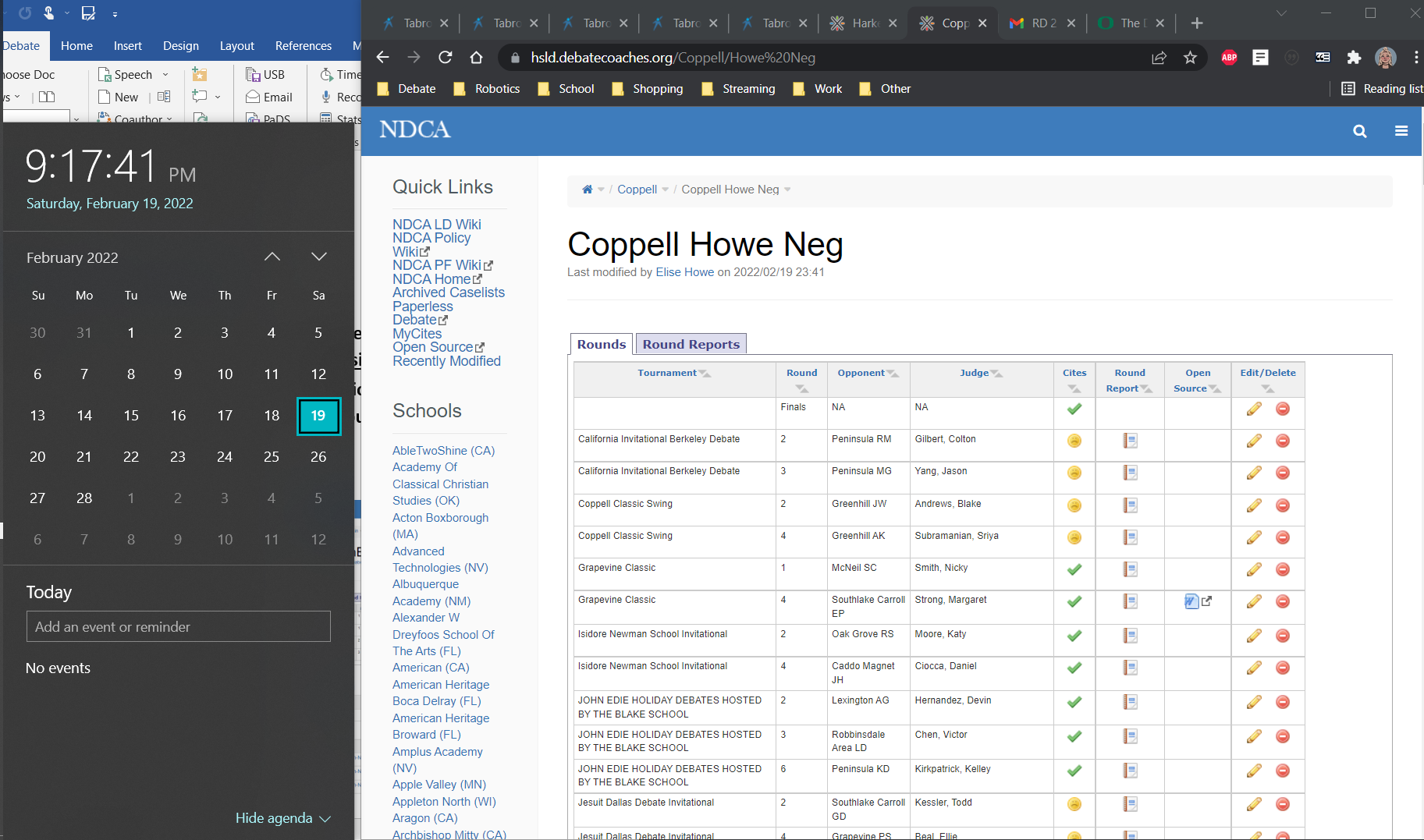
# 1NC R4 Coppell EW vs Kacee

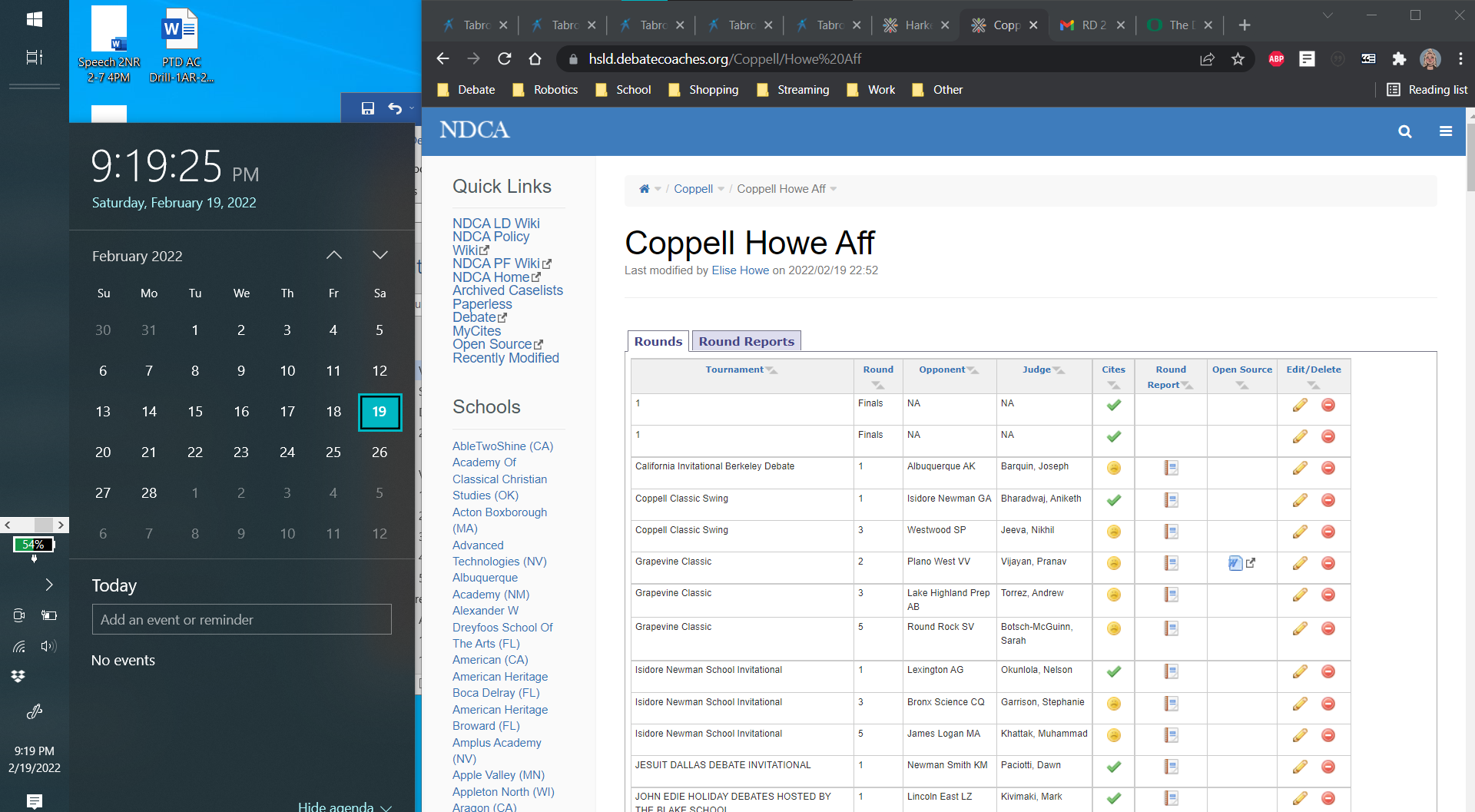
## 1NC

### 1 – Theory

#### Interp: Debaters must open-source with highlighting documents on the NDCA LD Wiki for every affirmative read at a TOC-bid distributing tournament.

#### Violations: They don’t open source a single affirmative document. Supercharge this they open sourced rd 4 at grapevine on their neg page, they knew how to do it, they just choose not to.





#### Standards

#### Debate resource inequities—you’ll say people will steal cards, but that’s good—it’s the only way to truly level the playing field for students such as novices in under-privileged programs.

Antonucci 05 [Michael (Debate coach for Georgetown; former coach for Lexington High School); “[eDebate] open source? resp to Morris”; December 8; http://www.ndtceda.com/pipermail/edebate/2005-December/064806.html //]

a. Open source systems are preferable to the various punishment proposals in circulation. It's better to share the wealth than limit production or participation. Various flavors of argument communism appeal to different people, but banning interesting or useful research(ers) seems like the most destructive solution possible. Indeed, open systems may be the only structural, rule-based answer to resource inequities. Every other proposal I've seen obviously fails at the level of enforcement. Revenue sharing (illegal), salary caps (unenforceable and possibly illegal) and personnel restrictions (circumvented faster than you can say 'information is fungible') don't work. This would - for better or worse. b. With the help of a middling competent archivist, an open source system would reduce entry barriers. This is especially true on the novice or JV level. Young teams could plausibly subsist entirely on a diet of scavenged arguments. A novice team might not wish to do so, but the option can't hurt. c. An open source system would fundamentally change the evidence economy without targeting anyone or putting anyone out of a job. It seems much smarter (and less bilious) to change the value of a professional card-cutter's work than send the KGB after specific counter-revolutionary teams.

#### 2. Key to in round education and fairness, cites alone mean I can basically only respond to your tag lines, meaning it is nearly impossible for me to provide high quality evidence, which is key to education. This is an independent voter, affs have infinite time to frontline, they refused to give me even a sliver of that benefit. Also key to academic integrity, OS is the only way to verify you cut cards in accordance to the source.

#### 

#### Voters:

#### Fairness is a voter because debate is a game and if winning and losing is arbitrary no one would play.

#### Education is a voter, the only portable long lasting skills we get from debate are based in what we learn.

#### DTD drop the debater is key to deterring future abuse, and dropping the arg would grant them the conditionality which caused the abuse

#### Vote on CI a. reasonability is a race to the bottom b. invites too much judge interference c. no brightline

#### No RVI’s a. illogical just because you put defense on an argument doesn’t mean you should win the round b. you shouldn’t win just because you’ve been fair that should be an expectation not something to reward c. granting RVIs prevents debaters from calling out actual abuse esp if they think they’re opponent is a better theory debater bc of the risk of losing

### 2 – Framing

#### I agree – private appropriation of outer space expands cap into a limitless frontier and that’s awesomesauce.

#### Prefer objective indicators – human cognition drastically inflates the importance of perception in analysis.

Pinker 19

(Steven Pinker is an experimental cognitive psychologist and a popular writer on language, mind, and human nature. His books include "The Language Instinct," "How the Mind Works," and "The Blank Slate."Pinker is the Johnstone Family Professor of Psychology at Harvard University, and his academic specializations are visual cognition and developmental linguistics. His experimental subjects include mental imagery, shape recognition, visual attention, children's language development, regular and irregular phenomena in language, the neural bases of words and grammar, as well as the psychology of cooperation and communication, including euphemism, innuendo, emotional expression, and common knowledge.), “One thing to change: Anecdotes aren’t data”, The Harvard Gazette, 6/21/19, NCS, https://news.harvard.edu/gazette/story/2019/06/focal-point-harvard-professor-steven-pinker-says-the-truth-lies-in-the-data/

QUESTION: What is one thing wrong with the world that you would change, and why? Too many leaders and influencers, including politicians, journalists, intellectuals, and academics, surrender to the cognitive bias of assessing the world through anecdotes and images rather than data and facts. Our president assumed office with a dystopian vision of American “carnage” in an era in which violent crime rates were close to historical lows. His Republican predecessor created a massive new federal department and launched two destructive wars to protect Americans against a hazard, terrorism, that most years kills fewer people than bee stings and lightning strikes. In the year after the 9/11 attacks, 1,500 Americans who were scared away from flying perished in car crashes, unaware that a Boston-LA air trip has the same risk as driving 12 miles. One death from a self-driving Tesla makes worldwide headlines, but the 1.25 million deaths each year from human-driven vehicles don’t. Small children are traumatized by school drills that teach them how to hide from rampage shooters, who have an infinitesimal chance of killing them compared with car crashes, drownings, or, for that matter, non-rampage killers, who slay the equivalent of a Sandy Hook and a half every day. Several heavily publicized police shootings have persuaded activists that minorities are in mortal danger from racist cops, whereas three analyses (two by Harvard faculty, Sendhil Mullainathan and Roland Fryer) have shown no racial bias in police shootings. “How do we change this destructive statistical illiteracy and disdain for data?” Many people are convinced that the country is irredeemably racist, sexist, homophobic, and sexually assaultive, whereas all of these scourges are in steady decline (albeit not quickly enough). People on both the right and left have become cynical about global institutions because they think that the world is becoming poorer and more war-torn, whereas in recent decades global measures of extreme poverty and battle deaths have plummeted. People are terrified of nuclear power (the most scalable form of carbon-free energy) because of images of Three Mile Island (which killed no one), Fukushima (which killed no one; the deaths were caused by the tsunami and a panicked, unnecessary evacuation), and Chernobyl (which killed fewer people than are killed by coal every day). They imagine that fossil fuels can be replaced by solar energy, without doing the math on how many square miles would have to be tiled with solar panels to satisfy the world’s vastly growing thirst for electricity. And they think that voluntary sacrifices, like unplugging laptop chargers, are a sensible way to deal with climate change. How do we change this destructive statistical illiteracy and disdain for data? We need to make “factfulness” (as Hans, Ola, and Anna Rosling call it) an inherent part of the culture of education, journalism, commentary, and politics. An awareness of the infirmity of unaided human intuition should be part of the conventional wisdom of every educated person. Guiding policy or activism by conspicuous events, without reference to data, should come to be seen as risible as guiding them by omens, dreams, or whether Jupiter is rising in Sagittarius.

#### And, the role of the ballot is to vote for the debater who best defends free markets in outer space from the luxury communists. All DAs prove it impact turns their role of the ballot.

#### The warrants for their role of the ballot obviously all beg the question of whether capitalism is actually bad and worth resisting and therefore cannot be dis-entangled from the rest of the debate, so you shouldn’t vote on artificial ROTB preclusion.

### 3 – Colonization

#### Colonization of Mars is feasible but requires investment incentive from private appropriation.

Martin & Saydam 21

(BA Journalism University of Central Lancashire, Media & Content Coordinator for The University of New South Wales Serkan Saydam received his BSc, MSc and PhD degrees in Mining Engineering from the Dokuz Eylul University, Izmir, Turkey and completed his Postdoctoral Fellowship at the University of Witwatersrand, Johannesburg, South Africa. He then worked at De Beers for 3 years as project manager in Johannesburg, South Africa. Serkan joined the School of Mining Engineering as a Senior Lecturer in 2006 and was promoted to Associate Professor in 2012. Serkan then was then promoted to the Professorial role in 2017 and he is currently working as a Professor and Director of Research at the School of Minerals and Energy Resources Engineering at UNSW. A key focus of his research is to address the current needs and future challenges faced by the mining industry. These are generally very complex engineering problems, as mining environments become more extreme and constraints are imposed due to increasing social, environmental, and health and safety standards. His fields of research include ground control, mine planning & design, technology integration, new mining methods and off-Earth mining. In addition, he established research collaboration with NASA's Jet Propulsion Laboratory & Kennedy Space Center, and Luxembourg Space Agency as well more than 20 research organisations and universities globally. He has more than 250 publications and graduated 18 PhD students. Serkan is currently Fellow Member of Australian Institution of Mining and Metallurgy; President of the ISRM Commission on Planetary Rock Mechanics; Deputy Director of the Australian Centre for Space Engineering Research (ACSER) at UNSW; Deputy Secretary General and Council Member of the SOMP (The Society of Mining Professors). <https://newsroom.unsw.edu.au/news/science-tech/mars-settlement-likely-2050-says-unsw-expert-%E2%80%93-not-levels-predicted-elon-musk>, USNW Sydney Newsroom, 3/10/21, NCS, <https://newsroom.unsw.edu.au/news/science-tech/mars-settlement-likely-2050-says-unsw-expert-%E2%80%93-not-levels-predicted-elon-musk> brackets for spelling mistake

Robotic mining that can provide water and fuel is the key to developing a colony on the red planet within the next 30 years. Mars will be colonised by humans by the year 2050, as long as autonomous mining processes quickly become more commercially viable. That’s the view of Professor Serkan Saydam from UNSW Sydney in the wake of the amazing landing on Mars by NASA’s Perseverance rover. Perseverance is expected to provide answers about whether forms of life ever existed on the red planet, but it is also designed to help address the challenges of future human expeditions there. Professor Saydam, from the School of Mineral Energy Resources Engineering, says the main focus in terms of creating a colony on Mars is finding water – and being able to extract it and process it using robots before humans land. “Everything is all about water,“ Prof. Saydam says. “You use water as a life support, plus also being able to separate out the hydrogen to use as an energy source. “The process for having humans on Mars will be to set up operations, go there and produce water with robots first, and then be able to extract the hydrogen to make the energy ready before people arrive. “Innovation in robotics and autonomous systems are clearly important so that we have the water ready and the hydrogen separated and ready for when human beings land. “At the moment, we don’t have ability to do it. There are significant research efforts, specifically here at UNSW under ACSER (Australian Centre for Space Engineering Research), about the best way to do it, but there is no consensus yet. It also depends on how many people we expect to be living on Mars. Is it five, or 5000, or 50,000, or even more?“ Entrepreneur Elon Musk has claimed he’s confident there will be a city of 1 million on Mars by 2050, transported there by 1000 Starships proposed by his SpaceX venture, with plans for up to three rocket launches per day. Prof. Saydam says that may be unrealistic in the specific timeframe, but admits that demand for travel and a potential colonisation of Mars is what’s needed to drive the technological developments required. “I think the technology is ready and we already have the knowledge, but the main problem is having the focus,“ says Prof. Saydam, who is organising an International Future Mining Conference in December 2021 that will feature former NASA astronaut Pamela Melroy and Honeybee Robotics vice-president Kris Zacny. “It’s a bigger question: ‘Why don’t we do that already on earth? Why are we still using human beings for physical work in mining here?’ We have huge experience in mining, but still heavily depend on humans. “One issue is that demand is not there. For companies to get involved in developing products (for Mars missions), they need to be able to produce minerals or something that can be used for manufacturing goods and then sell it. “At the moment, everything is just a cost and there is no revenue for companies.“ However, that could be starting to change. United Launch Alliance, a joint venture between Lockheed Martin and Boeing who are heavily invested in the rockets used to launch spaceships, has publicly announced they will pay $500 per kilogram for fuel – derived from water – supplied on the moon. That rises to $3000 per kilogram if the fuel is available in a low-earth orbit. “That immediately creates a market,“ Prof. Saydam says. “Plus, if Elon Musk does what he says and puts people on the surface of Mars in 20 years, then that also creates a market. “I believe a colony on Mars is going to happen, but between 2040 and 2050 is more feasible. This could be shortened depending on the technological advances that can reduce the costs or [form] from stronger motivation. “What I think will happen is that first of all we will do these activities on the moon and have a colony there. Then we can use the moon as a petrol station to get to Mars and beyond. “But before 2050, I think we will have settlements on both the moon and Mars.“

#### Mars colonization is try or die - even if we reduce to 0 emissions tomorrow the planet is still cooked – permafrost thaw cycle proves.

Randers & Goluke 21

(Jørgen Randers (born 22 May 1945) is a Norwegian academic, professor emeritus of climate strategy at the BI Norwegian Business School,[1] and practitioner in the field of future studies.[2] His professional field encompasses model-based futures studies, scenario analysis, system dynamics, sustainability, climate, energy and ecological economics. He is also a full member of the Club of Rome, a company director, member of various not-for-profit boards, business consultant on global sustainability matters and author. His publications include the seminal work The Limits to Growth (co-author),[1] and Reinventing Prosperity. Associate Professor Ulrich Golüke has spent his professional life in business, academia, NGOs and as a freelancer. He is a system dynamicist by training and has worked for over thirty years with systems modelling (in shipping, health care, real estate, economics and climate change). He has taught system dynamics courses and supervised MSc students. He also used scenarios for strategy development, starting in the 1990ties with the World Business Council for Sustainable Development as the Director of the Scenario Unit and since 2000 as free-lancer. Clients have included Fortune 100 companies, universities, and foundations.) An earth system model shows self-sustained thawing of permafrost even if all man-made GHG emissions stop in 2020. Sci Rep 10, 18456 (2020). NCS <https://doi.org/10.1038/s41598-020-75481-z> An Author Correction to this article was published on 02 February 2021

An earth system model shows self-sustained thawing of permafrost even if all man-made GHG emissions stop in 2020 Abstract The risk of points-of-no-return, which, once surpassed lock the world into new dynamics, have been discussed for decades. Recently, there have been warnings that some of these tipping points are coming closer and are too dangerous to be disregarded. In this paper we report that in the ESCIMO climate model the world is already past a point-of-no-return for global warming. In ESCIMO we observe self-sustained thawing of the permafrost for hundreds of years, even if global society stops all emissions of man-made GHGs immediately. We encourage other model builders to explore our discovery in their (bigger) models, and report on their findings. The thawing (in ESCIMO) is the result of a continuing self-sustained rise in the global temperature. This warming is the combined effect of three physical processes: (1) declining surface albedo (driven by melting of the Arctic ice cover), (2) increasing amounts of water vapour in the atmosphere (driven by higher temperatures), and (3) changes in the concentrations of the GHG in the atmosphere (driven by the absorption of CO2 in biomass and oceans, and emission of carbon (CH4 and CO2) from thawing permafrost). This self-sustained, in the sense of no further GHG emissions, thawing process (in ESCIMO) is a causally determined, physical process that evolves over time. It starts with the man-made warming up to the 1950s, leading to a rise in the amount of water vapour in the atmosphere—further lifting the temperature, causing increasing release of carbon from thawing permafrost, and simultaneously a decline in the surface albedo as the ice and snow covers melts. To stop the self-sustained warming in ESCIMO, enormous amounts of CO2 have to be extracted from the atmosphere. Introduction The possibility of points-of-no-return in the climate system has been discussed for two decades1,2,3. A point-of-no-return can be seen as a threshold which, once surpassed, fundamentally changes the dynamics of the climate system. For example, by triggering irreversible processes like thawing of the permafrost, drying of the rainforests, or acidification of surface waters. Recently, Lenton et al.4 summarized the global situation and warned that thresholds may be closer in time than commonly believed. The purpose of this article is to report that we have identified a point-of-no-return in our climate model ESCIMO—and that it is already behind us. ESCIMO is a “reduced complexity earth system” climate model5 which we run from 1850 to 2500. In ESCIMO the global temperature keeps rising to 2500 and beyond, irrespective of how fast humanity cuts the emissions of man-made greenhouse gas (GHG) emissions. The reason is a cycle of self-sustained thawing of the permafrost (caused by methane release), lower surface albedo (caused by melting ice and snow) and higher atmospheric humidity (caused by higher temperatures). This cycle appears to be triggered by global warming of a mere + 0.5 °C above the pre-industrial level. Method We used ESCIMO to simulate the development of the global climate system from 1850 to 2500 under different assumptions concerning the emission of man-made GHGes. ESCIMO is a system dynamics model that includes representations of the world’s atmosphere, oceans, forests (and other land types), biomass—and their interactions. It is described here5. The source code with documentation is available online6. In the first simulation reported here, “Scenario 1”, we assume that humanity reduces man-made GHG emissions to zero by 2100. In the second simulation, “Scenario 2”, we assume that emissions are cut much faster—to zero in 2020. In both cases man-made emissions remain zero thereafter. Results The result is shown in Fig. 1. In both scenarios the global temperature keeps rising for hundreds of years—to around + 3 °C in 2500—after a temporary decline in this century in conjunction with the decline in man-made emissions (Fig. 1c). The sea level rises monotonically to around + 3 m in 2500 (Fig. 1e). Figure 1 figure1 Man-made greenhouse gas (GHG) emissions (a), the global average surface temperature (c), sea level rise (e), and cumulative release of carbon from permafrost (g) in two scenarios from 1900 to 2500, generated by ESCIMO. Also shown are the concentration in the atmosphere of CO2 (b), CH4 (d), H2O (f), and surface albedo (h). Solid black curves show Scenario 1 where man-made GHG emissions are phased out by 2100. Black dotted curves show Scenario 2 where man-made GHG emissions are cut to zero in 2020. In both cases the global temperature keeps rising for hundreds of years after all man-made emissions have ceased. Full size image Scenario 1 Scenario 1 describes the result when we assume that man-made emissions peak in the 2030s and decline to zero in 2100 (see Fig. 1, solid lines). This is the “most likely” scenario as described here7. The historical part of the simulation (1850–2015) and the ensuing 60 years (2015–2075) are intuitive and understandable. Rising emissions of man-made GHGes lead to an increase in the concentration of GHGes in the atmosphere (Fig. 1b,d). This, in turn, leads to a rise in the global average surface temperature because GHG molecules block outgoing long-wave (heat) radiation from the surface. The warming is enhanced by the increased amount of water vapour which accumulates in a warmer atmosphere because H2O is a strong greenhouse gas which blocks other frequencies (Fig. 1f). The warming leads to rising sea levels because of thermal expansion and glacier run-off. Difficult to detect, but of great significance for the years beyond 2150, surface albedo starts a slow and smooth decline as the ice and snow cover melts, making the planet darker and leading to more absorption of short-wave (SW) radiation in the surface (Fig. 1h). In Scenario 1 the temperature passes a temporary peak around 2075 at + 2.3 °C above pre-industrial times. The temperature then falls for 75 years (2075–2150) to + 2 °C. There are two reasons: (a) the concentration of GHGs in the atmosphere declines, and (b) heat is used to melt on-land glaciers and Arctic ice. Furthermore, the concentration of CO2 declines (from its all-time peak of 450 ppm in 2050) through two processes: (a) CO2 is gradually absorbed in the ocean surface (and later transported into the deep ocean), and (b) CO2 is gradually absorbed in the biosphere. CO2 in the atmosphere is converted through photosynthesis into biomass in living matter and soils at a rate that is determined by the temperature and the amount of CO2 in the atmosphere. By 2150 all on-land snow and ice are gone in ESCIMO Scenario 1 (except in Greenland and Antarctica, which require thousands of years to melt). While the developments to 2150 are understandable, developments in ESCIMO beyond 2150 are more surprising (counter-intuitive). As shown in Fig. 1 the temperature once more starts rising. The surprising fact is that this rise takes place 50 years after man-made emissions have ceased, and after the concentration of CO2 in the atmosphere has been significantly reduced through absorption in oceans and biomass. The explanation (in ESCIMO) is as follows. While GHG concentrations—and thus their forcings—fall from 2070 to 2150, the effect of surface albedo continues on its smooth upward path throughout this period. Its time development is much slower than that of GHGes. It is the result of mainly Arctic ice melting—but it has enough ‘momentum’ to push the climate system back onto a path of rising temperatures, with its secondary effects of raising humidity and permafrost thawing, which then in turn help the system become warmer and warmer, even if man-made GHG emissions are zero. A cycle of self-reinforcing processes is established. See Fig. 2a. Figure 2 figure2 (a) The contribution to global warming (“energy radiation trapping”) from water vapour, CO2, CH4, other GHGes, and surface albedo in Scenario 1. After 2150 the main drivers are water vapour and CO2, with albedo in the third place. The contribution of CH4 is much smaller, while the other Montreal and Kyoto gases remain the fourth most important driver of the self-sustained warming and thawing of the permafrost. (b) The relative importance of water vapour in global warming in Scenario 1. After 2150 water vapor has approximately the same effect as the sum of all the other GHGes. Historically, from 1850 to 2000, the ratios in the ESCIMO base run fall well within the uncertainty band reported by Cess, Rind, Hansen and Ramanathan and Inamdar cited earlier. Full size image This cycle consists of decreasing surface albedo, increasing water vapour feedback and increasing thawing of the permafrost, releasing carbon (both as CH4 and CO2), resulting in even further temperature rises, and so on. In a highly coupled feedback model like ESCIMO it is the chain of events, closing in on itself, that matters. Even after no more man-made GHG are emitted, this cycle/chain continues on its own. The process is self-sustaining, at least until all carbon is released from permafrost and all ice is melted. Scenario 2 Scenario 2 (see Fig. 1, dotted curves) was made to check whether humanity could avoid continuing warming from the self-sustained chain of circumstances of decreasing ocean albedo, increasing water vapour feedback and increasing thawing of the permafrost by cutting man-made GHG emissions earlier than in Scenario 1. The answer is no. Figure 1 (dotted curves) shows that even if all man-made GHG emissions were (unrealistically) cut to zero in 2020, the temperature starts rising again after 2150—as a result of the cycle of self-sustaining processes of decreasing albedo, thawing of the permafrost and increasing water vapour feedback. Discussion Unexpected result The unexpected result in Scenarios 1 and 2 is that the global temperature keeps rising for centuries after man-made GHG emissions of are brought to zero. Even more surprising, at first glance, is the fact that the temperature keeps rising after the concentration of CO2 in the atmosphere has declined back to the pre-industrial level through absorption in the deep ocean, biomass and soil. In both cases the explanation (in ESCIMO) rests in the joint action of albedo, carbon (both as CH4 and CO2) from thawing permafrost, and water vapour in warm air—which together ensure that the temperature stays high even when the concentration of CO2 declines. Some additional comments help explain: The planet gets darker: the role of albedo As temperature rises, ice and snow are melted, making the planet darker. Between 2070 and 2300, for example, the average ocean albedo (in ESCIMO) declines from 0.080 to 0.067, and the surface albedo from 0.127 to 0.117, see Supplement Figure 15. As a result, more short-wave radiation is absorbed. In ESCIMO about 1.7 Wm−2—which is enough to trigger and drive significant change in the delicately balanced, global climate system. Water vapour feedback Water vapour exists in the atmosphere because of the balance between evaporation, which increases with temperature, and precipitation from the atmosphere, which also increases with temperature. H2O is not held in the atmosphere because of CO2, or any other GHG. This means that water vapour, and its warming effect, will not disappear when the CO2 concentration declines back to pre-industrial levels—as long as the temperature stays high enough. Comparing the effect of GHGs, albedo and water vapour on the energy balance of earth The relative importance of albedo, water vapour, and release of carbon from permafrost over time can be illustrated in terms of the “radiative forcing” each contributes. There are two ways to estimate radiative forcings, one, using the IPCC8 formulas for GHGs, and two, deducing the radiative forcing from changes in the long-wave radiation back to space (LW-ToA). The first works well, at least historically, for CO2, CH4, N2O and the other greenhouse gases (We show the result of calculating GHG radiative forcing in ESCIMO using the IPCC formulas in Supplement Figure 16), but not for climate feedbacks like water vapour and albedo. For water vapour, “radiative forcing” is generally not used (IPCC8, pg. 666), because it modifies the forcing of other forcing agents (Ramanathan and Inamdar9, pg. 121). Instead, using the effectiveness in absorbing thermal radiation of GHGs, including H2O and albedo, is an acceptable proxy for estimating their “radiative forcing”. This approach was used by Hansen et al.10, Rind11 and Ramanathan and Inamdar9, who built on the conceptual work of Cess12. Figure 2a compares the “radiative forcings”, defined as Ga, i.e. the difference between LWToA clear sky radiation and LW cloudy ToA radiation, normalized to 1850 (for detail, see Rind11, pg. 260) of CO2, CH4, other GHGes, water vapour and surface albedo. “The observed value of Ga = 146 Wm−2 K−1; clouds increase the value by about 33 Wm−2 K−1 (Raval and Ramanathan13).” The values for ESCIMO in 1995 are Ga = 148 Wm−2 K−1; clouds increase the value by about 30 Wm−2 K−1. Surface albedo affects the SW radiation balance at the surface. Thus, to estimate the “radiative forcing” of surface albedo, we follow a similar logic as for water vapour: we compare the SW reflection of the surface at timet to the SW reflection of the surface at time1850. The surface albedos are shown in Supplement Figure 15. Land albedo in ESCIMO rises ever so slightly in historical times, recreating the negative LUC “forcing” reported by IPCC. The ocean albedo in ESCIMO drops, because of the melting of the arctic ice. The declining albedo leads to an increase in the amount of short-wave radiation absorbed in the surface. The “radiative forcing of delta albedo” in the ESCIMO base run is shown in Fig. 2a dotted curve. Numerically, it rises from 0.8 Wm−2 in 2070 to 2.6 Wm−2 in 2300 in the ESCIMO base run, an increase of 1.7 Wm−2. Thus, the drop in albedo is the trigger of the resumed self-sustained thawing of the permafrost after 2150, aided in the real world, and in ESCIMO, by water vapour and the consequent continued release of carbon from the thawing permafrost. Match with other models We have compared ESCIMO with other models, with particular focus on the assumptions that are driving the self-sustained thawing of the permafrost. In ESCIMO we assume that the permafrost melts as a consequence of the transfer of heat from the atmosphere to the frozen soil. We assume that the rate of heat transfer is proportional to the temperature difference between air and frozen soil. Furthermore, we assume that the resulting tundra, after some delay, will start absorbing CO2 through photosynthesis once plants start establishing themselves on the formerly frozen ground. The absorption rate depends on the temperature and the concentration of CO2 in the atmosphere (CO2 stimulates plant growth). Needless to say, the causal mechanisms included in ESCIMO are very aggregate and far from a detailed description of the complex thawing process in the real permafrost. In order to check whether our assumptions lead to reasonable results, we compared the output from ESCIMO with the output from other models, as reported in McGuire et al.14. The comparison is halting, since the temperature path in Scenario 1 differs from the path in the RCP4.5 scenario, which the other models use. We found that ESCIMO Scenario 1 generates a thawing of 2 million km2 of permafrost by 2300, compared to 3–5 in other models. And that ESCIMO Scenario 1 releases an accumulated 175 billion tons of carbon (GtC), all from thawing permafrost, by 2300, compared to plus 66–minus 70 in other models. Sadly, ESCIMO is not sufficiently regionalized to generate numbers for the amount of carbon which is absorbed in the vegetation that forms on the formerly frozen ground (which is 8–244 GtC in other models). ESCIMO only gives numbers for the extra carbon absorbed in all tundra, which, in ESCIMO, does not overlap one-to-one with formerly frozen ground, both old and new, which is 200 GtC. The uptake is due to accelerated humus formation fuelled by increased carbon uptake in the biomass of tundra during the period of high CO2 concentration. The comparison with other models seems to indicate that ESCIMO in Scenario 1 releases more carbon than other models, but it needs further investigation to decide whether this is because the RCP4.5 scenario differs from Scenario 1 in the centuries beyond 2100. Sensitivity analysis We did a conventional sensitivity analysis to verify that the self-sustained thawing of the permafrost is a robust phenomenon in ESCIMO—in other words, we checked that the continuing rise in the global average temperature does not depend on a very specific choice of the parameter values that determine the strength of the various processes in the model system. There are many (ca 100) such parameters in ESCIMO. They all have independent physical meaning, and each got a numerical value based on information from the literature. To do the sensitivity analysis, we first randomly picked 14 uncertain parameters from the model. Next, we independently sampled all 14 parameters from random uniform distributions with ranges of plus minus 10% around their standard value for 200 sensitivity runs. Figure 3 shows the result, for Scenarios 1 (a) and 2 (b). The grey band includes 75% of the 200 runs, for the central variable in ESCIMO, namely the temperature increase relative to 1850. Figure 3 figure3 Sensitivity of the global average temperature to variation in parameter values in ESCIMO, for Scenarios 1 and 2. Sensitivity analysis of 14 randomly chosen uncertain parameters from the model. Sampled independently using Latin-Hypercube sampling from random uniform distributions with ranges of plus minus 10% around their standard value for 200 sensitivity runs. For the parameters see Supplement Table 1. Graph to the left shows Scenario 1 where man-made GHG emissions are phased out by 2100. Graph to the right shows Scenario 2 where man-made GHG emissions are cut to zero in 2020. Parameter variation does change absolute values but does not eliminate the broad pattern of self-sustained thawing of the permafrost. The thick curve in the centre of the shaded area is the mean of the 200 runs. The shaded area covers 75% of all runs. Full size image Our conclusion is that parameter variation has a strong effect on the absolute level of the future temperature in ESCIMO. But much more important, Fig. 3 shows that moderate variation in parameter values does not remove the self-sustained thawing of the permafrost. The impact of the sensitivity experiment on five additional variables is shown in Supplement Figures 1 and 2. This broad pattern of development (in system dynamics language: this behaviour mode) remains the same. This is consistent with the system dynamics literature, which argues that it is normally not possible to predict future events in complex systems, while it is possible to say something meaningful about future dynamics (future behaviour modes). It is, of course, simple to come up with parameter changes that remove the self-sustained thawing of the permafrost—especially if those changes are made in what we already know are the most sensitive parts of ESCIMO, namely the equations that describe water vapour, albedo and clouds. But much more important, it is not simple to find parameter combinations that do so, while still being able to recreate the observed history from 1850 to 2015, as the standard parameter set in ESCIMO does. We also did some further sensitivity analyses with parameters of special relevance for the study of permafrost thawing, as described below. Further experiments to explore what it takes to stop the self-sustained thawing of the permafrost We did further experiments with parameter variation, in order to study the robustness of the self-sustained thawing of the permafrost. We chose to vary three parameters that have significant influence on the self-sustained thawing process in ESCIMO. In Fig. 4 we show the effect of varying these three parameters. Our conclusion is that the effect on absolute rate of permafrost thawing is significant, but that the pattern of self-sustained warming persists. Figure 4 figure4 Sensitivity of the global average temperature to changes in three parameters that are central in permafrost thawing. (1) The fraction of carbon that is converted (by bacteria) from CH4 to CO2 before it leaves the thawing permafrost. (a,b) The shaded area includes 75% of the resulting runs. (2) The slope of the rate of thawing of the permafrost that results from a given temperature. (c,d) The shaded area includes 75% of the resulting runs. (3) The slope of the future relationship between additional blocking of outgoing radiation and additional water vapour in the atmosphere—for values of humidity beyond what has been observed this far. (e,f) The detail about how we change the slope is given in Supplement Fiure 10. Full size image Figure 4 shows the effect on the global temperature, Supplement Figures 3–9 and 11–12 show the effects of each experiment for each scenario on five additional variables. Supplement Figure 10 gives details about the effect of changing the relationship between blocking and the amount of H2O in the atmosphere. Our experiments involved the following three parameters: 1. The fraction of carbon that is converted (by bacteria) from CH4 to CO2 before it leaves the thawing permafrost. The fraction of carbon that is released as CH4 in the real world is still unknown (Schneider von Deimling et al.15, Turetsky et al.16), so we explored the entire physically possible range from 0 (i.e. all carbon released from permafrost is released as CO2) to 1 (i.e. all carbon released from permafrost is released as CH4). See Fig. 4a,b and Supplement Figures 3 and 4. Since Lawrence et al.17 report a fraction between 2.5% for dry soil and 12% for wet soil we also re-ran our sensitivity analysis bounded by 0 and 15% to highlight this restricted range. See Supplement Figures 5, 6 and 7. Our choice of all carbon released from permafrost thawing being released as methane for our base case results from the fact that we originally worked on ESCIMO between 2000 and 2015. At the time, we assumed, falsely as it turns out, that all carbon released from thawing permafrost is released as methane. As reported above, in this paper we run sensitivity analysis where we changed the fraction of carbon released as methane from 0 to 100%, i.e. the entire physically possible range. And we run sensitivity analysis where we changed the fraction of carbon released as methane from 0 to 15%, i.e. around the currently assumed value of around 10%. In all the runs, the characteristic behaviour of self-sustained (in the sense of no more man-made GHG emissions) temperature rise is maintained. 2. The slope of the rate of thawing of the permafrost that results from a given temperature. In ESCIMO, the rate of thawing permafrost is measured in km2 per year. At our chosen reference temperature (4 °C) we assume that 12.500 km2 per year is melted to all depth18,19,20. To calculate the rate of thawing at other temperatures we multiply with the following linear relationship: Effectoftemperature(dimensionless)=1+slope(dimensionless)×(Globalaveragesurfacetemperaturet(∘C)÷Globalaveragesurfacetemperature1850(∘C)−1) See Fig. 4c,d and Supplement Figures 8 and 9. 3. The slope of the future relationship between additional blocking of outgoing radiation as a function of additional water vapour in the atmosphere—for values of humidity beyond what has been observed this far. To make this extrapolation we use the following 3rd order polynomial function: Fractionblocked=−0.2842∗humidity3+1.8244∗humidity2−3.7148∗humiditiy+2.4523 where the unit for humidity is g/kg. The historical part of the relationship has been calibrated to actual global average temperature. For detail, see Supplement Figure 10. See Fig. 4e,f and Supplement Figures 11 and 12. Summary of the three parameter changes The chosen parameter variations do impact the rate of self-sustained thawing of the permafrost and its feedback effect on global temperature. But they do not stop the self-sustained thawing of the permafrost. We believe that the reason for these results in ESCIMO is the importance of surface albedo rise, H2O blocking of long wave radiation and methane release from permafrost. As Fig. 2 above shows, we are seeing in ESCIMO a regime change from man-made emission driven warming until about 2200 to albedo and water-vapour driven warming beyond 2150. Remedial action We did experiments with ESCIMO (see Supplement Figure 13) to explore (contra-factually) in what year man-made emissions must stop to avoid self-reinforcing thawing of the permafrost. The answer is that all man-made emissions would have had to be cut to zero sometime between 1960 and 1970—when global warming was still below some + 0.5 °C. Finally, we explored another strategy to stop self-sustained thawing. We asked how much CO2 humanity must remove from the atmosphere every year from 2020 in order to avoid self-sustained temperature rise in the centuries ahead. The answer, in ESCIMO, proved to be at least 33 GtCO2e per year, for example through direct CO2 capture or biomass CCS (see Supplement Figure 14 (a) and (b)). In other words, building 33.000 big CCS plants and keep them running for ever. This is technically feasible but would be hugely expensive. Cheaper opportunities exist to stop self-sustained global warming (through various forms of geo-engineering), but these will have unintended and undesired side effects beyond lowering the temperature. Conclusion Self-sustained thawing of the permafrost is a robust phenomenon in ESCIMO. It only disappears when man-made emissions are stopped counterfactually as early as in the 1960es. Or by choosing parameter values that do not recreate historical developments. We encourage other model builders to explore these conclusions in their models, and report on their findings.

### 4 – Climate DA

#### Cap is our only hope to combat climate change – CCS link turns every impact.

Graciela ‘16 (/16 – Professor of Economics and of Statistics at Columbia University and Visiting Professor at Stanford University, and was the architect of the Kyoto Protocol carbon market (being interviewed by Marcus Rolle, freelance journalist specializing in environmental issues and global affairs, “Reversing Climate Change: Interview with Graciela Chichilnisky,” http://www.globalpolicyjournal.com/blog/01/09/2016/reversing-climate-change-interview-graciela-chichilnisky)//cmr

GC: Green capitalism is a new economic system that values the natural resources on which human survival depends. It fosters a harmonious relationship with our planet, its resources and the many species it harbors. It is a new type of market economics that addresses both equity and efficiency. Using carbon negative technology™ it helps reduce carbon in the atmosphere while fostering economic development in rich and developing nations, for example in the U S., EU, China and India. How does this work? In a nutshell Green Capitalism requires the creation of global limits or property rights nation by nation for the use of the atmosphere, the bodies of water and the planet’s biodiversity, and the creation of new markets to trade these rights from which new economic values and a new concept of economic progress emerges updating GDP as is now generally agreed is needed. Green Capitalism is needed now to help avert climate change and achieve the goals of the 2015 UN Paris Agreement, which are very ambitious and universally supported but have no way to be realized within the Agreement itself. The Carbon Market and its CDM play critical roles in the foundation of Green Capitalism, creating values to redefine GDP. These are needed to remain within the world’s “CO2 budget” and avoid catastrophic climate change. As I see it, the building blocks for Green Capitalism are then as follows; (1) Global limits nation by nation in the use of the planet’s atmosphere, its water bodies and biodiversity - these are global public goods. (2) New global markets to trade these limits, based on equity and efficiency. These markets are relatives of the Carbon Market and the SO2 market. The new market create new measures of economic values and update the concept of GDP. (3) Efficient use of Carbon Negative Technologies to avert catastrophic climate change by providing a smooth transition to clean energy and ensuring economic prosperity in rich and poor nations. These building blocks have immediate practical implications in reversing climate change and can assist the ambitious aims of Paris COP21 become a reality. MR: What is the greatest advantage of the new generation technologies that can capture CO2 from the air? GC: These technologies build carbon negative power plants, such as Global Thermostat, that clean the atmosphere of CO2 while producing electricity. Global Thermostat is a firm that is commercializing a technology that takes CO2 out of air and uses mostly low cost residual heat rather than electricity to drive the capture process, making the entire process of capturing CO2 from the atmosphere very inexpensive. There is enough residua heat in a coal power plant that it can be used to capture twice as much CO2 as the plant emits, thus transforming the power plant into a “carbon sink.” For example, a 400 MW coal plant that emits 1 million tons of CO2 per year can become a carbon sink absorbing a net amount of 1 million tons of CO2 instead. Carbon capture from air can be done anywhere and at any time, and so inexpensively that the CO2 can be sold for industrial or commercial uses such as plastics, food and beverages, greenhouses, bio-fertilizers, building materials and even enhanced oil recovery, all examples of large global markets and profitable opportunities. Carbon capture is powered mostly by low (85°C) residual heat that is inexpensive, and any source will do. In particular, renewable (solar) technology can power the process of carbon capture. This can help advance solar technology and make it more cost-efficient. This means more energy, more jobs, and it also means economic growth in developing nations, all of this while cleaning the CO2 in the atmosphere. Carbon negative technologies can literally transform the world economy. MR: One final question. You distinguish between long-run and short-run strategies in the effort to reverse climate change. Would carbon negative technologies be part of a short-run strategy? GC: Long-run strategies are quite different from strategies for the short-run. Often long-run strategies do not work in the short run and different policies and economic incentives are needed. In the long run the best climate change policy is to replace fossil fuel sources of energy that by themselves cause 45% of the global emissions, and to plant trees to restore if possible the natural sources and sinks of CO2. But the fossil fuel power plant infrastructure is about 87% of the power plant infrastructure and about $45-55 trillion globally. This infrastructure cannot be replaced quickly, certainly not in the short time period in which we need to take action to avert catastrophic climate change. The issue is that CO2 once emitted remains hundreds of years in the atmosphere and we have emitted so much that unless we actually remove the CO2 that is already there, we cannot remain long within the carbon budget, which is the concentration of CO2 beyond which we fear catastrophic climate change. In the short run, therefore, we face significant time pressure. The IPCC indicates in its 2014 5th Assessment Report that we must actually remove the carbon that is already in the atmosphere and do so in massive quantities, this century (p. 191 of 5th Assessment Report). This is what I called a carbon negative approach, which works for the short run. Renewable energy is the long run solution. Renewable energy is too slow for a short run resolution since replacing a $45-55 trillion power plant infrastructure with renewable plants could take decades. We need action sooner than that. For the short run we need carbon negative technologies that capture more carbon than what is emitted. Trees do that and they must be conserved to help preserve biodiversity. Biochar does that. But trees and other natural sinks are too slow for what we need today. Therefore, negative carbon is needed now as part of a blueprint for transformation. It must be part of the blueprint for Sustainable Development and its short term manifestation that I call Green Capitalism, while in the long run renewable sources of energy suffice, including Wind, Biofuels, Nuclear, Geothermal, and Hydroelectric energy. These are in limited supply and cannot replace fossil fuels. Global energy today is roughly divided as follows: 87% is fossil, namely natural gas, coal, oil; 10% is nuclear, geothermal, and hydroelectric, and less than 1% is solar power — photovoltaic and solar thermal. Nuclear fuel is scarce and nuclear technology is generally considered dangerous as tragically experienced by the Fukushima Daichi nuclear disaster in Japan, and it seems unrealistic to seek a solution in the nuclear direction. Only solar energy can be a long term solution: Less than 1% of the solar energy we receive on earth can be transformed into 10 times the fossil fuel energy used in the world today. Yet we need a short-term strategy that accelerates long run renewable energy, or we will defeat long-term goals. In the short term as the IPCC validates, we need carbon negative technology, carbon removals. The short run is the next 20 or 30 years. There is no time in this period of time to transform the entire fossil infrastructure — it costs $45-55 trillion (IEA) to replace and it is slow to build. We need to directly reduce carbon in the atmosphere now. We cannot use traditional methods to remove CO2 from smokestacks (called often Carbon Capture and Sequestration, CSS) because they are not carbon negative as is required. CSS works but does not suffice because it only captures what power plants currently emit. Any level of emissions adds to the stable and high concentration we have today and CO2 remains in the atmosphere for years. We need to remove the CO2 that is already in the atmosphere, namely air capture of CO2 also called carbon removals. The solution is to combine air capture of CO2 with storage of CO2 into stable materials such as biochar, cement, polymers, and carbon fibers that replace a number of other construction materials such as metals. The most recent BMW automobile model uses only carbon fibers rather than metals. It is also possible to combine CO2 to produce renewable gasoline, namely gasoline produced from air and water. CO2 can be separated from air and hydrogen separated from water, and their combination is a well-known industrial process to produce gasoline. Is this therefore too expensive? There are new technologies using algae that make synthetic fuel commercially feasible at competitive rates. Other policies would involve combining air capture with solar thermal electricity using the residual solar thermal heat to drive the carbon capture process. This can make a solar plant more productive and efficient so it can out-compete coal as a source of energy. In summary, the blueprint offered here is a private/public approach, based on new industrial technology and financial markets, self-funded and using profitable greenmarkets, with securities that utilize carbon credits as the “underlying” asset, based on the KP CDM, as well as new markets for biodiversity and water providing abundant clean energy to stave off impending and actual energy crisis in developing nations, fostering mutually beneficial cooperation for industrial and developing nations. The blueprint proposed provides the two sides of the coin, equity and efficiency, and can assign a critical role for women as stewards for human survival and sustainable development. My vision is a carbon negative economy that represents green capitalism in resolving the Global Climate negotiations and the North–South Divide. Carbon negative power plants and capture of CO2 from air and ensure a clean atmosphere together innovation and more jobs and exports: the more you produce and create jobs the cleaner becomes the atmosphere. In practice, Green Capitalism means economic growth that is harmonious with the Earth resources.

#### Climate change outweighs – widespread structural violence.

Schwartz 19

(Communications Information Officer at Mercy Corps, BA in Communication and Media Studies at UNC Chapel Hill), "Quick facts: How climate change affects people living in poverty", Mercy Corps, Updated 8/13/19, <https://www.mercycorps.org/articles/climate-change-affects-poverty> NS

Around the world, people are experiencing both the subtle and stark effects of climate change. Gradually shifting weather patterns, rising sea levels and more extreme weather events are all clear and devastating evidence of a rapidly changing climate. The impacts of climate change affect every country on every continent. The increased frequency and intensity of extreme weather events like hurricanes, wildfires and droughts threaten the world's food supply, drive people from their homes, separate families and jeopardize livelihoods. And all of these effects increase the risk of conflict, hunger and poverty. Visible evidence and climbing numbers demonstrate that climate change is not a distant or imaginary threat, but rather a growing and undeniable reality. The situation is dire. The latest United Nations climate change report warns that our window to address the threat is shrinking rapidly. And it's people living in poverty who have the most to lose. Read on to learn more about how climate change triggers conflict, exacerbates hunger and poverty, and what Mercy Corps is doing to help communities become more resilient in the face of change. What are the biggest effects of climate change? Who is most affected by climate change? How does climate change increase conflict? What’s the relationship between hunger and climate change? How does climate change create refugees? What’s the forecast for the future and climate change? How is Mercy Corps helping? How can I help? What are the biggest effects of climate change? Climate change places compounded stress on our environment, as well as our economic, social and political systems. Whether it comes in the form of unbearable heat waves, harsh winters or extreme weather events like Hurricane Maria in Puerto Rico or Cyclone Idai in Zimbabwe, climate change undermines development gains and leads to shortages in basic necessities like food and water. Climate change threatens the cleanliness of our air, depletes our water sources and limits food supply. It disrupts livelihoods, forces families from their homes and pushes people into poverty. Research suggests the planet has lost around one-third of its arable land over the past 40 years, in large part due to climate disasters and poor conservation, and every year more trees and soil are lost. More than 1.3 billion people live on deteriorating agricultural land, putting them at risk of depleted harvests that can lead to worsening hunger, poverty and displacement. Soil is being lost between 10 and 100 times faster than it is forming. And natural disasters are becoming increasingly frequent and destructive. The number of people affected by natural disasters doubled from approximately 102 million in 2015 to 204 million in 2016. Fewer people were affected in 2017, but at a higher price, with the year’s events costing a total of $335 billion and driving a 49 percent increase in economic losses over the previous decade. These damages can be nearly impossible for families living in poverty to overcome. As climate events worsen, people are also threatened by more gradual changes, such as climbing temperatures and declining rainfall. Droughts alone have affected more than 1 billion people in the last decade, and the damage hits the agriculture industry — the primary source of food and income for many people in developing countries — particularly hard. Between 2006 and 2016, more than 80 percent of drought damage was absorbed by agriculture, and 2017 data from the World Bank reported drought has wiped out enough produce to feed 81 million people every day for a year since 2001. As these situations grow more desperate, food shortages could also force families to leave their homes and migrate to other countries. “We see climate as a magnifier, and in many cases a multiplier, of existing underlying causes of risk.” — Sarah Henly-Shepard, Mercy Corps Senior Advisor for Climate Change and Resilience Climate change is one of many root causes of conflict around the world: it leads to food shortages, threatens people’s livelihoods, and displaces entire populations. Where institutions and governments are unable to manage the stress or absorb the shocks of a changing climate, threats to the stability of states and societies will only increase. Who is most affected by climate change? While everyone around the world feels the effects of climate change, the most vulnerable are people living in the world’s poorest countries — like Haiti and Timor-Leste — and the world’s 2.5 billion smallholder farmers, herders and fisheries who depend on the climate and natural resources for food and income. Increasingly unpredictable weather patterns, shifting seasons, and natural disasters disproportionately threaten these populations, increasing their risk and their dependency on humanitarian aid. Three out of four people living in poverty rely on agriculture and natural resources to survive. For these people, the effects of climate change — shifting weather, limited water sources and increased competition for resources — are a real matter of life and death. Climate change has turned their lives into a desperate guessing game. As the effects of climate change increase, so will their desperation. How does climate change increase conflict? Conflict is the primary cause of poverty and suffering in the world today. And it’s exacerbated by climate change. By amplifying existing environmental, social, political and economic challenges, climate change increases the likelihood of competition and conflict over resources. It can also intensify existing conflicts and tensions. In the Democratic Republic of Congo, shifts in the timing and magnitude of rainfall undermine food production and increase competition for remaining arable land, contributing to ethnic tensions and conflict. And in places like central Nigeria and Karamoja, an area of land that straddles the border of Kenya and Uganda, where resource scarcity has been a long-standing challenge, climate change has further reduced pasture and water resources, increasing competition and resulting in violence, such as cattle raiding. “Climate change is not a distant threat. It’s a driver of fragility and conflict, and it’s leading to a hungrier and more vulnerable world.” — Eliot Levine, Mercy Corps Deputy Director of Environment, Energy and Climate But while climate change can lead to conflict, it can also provide an opportunity for collaboration. These challenges present a unique opportunity for collective action and cooperation in order to mitigate the impacts. For some communities, food, health and lives will depend on cooperation over conflict. In Uganda, Mercy Corps is helping one South Sudanese refugee form a friendship without borders ▸ What’s the relationship between hunger and climate change? Climate change threatens the world's food supply. Floods and droughts brought on by climate change make it harder to produce food. As a result, the price of food increases, and access becomes more and more limited, putting many at higher risk of hunger. Undernutrition is the largest health impact of climate change in the 21st century. The number of undernourished people in the world has been increasing since 2014, reaching nearly 821 million — a staggering 11 percent of the entire global population — in 2017. The vast majority live in developing countries — research shows hunger to be particularly on the rise in South America and almost every region in Africa. More than 30 percent of people in eastern Africa faced hunger in 2017. Much of the increase is linked to the growing number of conflicts, which are often exacerbated by climate-related shocks. According to the 2019 Global Report on Food Crises, more than 113 million people in 53 countries were plunged into crisis levels of hunger in 2018; two-thirds of them were in places affected by conflict or insecurity. And climate and natural disasters alone triggered food crises for an additional 29 million people — mostly in Africa — with shocks such as drought leaving them in need of urgent assistance. How does climate change create refugees? Rising sea levels, extreme weather events and prolonged drought force millions of people to lose or move away from their homes every year in search of food, water, shelter or jobs. More than 60 percent of all new displacements last year were the result of weather-related disasters, with a total of 17.2 million people around the world being driven from their homes by shocks like drought, hurricanes and landslides — almost 50,000 people every day. Meanwhile, gradual changes brought on by deforestation, overgrazing and decreased rainfall slowly transform pastures to dust, destroy crops and kill livestock, effectively challenging the livelihoods of millions of farmers. These families are forced to leave their homes behind in search of basic necessities and new work. And as sea levels continue to rise, those living near the ocean — about 40 percent of the world’s population — will be left with no choice but to move inland. Almost all of these displacements are occurring in developing countries, where people have fewer resources on hand to cope with progressive shifts or sudden disasters.

### 5 – Structural Violence

#### Capitalism has drastically reduced structural violence by every empirical metric.

Swan 20

Josh Swan (Policy and Data Analyst for the City Region Economic and Development Institute of the University of Birmingham). “Capitalism and its Impact on Global Living Standards.” City REDI. 18 March 202. JDN. <https://blog.bham.ac.uk/cityredi/capitalism-and-its-impact-on-global-living-standards/>

Fundamentally, it must be said straight away that capitalism has been, and still is, an incredibly overwhelming positive force for the world and is easily the most successful economic system that has ever been produced. Since the time of Karl Marx, the embourgeoisement of populations has led to greater financial and social security, as well as fulfilling careers that were once reserved for the elite. With the right saving plan, many will buy their own home, start their own business, save for their pension and enjoy unprecedented levels of leisure time. Just in case you are still not convinced why this is the single greatest economic system ever invented, let us examine the past. Technology has created more jobs than it has destroyed in the colossal world population boom in the last 144 years. Work is more fulfilling as dull jobs have been automated and creative careers becoming more numerous. Incredible advances in medicine, accountancy and professional services were made under capitalism, and essential products like the television have seen a 98% fall in real-price since 1950. Some would say this is a prerequisite to materialism; the making of commodities to fulfil our happiness and needs. You may say, so what if televisions have fallen in value meaning every family, including poor families that live in a home, can afford one? This isn’t a real argument to say it is the best system in the world… this hasn’t made a huge difference to reprimanding the suffering of Humankind. Well, is it enough to say capitalism has dramatically reduced child mortality rates and vastly increased the lifespan of old age? If that was not so then how would we explain an exponential world population increase? Whilst medical science has been credited for a positive difference with these two areas, the innovative nature of capitalism and the wealth it generated was able to fund and foster scrutiny of medical ideas which led to successful research. For example, in the Soviet Union, the goal of the central planners was to “catch up with and surpass the West”. Despite the Soviet Union in 1986 having a population 14% larger than the United States, they had 73% more hospitals than the US (23,100 vs 6229), 69% more beds for patients, 48% more physicians and 99% more midwives. However, the average life expectancy was 64 and 73 for males and females in the Soviet Union compared to 71 and 78 for males and females in the United States. It may be telling that despite far fewer staff and hospitals, the United States outspent the Soviets by more than $184 billion in 1979 ($645 billion in today’s money) and the US government paid less than half this amount compared to the 92% share the Soviet Union planners contributed. Capitalism enabled the United States to mobilise and efficiently allocate its resources, as well as create far more efficient hospitals than its rival and was able to show a clear health benefit to its population as a result. Other areas of living standards have skyrocketed such as education (and female education), skills, information and social mobility. But most of all, capitalism as a form of trade and enterprise has been the engine in the immense reduction of world absolute poverty as The Guardian writes “In the past 200 years, extreme poverty has collapsed from a whopping 94% of the entire world population to less than 10% today”. 60,000 people are escaping extreme poverty every day because of trade. But if capitalism is so good, why are there huge swathes of populations still poor and suffering today? Capitalism isn’t the cause of this poverty but rather that there is a lack of capitalism that affects these areas. Government corruption, war, political instability and other structural problems prevent power being placed into the markets and operating efficiently in these areas.

### Case (ROB)

#### Industrial and post-industrial capitalism is literally the best thing that’s ever happened to education. This hijacks their pedagogy internal link to the ROB.

Grostic 16 (Director of Professional Learning, 2013 to Present Pete joined our team in the summer of 2013 after serving Kentwood Public Schools for 7 years as a High School Math teacher. He received his bachelor’s degree from Albion College, his Master’s degree in Educational Leadership and his Specialist in Education degree from Western Michigan University. As a member of our professional learning team, Pete brings a quiet confidence to his work with teachers. Our work in classroom transformation is a long journey with many ups and downs but Pete does a fabulous job of breaking down the most complex problems into their simplest forms in order to assist each teacher.), "enlightenment now: 3 ways education has improved", Curriculum By Design, NCS, 2016, https://cbdconsulting.com/enlightenmentnow/

I recently read Steven Pinker’s latest book: Enlightenment Now: The Case for Reason, Science, Humanism, and Progress. Pinker does a phenomenal job of showcasing just how far humanity has come in myriad ways. It’s well worth a read. Here’s the upshot: We live in the safest, wealthiest, and smartest time in the history of our planet. The world is better in almost every way: wealth distribution, health outcomes, social spending, wars, crime, racism, democracy, you name it. (Here’s a nice summary of the book if you’re interested, complete with the data to back up these claims.) What I really want to write about today is how education has improved. But first, a couple of quick examples that show just how far our civilization has come. Life expectancy: In the year 1800, the world’s life expectancy was 29 years (it was only 35 in the US if you’re wondering). By 2015, life expectancy had risen to 70 worldwide. Extreme poverty: Believe it or not, but in 1820, 89% of the world lived in extreme poverty. By 2015, that percentage had dropped to 10% worldwide. Pinker goes on and on with many more examples. Needless to say, we should all feel lucky to be alive here and now. There simply has never been a better time than now, despite what your nostalgia for the ’60s or ’80s might be telling you. The same can be said for education. The common narrative is that our system of education, both here in the US and worldwide, is on the decline. Well, it turns out that’s not what the facts say. Here are 3 ways that education has improved dramatically. Literacy – In the year 1500, rates of literacy were minuscule, roughly 10% of the world. By 1825, that rate had ticked up to… 11%. As of 2016, over 80% of the world is literate. That’s amazing. Basic Education – this is a measure of formal schooling. Believe it or not, only 22% of the world received some kind of formal education in 1870. In the US, that rate was much higher, but still only 80%. By 2010, over 75% of the world was educated formally; it’s nearly 100% in the US. IQ Gains – And we’re getting smarter. The average person in the world would score nearly 30 points higher on an IQ test today than they would in 1909 (that’s incredible!). Despite the narrative about diminishing US standing on test scores compared to the rest of the world, the TIMMS and NAEP assessments show that US students are getting smarter too (insofar as tests like those can actually measure intelligence). Doomsday narratives are arresting and get people’s attention. But when it comes to education, doomsday is quite far from the truth. We’re actually doing amazingly well. That isn’t to say that it’s time to kick our feet up and celebrate. All of those gains listed above came from hard work and ingenuity. There’s work left to do, to be sure. But for just a moment, feel free to zoom out and recognize just how far we’ve come.

## 2N

### Space Col Feasible & Cap Key

#### Colonization of Mars is feasible but requires investment incentive now.

Martin & Saydam 21

(BA Journalism University of Central Lancashire, Media & Content Coordinator for The University of New South Wales Serkan Saydam received his BSc, MSc and PhD degrees in Mining Engineering from the Dokuz Eylul University, Izmir, Turkey and completed his Postdoctoral Fellowship at the University of Witwatersrand, Johannesburg, South Africa. He then worked at De Beers for 3 years as project manager in Johannesburg, South Africa. Serkan joined the School of Mining Engineering as a Senior Lecturer in 2006 and was promoted to Associate Professor in 2012. Serkan then was then promoted to the Professorial role in 2017 and he is currently working as a Professor and Director of Research at the School of Minerals and Energy Resources Engineering at UNSW. A key focus of his research is to address the current needs and future challenges faced by the mining industry. These are generally very complex engineering problems, as mining environments become more extreme and constraints are imposed due to increasing social, environmental, and health and safety standards. His fields of research include ground control, mine planning & design, technology integration, new mining methods and off-Earth mining. In addition, he established research collaboration with NASA's Jet Propulsion Laboratory & Kennedy Space Center, and Luxembourg Space Agency as well more than 20 research organisations and universities globally. He has more than 250 publications and graduated 18 PhD students. Serkan is currently Fellow Member of Australian Institution of Mining and Metallurgy; President of the ISRM Commission on Planetary Rock Mechanics; Deputy Director of the Australian Centre for Space Engineering Research (ACSER) at UNSW; Deputy Secretary General and Council Member of the SOMP (The Society of Mining Professors). <https://newsroom.unsw.edu.au/news/science-tech/mars-settlement-likely-2050-says-unsw-expert-%E2%80%93-not-levels-predicted-elon-musk>, USNW Sydney Newsroom, 3/10/21, NCS, <https://newsroom.unsw.edu.au/news/science-tech/mars-settlement-likely-2050-says-unsw-expert-%E2%80%93-not-levels-predicted-elon-musk> brackets for spelling mistake

Robotic mining that can provide water and fuel is the key to developing a colony on the red planet within the next 30 years. Mars will be colonised by humans by the year 2050, as long as autonomous mining processes quickly become more commercially viable. That’s the view of Professor Serkan Saydam from UNSW Sydney in the wake of the amazing landing on Mars by NASA’s Perseverance rover. Perseverance is expected to provide answers about whether forms of life ever existed on the red planet, but it is also designed to help address the challenges of future human expeditions there. Professor Saydam, from the School of Mineral Energy Resources Engineering, says the main focus in terms of creating a colony on Mars is finding water – and being able to extract it and process it using robots before humans land. “Everything is all about water,“ Prof. Saydam says. “You use water as a life support, plus also being able to separate out the hydrogen to use as an energy source. “The process for having humans on Mars will be to set up operations, go there and produce water with robots first, and then be able to extract the hydrogen to make the energy ready before people arrive. “Innovation in robotics and autonomous systems are clearly important so that we have the water ready and the hydrogen separated and ready for when human beings land. “At the moment, we don’t have ability to do it. There are significant research efforts, specifically here at UNSW under ACSER (Australian Centre for Space Engineering Research), about the best way to do it, but there is no consensus yet. It also depends on how many people we expect to be living on Mars. Is it five, or 5000, or 50,000, or even more?“ Entrepreneur Elon Musk has claimed he’s confident there will be a city of 1 million on Mars by 2050, transported there by 1000 Starships proposed by his SpaceX venture, with plans for up to three rocket launches per day. Prof. Saydam says that may be unrealistic in the specific timeframe, but admits that demand for travel and a potential colonisation of Mars is what’s needed to drive the technological developments required. “I think the technology is ready and we already have the knowledge, but the main problem is having the focus,“ says Prof. Saydam, who is organising an International Future Mining Conference in December 2021 that will feature former NASA astronaut Pamela Melroy and Honeybee Robotics vice-president Kris Zacny. “It’s a bigger question: ‘Why don’t we do that already on earth? Why are we still using human beings for physical work in mining here?’ We have huge experience in mining, but still heavily depend on humans. “One issue is that demand is not there. For companies to get involved in developing products (for Mars missions), they need to be able to produce minerals or something that can be used for manufacturing goods and then sell it. “At the moment, everything is just a cost and there is no revenue for companies.“ However, that could be starting to change. United Launch Alliance, a joint venture between Lockheed Martin and Boeing who are heavily invested in the rockets used to launch spaceships, has publicly announced they will pay $500 per kilogram for fuel – derived from water – supplied on the moon. That rises to $3000 per kilogram if the fuel is available in a low-earth orbit. “That immediately creates a market,“ Prof. Saydam says. “Plus, if Elon Musk does what he says and puts people on the surface of Mars in 20 years, then that also creates a market. “I believe a colony on Mars is going to happen, but between 2040 and 2050 is more feasible. This could be shortened depending on the technological advances that can reduce the costs or [form] from stronger motivation. “What I think will happen is that first of all we will do these activities on the moon and have a colony there. Then we can use the moon as a petrol station to get to Mars and beyond. “But before 2050, I think we will have settlements on both the moon and Mars.“

### Space Col OW

#### Space col outweighs.

Baum 16

[Seth D. Baum, Executive Director of the Global Catastrophic Risk Institute, “The Ethics of Outer Space: A Consequentialist Perspective,” 2016, Springer, pp. 115-116, EA]

Space colonization is notable because it may be able to bring utterly immense increases in intrinsic value. Early colonies might start small, given that other planets and moons have inhospitable environments. However, it may be possible to build large indoor colonies or create more hospitable outdoor environments (i.e., terraforming). Even just on other planets and moons in the Solar System, space colonies could multiply the total area available for human habitation. And there are many more planets around other stars, as ongoing research on exoplanets is now learning. One recent study estimates 22 % of Sun-like stars have Earth-like exoplanets (Petigura et al. 2013), implying billions to tens of billions of potentially habitable planets across the galaxy. Opportunities at any given star may also be quite a bit greater than those available only on planets. Earth only receives about one two-billionth of the Sun’s radiation. To collect all the Sun’s radiation, humanity would need a Dyson swarm (named after Dyson 1960), which is a series of structures that surrounds a star, collecting its radiation to power a civilization. A Dyson swarm around the Sun could potentially enable a civilization a billion times larger than is possible on Earth. Likewise, Dyson swarms around one billion stars would bring humanity approximately 1018 (one billion–billion) times more energy per unit time. Space colonies could also increase the amount of time available for human civilization. Earth will remain habitable for a few billion more years (O’Malley-James et al. 2014). Stars will continue shining for about 1014 more years (Adams 2008). That gives us an additional 105 times more energy, for a total of 1023 times more energy than is available on Earth. After the stars fade, other energy sources may be available. And even if our current universe eventually becomes uninhabitable, it may be possible to move to other universes (Kaku 2005). The physics here is speculative, but it cannot be ruled out, and hence there is a nonzero chance of a literally infinite opportunity for space colonization (Baum 2010a). Whether the opportunity is infinite or merely, say, 1023 times larger than what can be done on Earth, the opportunity is clearly immense. As long as space colonization is an improvement (Sect. 8.3.1), then it would seem that the consequentialist should prioritize space colonization. The sooner space colonization begins, the more of its immense opportunity can be gained. Indeed, Ćirković (2002) estimates 5 × 1046 human lifetimes are lost for every century in which space colonization is delayed.

### A2 Cap Climate Contradicts Permafrost

No it doesn’t – the permafrost card assumes net zero emissions.