the United States’ major rivals to (borrowing a term from Monroe’s declaration) “interpose” themselves into the region and, by so doing, threaten regional stability and U.S. security. Two discernible trends suggest that current and prospective Eurasian rivals could seek to exploit regional conditions and dynamics in ways that could impose immense costs on the United States and divert its attention from more distant theaters overseas. The first trend is a return to a heightened level of competition among the “great powers” following two decades of U.S. dominance. The second trend concerns the growing cost of projecting power by traditional military means due to the proliferation of “anti-access/area-denial” (A2/AD) capabilities in general, and precision-guided munitions (PGMs) in particular. These trends suggest that, despite a possible decline in relative U.S. power, external forces will continue to 􀂿nd it beyond their means to threaten the hemisphere through traditional forms of power projection. Far more likely is a return of a competition similar to that which the United States engaged in with the Soviet Union during the Cold War. During that period both powers sought to avoid direct con􀃀ict with the other, given the risks of escalation to nuclear con􀃀ict. Instead each focused primarily on gaining an advantage over the other through the employment of client states and non-state groups as proxies. Proxies were employed for reasons other than avoiding a direct clash, such as gaining positional advantage (e.g., enabling the sponsor to establish bases in its country, as the Soviets did in Cuba). Proxies were also employed as a means of diverting a rival’s attention from what was considered the key region of the competition and to impose disproportionate costs on a rival (e.g., Moscow’s support of 􀀱orth Vietnam as a means of drawing o􀌆 U.S. resources from Europe). This chapter outlines trends in the Western Hemisphere security environment that outside powers may seek to exploit to advance their objectives in ways that threaten regional stability and U.S. security. This is followed by a discussion of how these external powers might proceed to do so. Seeds of Instability Crime, Illicit Networks, and Under-Governed Areas Latin America has a long history of banditry, smuggling, and organized crime. As in the case of Pancho Villa and the 1916-1917 Punitive Expedition, these activities have occasionally risen to a level at which they in􀃀uence U.S. national security calculations. Rarely, however, have these activities been as pervasive and destabilizing as they are today. Although a wide variety of illicit activity occurs in Latin America, criminal organizations conducting drug tra􀌇cking are the dominant forces in the Latin American underworld today, accounting for roughly 􀀇􀀗0 billion per year63 of an estimated 􀀇100 billion in annual illicit trade.6􀀗 Since the Colombian cartels were dismantled in the 1990s, this lucrative trade has been dominated by powerful Mexican cartels whose operations extend across the length and breadth of Mexico, as well as up the supply chain into the cocaine-producing regions of the Andean Ridge and through their wholesale and retail drug distribution networks across the United States.65 The cartels, along with countless smaller criminal organizations, comprise what the head of SOUTHCOM has described as, 􀀾a􀁀n interconnected system of arteries that traverse the entire Western Hemisphere, stretching across the Atlantic and Paci􀂿c, through the Caribbean, and up and down 􀀱orth, South, and Central America . . . 􀀾a􀁀 vast system of illicit pathways 􀀾that is used􀁀 to move tons of drugs, thousands of people, and countless weapons into and out of the United States, Europe, and Africa with an e􀌇ciency, payload, and gross pro􀂿t any global transportation company would envy.66 That being said, the drug tra􀌇cking underworld is by no means a monolithic entity or cooperative alliance. Rather, it is a fractious and brutally competitive business in which rival entities are constantly and literally 􀂿ghting to maximize their share of the drug trade and for control of the critical transshipment points, or plazas, through which it 􀃀ows. To attack their competitor’s operations and protect their own operations from rivals and the Mexican government’s crackdown that began in 2006, the cartels have built up larger, better armed, and more ruthless forces of hired gunmen known as sicarios. Using the billions of dollars generated by their illicit activities, they have acquired weapons and equipment formerly reserved for state armies or state-sponsored insurgent groups, including body armor, assault ri􀃀es, machine guns, grenades, landmines, anti-tank rockets, mortars, car bombs, armored vehicles, helicopters, transport planes, and—perhaps most remarkably—long-range submersibles.67 The cartels’ pro􀂿ts have also enabled them to hire former police and military personnel, including members of several countries’ elite special operations units68 and, in several cases, active and former members of the U.S. military.69 These personnel bring with them—and can provide to the cartels—a level of training and tactical pro􀂿ciency that can be equal or superior to those of the government forces they face. As a result of this pro􀂿ciency and the military-grade weapons possessed by the cartels, more than 2,500 Mexican police o􀌇cers and 200 military personnel were killed in confrontations with organized crime forces between 2008 and 2012 along with tens of thousands of civilians.70 In the poorer states of Central America, state security forces operate at an even greater disadvantage.71 While their paramilitary forces enable the cartels to dominate entire cities and large remote areas through force and intimidation, they are not the only tool available. The cartels also leverage their immense wealth to buy the silence or support of police and government o􀌇cials who are often presented with a choice between plata o plomo—“silver or lead.” According to the head of the Mexican Federal Police, around 2010 the cartels were spending an estimated 􀀇100 million each month on bribes to police.72 By buying o􀌆 o􀌇cials—and torturing or killing those who cannot be corrupted—the cartels have greatly undermined the e􀌆ectiveness of national government forces in general and local police in particular. This, in turn, has undermined the con􀂿dence of the population in their government’s willingness and ability to protect them. Through these means and methods the cartels have gained a substantial degree of de facto control over many urban and rural areas across Mexico, including major cities and large swathes of territory along the U.S.-Mexico border. In many of these crime-ridden areas the loss of con􀂿dence in the government and police has prompted the formation of vigilante militias, presenting an additional challenge to government control.73 Meanwhile, in the “northern triangle” of Central America (the area comprising Guatemala, Honduras, and El Salvador through which the cartels transship almost all cocaine bound for Mexico and the United States) the situation is even more dire. Approximately 90 percent of crimes in this area go unpunished, while in Guatemala roughly half the country’s territory is e􀌆ectively under drug tra􀌇ckers’ control.7􀀗 Further south, similar pockets of lawlessness exist in coca-growing areas in Colombia, Venezuela, Ecuador, Peru, and Bolivia. In Colombia and along its borders with Venezuela, Ecuador, and Peru, much of the coca-growing territory remains under the control of the Revolutionary Armed Forces of Colombia, or FARC. A guerrilla organization founded in the 1960s as a Marxist-Leninist revolutionary movement dedicated to the overthrow of the Colombian government, the FARC embraced coca growing in the 1990s as a means of funding its operations and has subsequently evolved into a hybrid mix of left-wing insurgent group and pro􀂿t-driven cartel.76 This hybrid nature has facilitated cooperation between the FARC and ideological sympathizers like the Bolivarian Alliance, Hezbollah, Al Qaeda in the Islamic Maghreb, and other extremist groups77 as well as with purely criminal organizations like the Mexican cartels. Although the FARC has been greatly weakened over the past decade and no longer poses the existential threat to the Colombian government that it once did, it remains 􀂿rmly in control of large tracts of coca-producing jungle, mostly straddling the borders between Colombia and FARC supporters Venezuela and Ecuador. In summary, organized crime elements have exploited under-governed areas to establish zones under their de facto control. In so doing they pose a signi􀂿cant and growing threat to regional security in general and U.S. interests in particular. As SOUTHCOM commander General Kelly recently observed: 􀀾T􀁀he proximity of the U.S. homeland to criminally governed spaces is a vulnerability with direct implications for U.S. national security. I am also troubled by the signi􀂿cant criminal capabilities that are available 􀀾within them􀁀 to anyone—for a price. Transnational criminal organizations have access to key facilitators who specialize in document forgery, trade-based money laundering, weapons procurement, and human smuggling, including the smuggling of special interest aliens. This criminal expertise and the ability to move people, products, and funds are skills that can be exploited by a variety of malign actors, including terrorists.78 Hezbollah and the Bolivarian Alliance Hezbollah in Latin America 􀀱on-state entities recognized by the U.S. as terrorist organizations also operate in the region, most notably Lebanon-based Hezbollah, an Iranian client group. Hezbollah maintains an active presence in the tri-border area (TBA) of South America— the nexus of Argentina, Brazil, and Paraguay—stretching back to the 1980s. The TBA has traditionally been under-governed and is known by some as “the United 􀀱ations of crime.”79 Eight syndicate groups facilitate this activity in South America’s so-called “Southern Cone,” overseeing legitimate businesses along with a wide range of illegal activities to include money laundering, drug and arms traf- 􀂿cking, identity theft and false identi􀂿cation documents, counterfeiting currency and intellectual property, and smuggling. 􀀱ot surprisingly they are linked to organized crime and to non-state insurgent and terrorist groups, such as the FARC.80 Estimates are that over 􀀇12 billion in illicit transactions are conducted per year, a sum exceeding Paraguay’s entire GDP by a substantial amount.81 Hezbollah achieved notoriety in the region in 1992 when it bombed the Israeli embassy in Argentina. This was followed with the bombing of the AMIA Jewish community center in Buenos Aires two years later. Like many other terrorist organizations, as Hezbollah expanded it established relationships with drug cartels82 that it supports in a variety of ways. For example, the cartels have enlisted Hezbollah, known for its tunnel construction along the Israeli border, for help in improving their tunnels along the U.S.-Mexican border. In 2008, Hezbollah helped broker a deal in which one of Mexico’s major drug cartels, Sinaloa, sent members to Iran for weapons and explosives training via Venezuela using Venezuelan travel documents. 83 As the locus of the drug trade and other illegal cartel activities moved north into Central America and Mexico, Hezbollah has sought to move with it with mixed success. In October 2011, Hezbollah was linked to the e􀌆orts of an Iranian-American to conspire with Iranian agents to assassinate the Saudi ambassador to the United States. The plot involved members of the Los Zetas Mexican drug cartel.8􀀗 The would-be assassin, Mansour Arbabsiar, had established contact with his cousin, a Quds Force85 handler, Gen. Gholam Shakuri. The plot is believed by some to be part of a wider campaign by the Quds Force and Hezbollah to embark on a campaign of violence extending beyond the Middle East to other Western targets, including those in the United States.86 In early September 2012, Mexican authorities arrested three men suspected of operating a Hezbollah cell in the Yucatan area and Central America, including a dual U.S.-Lebanese citizen linked to a U.S.-based Hezbollah money laundering operation. 87A few months later, in December 2012, Wassim el Abd Fadel, a suspected Hezbollah member with Paraguayan citizenship, was arrested in Paraguay. Fadel was charged with human and drug tra􀌇cking and money laundering. Fadel reportedly deposited the proceeds of his criminal activities—ranging from 􀀇50-200,000 per transaction—into Turkish and Syrian bank accounts linked to Hezbollah. In summary, Hezbollah has become a 􀂿xture in Central and Latin America, expanding both its activities and in􀃀uence over time. It has developed links with the increasingly powerful organized crime groups in the region, particularly the narco cartels, along with radical insurgent groups such as the FARC and states like Venezuela who are hostile to the United States and its regional partners. Hezbollah’s principal objectives appear to be undermining U.S. in􀃀uence in the region, imposing costs on the United States, and generating revenue to sustain its operations in Latin America and elsewhere in the world. These objectives are shared by Iran, Hezbollah’s main state sponsor. The Bolivarian Alliance As noted above, geographic, economic, and cultural factors have traditionally helped to prevent the emergence in Latin America of any real military rival to the United States. Although there are no traditional military threats in the region, there are indigenous states whose actions, policies, and rhetoric challenge regional stability and U.S. security. Over the past decade, several states have come together to form the Bolivarian Alliance of the Americas (ALBA), an organization of left-leaning Latin American regimes whose overarching purpose is to promote radical populism and socialism, foster regional integration, and reduce what they perceive as Washington’s “imperialist” influence in the region.89 Since its founding by Hugo Chavez of Venezuela and Fidel Castro of Cuba in December 200􀀗, the Bolivarian Alliance has expanded to include Antigua and Barbuda, Bolivia, Dominica, Ecuador, 􀀱icaragua, and Saint Vincent and the Grenadines. Although the members of the Bolivarian Alliance are militarily weak and pose almost no traditional military threat to the United States or its allies in the region,90 they challenge American interests in the region in other ways. First, they espouse an anti-American narrative that finds substantial support in the region and consistently oppose U.S. efforts to foster cooperation and regional economic integration.91 Second, in their efforts to undermine the government of Colombia, which they consider to be a U.S. puppet, ALBA states provide support and sanctuaries within their borders to coca growers, drug traffickers, other criminal organizations, and the FARC.92 Links to Hezbollah have also been detected.93 Perhaps of greatest concern, they have aligned themselves closely with Iran, inviting it and Syria to participate as “observer states” in the alliance. Other worrisome ALBA activities involve lifting visa requirements for Iranian citizens and hosting large numbers of Iranian diplomats and commercial exchange members that some observers believe to be Iranian intelligence and paramilitary Quds Force operatives.9􀀗 By hosting and cooperating with both foreign agents and violent non-state actors, the ALBA states have come to function as critical nodes in a network of groups hostile to the United States. A Coming Era of Proxy Wars in the Western Hemisphere? History shows that Washington has often emphasized an indirect approach to meeting challenges to its security in Latin America. Yet the United States has not shied away from more direct, traditional uses of force when interests and circumstances dictated, as demonstrated over the past half century by U.S. invasions of the Dominican Republic (1965), Grenada (1983), and Panama (1989) and the occupation of Haiti (199􀀗).Yet several trends seem likely to raise the cost of such operations, perhaps to prohibitive levels. Foremost among these trends is the diffusion of precision-guided weaponry to state and non-state entities. 92 The Second Lebanon War as “Precursor” War A precursor of this trend can be seen in the Second Lebanon War between Israel and Hezbollah.95 During the con􀃀ict, which lasted less than 􀂿ve weeks, irregular Hezbollah forces held their own against the highly regarded Israeli Defense Force (IDF), demonstrating what is now possible for non-state entities to accomplish given the proliferation of militarily-relevant advanced technologies. Hezbollah’s militia engaged IDF armor columns with salvos of advanced, man-portable, antitank guided missiles and other e􀌆ective anti-armor weapons (e.g. rocket-propelled grenades (RPGs) with anti-armor warheads) in great numbers. When the IDF employed its ground forces in southern Lebanon, its armored forces su􀌆ered severe losses; out of the four hundred tanks involved in the 􀂿ghting in southern Lebanon, forty-eight were hit and forty damaged.96 Hezbollah’s defensive line was also well equipped with latest-generation thermal and low-/ no-light enhanced illumination imaging systems, while frontline units were connected to each other and higher command elements via a proprietary, 􀂿ber-optic based communications network, making collection of communications tra􀌇c by Israeli intelligence extremely di􀌇cult. Perhaps most important, Hezbollah possessed thousands of short- and medium- range rockets, often skillfully hidden below ground or in bunkers that made detection from overhead surveillance platforms nearly impossible. During the brief con􀃀ict Hezbollah’s forces 􀂿red some four thousand unguided rockets of various types that hit Israel. Hezbollah’s rocket inventory enabled its forces to attack targets throughout the northern half of Israel. Over nine hundred rockets hit near or on buildings, civilian infrastructure, and industrial plants. Some two thousand homes were destroyed, and over 􀂿fty Israelis died with several thousand more injured. The casualties would undoubtedly been greater if between 100,000 and 250,000 Israeli civilians had not 􀃀ed their homes. Haifa, Israel’s major seaport had to be shut down, as did its oil re􀂿nery.97 Hezbollah also employed several unmanned aerial vehicles for surveillance of Israel, as well as C-802 anti-ship cruise missiles used to attack and damage an Israeli corvette. 98 The G-RAMM Battlefield The brief war between Israel and Hezbollah suggests that future irregular forces may be well-equipped with enhanced communications, extended-range surveillance capabilities, and precision-guided rockets, artillery, mortars and missiles (G-RAMM) 99 able to hit targets with high accuracy at ranges measured from the tens of kilometers perhaps up to a hundred kilometers or more. In projecting power against enemies equipped in this manner and employing these kinds of tactics U.S. forces—as well as other conventional forces— will find themselves operating in a far more lethal battlefield than those in either of the Gulf wars or in stability operations in Afghanistan and Iraq. Moreover, currently constituted conventional forces typically depend on large fixed infrastructure (e.g., military bases, logistics depots, ports, airfields, railheads, bridges) to deploy themselves and sustain combat operations. These transportation and support hubs also serve as the nodes through which internal commerce and foreign trade moves within a country. This key, fixed infrastructure will almost certainly prove far more difficult to defend against irregular forces armed with G-RAMM weaponry. Indeed, had Hezbollah’s “RAMM” inventory had only a small fraction of G-RAMM munitions, say 10-20 percent, it would have been able to in􀃀ict far greater damage than it did historically to Israeli population centers, key government facilities, military installations, and essential commercial assets such as ports, air􀂿elds, and industrial complexes. An irregular enemy force armed with G-RAMM capabilities in substantial numbers could seriously threaten Latin American governments as well as any U.S. (or external great power) forces and support elements attempting a traditional intervention operation. Implications for the U.S. and Other Major Powers The preceding narrative suggests that the combat potential of irregular forces is likely to increase dramatically in the coming years. As this occurs, the cost of operating conventional forces—especially ground forces—and defending key military support infrastructure is likely to rise substantially. Given these considerations the United States and other major powers external to the Western Hemisphere will have strong incentives to avoid the use of conventional forms of military power, particularly large ground forces, in favor of employing irregular proxy forces to advance their interests. Moreover, the high cost and questionable bene􀂿t of the campaigns in Afghanistan and Iraq are likely to create strong domestic opposition in the United States to such operations for some time to come. This must be added to the United States’ greatly diminished 􀂿scal standing that has led to large cuts in planned investments in defense. These factors suggest that Washington will be much less likely to engage in direct military action in Latin America in the coming years than historically has been the case. At the same time, rivals of the United States like China and Russia may be incentivized by these trends, as well as the United States’ overwhelming military dominance in the Western Hemisphere, to avoid the direct use of force to expand their in􀃀uence in Latin America. Instead, like some of the Bolivarian Alliance members, they appear likely to follow the path taken by the Soviet Union during the Cold War and Iran today: supporting non-state proxies to impose disproportionate costs on the United States and to distract Washington’s resources and attention from other parts of the world. This is not to say that Beijing, Moscow, and Tehran would eschew future opportunities to establish bases in Latin America. As in the past, such bases can support efforts to accomplish several important objectives. They can, for example, further insulate a Latin American regime from the threat of direct U.S. military intervention, since Washington would have to account for the possibility that the conflict would lead to a direct confrontation with a more capable and potentially nuclear-armed power.100 Bases in the hemisphere can also enable external powers to conduct military assistance activities, such as training, more easily. Electronic surveillance of the United States and Latin American states could be accomplished more cheaply and e􀌆ectively from forward positions. Finally, certain kinds of military capabilities, such as long-range ballistic missiles and attack submarines, could be pro􀂿tably stationed in Latin America by powers external to that region, particularly if they intended to create the option of initiating con􀃀ict at some future date. These reasons, among others, have made preventing an extra-hemispheric power from establishing bases in Latin America an enduring U.S. priority. Players in a Latin American Great Game Given current trends, several powers external to the region may, either now or over the coming decade, have both the motive and the means to employ both state and non-state proxies in Latin American to achieve their interests. Principal among them is Iran, which is already engaged in supporting proxies against the United States and its partners in the Middle East and has long been developing proxies in Latin America. Additionally, there are reasons to think that China and Russia may be interested in cultivating and supporting Latin American proxies as well.