National Defence Défense nationale

Canadian Forces College

Collège des Forces Canadiennes

Climate Change Disinformation Warfare

Lieutenant-Commander Lance Mooney

JCSP 49

Master of Defence Studies

Disclaimer

Opinions expressed remain those of the author and do not represent Department of National Defence or Canadian Forces policy. This paper may not be used without written permission.

PCEMI n° 49

Maîtrise en études de la défense

Avertissement

Les opinons exprimées n'engagent que leurs auteurs et ne reflètent aucunement des politiques du Ministère de la Défense nationale ou des Forces canadiennes. Ce papier ne peut être reproduit sans autorisation écrite.

Canada

CANADIAN FORCES COLLEGE - COLLÈGE DES FORCES CANADIENNES

JCSP 49 - PCEMI n° 49
2022 - 2023

Master of Defence Studies – Maîtrise en études de la défense

Climate Change Disinformation Warfare

Lieutenant-Commander Lance Mooney

CLIMATE CHANGE DISINFORMATION WARFARE:
ENSURING PROFITS AT THE COST OF NATIONAL SECURITY

TABLE OF CONTENTS

LIST OF FIGURES

CLIMATE CHANGE DISINFORMATION WARFARE:
ENSURING PROFITS AT THE COST OF NATIONAL SECURITY

ABSTRACT

This paper investigated the effects of the decades long disinformation campaign waged by various carbon dioxide emitting industries, loosely disconnected interest groups and other stakeholders, by looking at both historic efforts to deny climate change and modern discourses to delay governments taking meaningful action that might impact profits. The lack of sufficient action both historically and in the present will result in significant climate driven national security impacts, a lot of which will be extremely costly and difficult to predict or prepare for. These highly damaging, ongoing and ever evolving disinformation campaigns can be compared to information warfare waged against the general public to prevent the necessary political consensus to take action, and thus a case could be made to use information operations doctrine to disseminate a counter narrative to the benefit of the global citizenship.

1. INTRODUCTION

The Russian invasion of Ukraine has brought generational change to a world that hasn't witnessed such significant state on state conflict and aggressive attack on another country's sovereignty since the end of the second world war. The significance of this attempted Russian expansion has led to major international sanctions and unprecedented military and financial aid for Ukraine. Western assistance to Ukraine has stopped short of direct military assistance or intervention due to the thinly veiled threat of nuclear response from Russia should such an intervention occur. UN Secretary General Antonio Gutteres identified that the conflict leaves humanity, "…one miscalculation away from nuclear annihilation"[1] which is a notable reason the Bulletin of the Atomic Scientists recently moved the Doomsday Clock to ninety seconds to midnight,[2] the closest it has ever been.

This movement of the clock, managed by the Bulletin's Board that includes a number of Nobel Laureates, symbolizes the potential of the myriad of threats facing humankind occurring, one of which is the existential dangers of climate change. When the clock was last moved in forward in 2020 from two minutes (120s) to one-hundred seconds a key factor in making the move was the, "[c]ontinued corruption of the information ecosphere on which democracy and public decision making depend."[3] Concerted long term disinformation campaigns by industrial interests (including oil, coal, power generation and automotive manufacturers among others), aimed at causing confusion surrounding anthropogenic climate change and thus protect their bottom line, have resulted in morphing what might have once been a manageable problem into one that seems insurmountable in 2023.

> Vested interests have generated rhetoric and misinformation that undermines climate science and disregards risk and urgency... Resultant public misperception of climate risks and polarized public support for climate actions is delaying urgent adaptation planning and implementation[4]

Notably the war in Ukraine, which has impacted world markets and increased the cost of living has also opened, "…fertile ground for the spread of mis- and disinformation, and the opportunity to further a decades-long agenda of delaying climate

---

[1] Gutteres, Antonio, 'Secretary-General's Remarks to the Tenth Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons', 1 August 2022, https://www.un.org/sg/en/content/sg/statement/2022-08-27/statement-attributable-the-spokesperson-for-the-secretary-general-the-tenth-review-conference-of-the-treaty-the-non-proliferation-of-nuclear-weapons.
[2] Mecklin, John, 'A Time of Unprecedented Danger: It Is 90 Seconds to Midnight', Bulletin of the Atomic Scientists, 24 January 2023, https://thebulletin.org/doomsday-clock/current-time/.
[3] Mecklin, John, 'Closer than Ever: It Is 100 Seconds to Midnight', Bulletin of the Atomic Scientists, 23 January 2020, https://thebulletin.org/doomsday-clock/2020-doomsday-clock-statement/.
[4] Hans Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, UK and New York, NY, USA: Cambridge University Press, 2022), 1931.

action."[5] The war has also challenged European energy security which has led countries to seek out sources other than Russia leading to an increase in natural gas exploration when the world needs to be doing the exact opposite.

While the world waits to see whether the Russian invasion of Ukraine or tensions between the US and China lead to a possible World War 3, continued lack of sufficient action on climate change will result in the exacerbation of all current global problems from inequality to increased conflict over scarce water and food resources and mass migration. This is not just the belief of committed environmentalist groups, the top three spots on the World Economic Forum's (WEF) list of top 10 global risks all can be linked to anthropometric climate change, these being Climate Action Failure, Extreme Weather and Biodiversity Loss.[6]

As it provides the latest information surrounding human emissions and impacts of climate change, it's worth summarizing some of the notable findings (of high or very high confidence) from the recently released Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment (AR6) Synthesis Report.[7] Cumulative net carbon dioxide emission from 1850 to present is 2400±10% Gigatons, with 42% of that having been released since 1990, when there was sound knowledge of the effects of greenhouse gas emissions. The cumulative total has had the effect of the global average temperature rising faster in the last 50 years than any other equivalent period in the last 2000 years. The overall CO_2 concentrations in the atmosphere are higher than at any time in the last 2 million years with concentrations of other greenhouse gasses attributed to human activities, methane and nitrous oxide being higher than any time in the last 800 000 years.

The assessment reporting contained some minor positive findings in that the rate of growth for the second decade of the 21st century was less than the first (1.3% vs 2.1%), but this was a time when net reductions of carbon emissions were needed. The reduced rate of emissions can be attributed to, "…improvements in energy intensity of GDP and carbon intensity of energy,"[8] but unfortunately ever-increasing economic growth founded on carbon dependent energy sources has resulted in continued overall increase in total emissions.

Lastly, the sources and volumes of carbon emissions varies significantly across the regions of the globe, with 35% of the population having a per capita carbon footprint of greater than 9 tons of CO_2 equivalent while 41% release less than 3 tons of CO_2 equivalent per capita. Of note, the IPCC found that the 10% of highest emitting households are responsible for 34-45% of consumption-based emissions while the least polluting 50% of the population only contribute 13-15%. Unfortunately, the portion of

---

[5] 'Deny, Deceive, Delay - Exposing New Trends in Climate Mis- and Disinformation at COP27', January 2023, 4.
[6] Chris Morris, 'World Economic Forum Lists Biggest Global Risks of 2022', 7 February 2022, https://www.nasdaq.com/articles/world-economic-forum-lists-biggest-global-risks-of-2022.
[7] Hoesung Lee et al., 'Synthesis Report of the IPCC Sixth Assessment Report (AR6) - Summary for Policymakers', Sixth Assessment Report (The Intergovernmental Panel on Climate Change, 19 March 2023), 4–5.
[8] Lee et al., 4.

the population who contribute the least emissions are those disproportionately affected by the effects of climate change. All told the level of effort required to meet this challenge varies significantly, while there needs to be caution to ensure the global poor are simultaneously lifted out of poverty into a more sustainable way of life.

Nearly all of the potential humanitarian crises that will arise due to climate change will require military intervention of some sort, whether through ever increasing Op LENTUS type deployments to assist Canadians in need, Peace Support Operations to regions further destabilized due to the effects of climate change or perhaps establishing a robust military presence along borders to staunch the inflow of climate refugees. While the military will respond to these unfortunate problems it might be worth considering whether military doctrine could be used to counter the underlying cause of the issue, the pervasive disinformation efforts by industry to ensure their profits at the expense of the broader public good.

This paper examines the history of disinformation used by industry to deny, deceive and delay action on climate change and will consider ongoing tactics to further protect the bottom line despite acknowledgement by the oil industry that anthropogenic climate change exists. The paper then provides a summary of the many ways in which the effects of climate change will impact national security. Finally, the paper will investigate whether there are parallels with Information Operations doctrine and the ongoing efforts to stall climate change and whether doctrine might be used to dispel the doubt amongst the general public and build political consensus to take the necessary actions to respond to the threat.

Terminology

It is beneficial to investigate a number of definitions or terminologies that surround the topic of both false information and climate change and set the baseline for how they will be used in this paper. The first terms to consider are Misinformation and Disinformation, both being associated with the spread of potentially harmful incorrect information. The former being done unintentionally by the disseminator[9] while the latter is attributed to the person sharing the information knowing it is incorrect and deliberately passing it on to deceive the recipient.[10] While these are relatively new terms, made all the more prevalent and impactful due to electronic means of mass distribution, parallels can be drawn between disinformation and Propaganda which from a military perspective is, "…the propagation of an idea or narrative that is intended to influence, similar to psychological or influence operations."[11]

---

[9] Deen Freelon and Chris Wells, 'Disinformation as Political Communication', *Political Communication* 37, no. 2 (3 March 2020): 149.
[10] Frederik Hjorth and Rebecca Adler-Nissen, 'Ideological Asymmetry in the Reach of Pro-Russian Digital Disinformation to United States Audiences', *Journal of Communication* 69, no. 2 (1 April 2019): 168.
[11] Catherine A Theohary, 'Defense Primer: Information Operations', *Congressional Research Service*, 15 December 2020, https://apps.dtic.mil/sti/pdfs/AD1169650.pdf.

A report prepared for the 2022 Conference of Parties (COP26) in Glasgow that looked at disinformation surrounding that meeting provided definitions and some explanation surrounding the following terms[12]:

- Climate Denial – The outright denial that climate change exists including the contributing sources and impacts. The narratives that climate change is a hoax, there has been no increase in global temperatures, that it's an entirely natural process and thus not driven by human greenhouse emissions can all be considered climate denial.

- Climate Skepticism – That strategy that leverages the inherent uncertainty surrounding the scientific method to build skepticism of consensus on climate change, including attacking the credibility of climate scientists and research institutions (epistemic skepticism). Also includes efforts to convince that action is unnecessary or that nothing can be done to mitigate the impacts of climate change (response skepticism).

- Delayism – Modern approach by industry where stakeholders acknowledge the anthropogenic climate change exists but justify inaction or inadequate efforts by arguing that sufficient action isn't being taken by others, bringing increased attention to detrimental economic impacts of social policy or raising doubts that suitable action isn't even possible.

- Lukewarmerism – The belief that while human caused climate change exists, the threat is exaggerated, that there may even be benefits from a warming climate and that those calling for significant action are 'alarmist'.

The term Climate Alarmism can be interpreted to mean efforts to exaggerate the human contributions and / or the possible impacts of anthropogenic climate change to spur greater action. While Treen et al posit that the concept has the potential to be used to misinform from an opposite ideological position than climate change denial, the amount of literature suggesting this is being done is negligible.[13] A brief scan of academic search results for the term seems to indicate that it is more readily used for skepticism purposes to generate the narrative that proponents of action on climate change are being overly dramatic and therefore should not be taken seriously.

The last few terms worth summarizing are related to how false information is readily shared in cyberspace and thus contributes to narratives limiting action on climate change becoming so pervasive. The first term, Spammers (sometimes referred to as Sock

[12] 'Deny, Deceive, Delay - Documenting and Responding to Climate Disinformation at COP26 and Beyond', June 2022, 2, https://www.isdglobal.org/wp-content/uploads/2022/06/Summative-Report-COP26.pdf.
[13] Kathie Treen, Hywel Williams, and Saffron O'Neill, 'Online Misinformation about Climate Change', *WIREs Climate Change* 11, no. 5 (September 2020): 4.

Puppets[14]) are humans who generate fake profiles on social networks or online news comment boards and spread false information either knowingly (dis) or unknowingly (mis).[15] Bots refers to fully automated fake accounts that run algorithms to share, retweet, like, etc. certain accounts or posts making the desired information appear to have greater consensus among the general population than it actually does.[16] Lastly, Crowdturfers (or Astroturfers in some papers) is a term that appears to have developed within the climate change information space and refers to the coordinated efforts of large groups of people online (perhaps paid) to spread particular information to make it look like there is a grassroots initiative on a particular topic with the aim of swaying search engine results.[17]

2. HISTORY OF CLIMATE CHANGE DISINFORMATION

By design, disinformation surrounding climate change, with the aim of delaying necessary action, is confusing and difficult to investigate, therefore it's useful to have a bit of a framework within which to organize some of the history of the subject. Research published by Björnberg et al in 2017[18] looking at 161 articles on environmental and climate science denial, builds on previous work[19] to provide one useful framework with four variants of denial which are:

1. Trend denial (no significant warming is taking place);
2. Attribution denial (it is not anthropogenic);
3. Impact denial (it will not have significant negative impact);
4. Consensus denial (there is no consensus among climate scientists about anthropogenic climate change).

With the lens of denial variants to help frame the issues, the paper will now provide a historical summary of the efforts put forward to sow doubt around anthropogenic climate change. The heat absorbing and radiative properties of CO_2 was

---

[14] Spencer McKay and Chris Tenove, 'Disinformation as a Threat to Deliberative Democracy', *Political Research Quarterly* 74, no. 3 (1 September 2021): 706.
[15] Steve Webb, James Caverlee, and Calton Pu, 'Social Honeypots: Making Friends With A Spammer Near You.', in *CEAS* (San Francisco, CA, 2008).
[16] Robert Faris, Hal Roberts, and Yochai Benkler, *Network Propaganda - Manipulation, Disinformation and Radicalization in American Politics*, Book, Whole (New York, US: Oxford University Press, 2018), 243.
[17] Kyumin Lee, Prithivi Tamilarasan, and James Caverlee, 'Crowdturfers, Campaigns, and Social Media: Tracking and Revealing Crowdsourced Manipulation of Social Media', *Proceedings of the International AAAI Conference on Weblogs and Social Media* 7, no. 1 (2021).
[18] Karin Edvardsson Björnberg et al., 'Climate and Environmental Science Denial: A Review of the Scientific Literature Published in 1990–2015', *Journal of Cleaner Production* 167 (2017).
[19] Stefan Rahmstorf, 'The Climate Sceptics', *Weather Catastrophes and Climate Change*, 2004, 76–83; Anita Engels et al., 'Public Climate-Change Skepticism, Energy Preferences and Political Participation', *Global Environmental Change* 23, no. 5 (2013).

first noted in the mid-1800s by American amateur scientist Eunice Foote when she experimented with various gasses and even hypothesized that the Earth was much warmer in the past when concentrations of these gasses were higher.[20] In conducting detailed calculations to determine how CO_2 affected the earth's temperature, Swedish researcher Svante Arrhenius determined in 1896 that halving the concentration of carbon dioxide would result in a temperature drop of around 5°C. He further postulated that a doubling would see an equivalent temperature rise and estimated that CO_2 levels could rise about 50% in 3000 years due to the burning of coal and thus is believed to be the first person to identify that human action could impact the earth's temperature. Notably, Arrhenius' hypothesis was challenged from the start due to the oversimplification of his modelling (despite being quite detailed for the time) and with theories that the oceans and plant life would absorb any additional CO_2, a narrative that would endure in the misinformation space.[21]

The potential threat of global warming was known by modern industry at least as early as 1965 when US President Lyndon Johnson's science advisory committee first raised concern about the phenomenon, information that was then relayed as a warning to industry members by the American Petroleum Institute (API).[22]

Detailed reporting in 2015 uncovered that Exxon knew that carbon dioxide from the burning of fossil fuels would cause the planet to warm and without mitigation could pose a significant danger to life on earth.[23] Internal correspondence from Exxon's Research and Engineering division shows that the company knew about the greenhouse effect at the most senior levels as early as July of 1977 when the concept was presented to the Corporate Management Committee. A written version of that and another presentation that was generated in June 1978[24] shows that Exxon knew that CO_2 in the atmosphere was increasing due to fossil fuel combustion and that the gas contributed to warming of the earth's atmosphere. The correspondence also indicates that Exxon's internal modelling, though immature and not accounting for all feedback interactions, predicted a 2°C to 3°C rise in temperatures over most of the earth with a rise of 2 to 3 times that at the poles.

Notably Exxon initially used this information to fund significant research into the effects of CO_2 on the environment to better understand the impacts and opportunities on

---

[20] Amara Huddleston, 'Happy 200th birthday to Eunice Foote, hidden climate science pioneer', 17 July 2019, http://www.climate.gov/news-features/features/happy-200th-birthday-eunice-foote-hidden-climate-science-pioneer.

[21] Ian Sample, 'The Father of Climate Change', *The Guardian*, 30 June 2005, sec. Environment, https://www.theguardian.com/environment/2005/jun/30/climatechange.climatechangeenvironment2.

[22] Benjamin Franta, 'Early Oil Industry Knowledge of CO2 and Global Warming', *Nature Climate Change* 8, no. 12 (2018).

[23] Neela Banerjee, Lisa Song, and David Hasemyer, 'Exxon's Own Research Confirmed Fossil Fuels' Role in Global Warming Decades Ago', *Inside Climate News*, 16 September 2015, https://insideclimatenews.org/news/16092015/exxons-own-research-confirmed-fossil-fuels-role-in-global-warming/.

[24] Black, James, 'The Greenhouse Effect' (Exxon Research and Engineering Company, 6 June 1978), https://www.climatefiles.com/exxonmobil/1978-exxon-memo-on-greenhouse-effect-for-exxon-corporation-management-committee/.

operations. A lot of this research was conducted in conjunction with independent researchers and even included published papers detailing the significant climactic changes the projected increases in temperature would bring. It wasn't until the late 1980s when serious discussion about legislation to curb emissions along with a decline in oil prices that cut into Exxon's bottom line that the company pivoted to efforts to sow doubt around the science of climate change.[25]

A second internal memo from Exxon from the early 1980s[26] provides additional granularity on the company's predictions regarding temperature rise. The correspondence also provides a summary of the potential consequences that were being discussed in the broader scientific community ranging from increased rainfall / drought through to catastrophic sea level rise due to melting of the Antarctic ice sheet and notes that by the time the warming is perceptible, it might not be reversible. Notably, and perhaps messaging that was justified at the time, the executive summary of the document includes language that can be considered to set the tone for both impact and consensus denial efforts going forward:

> Making significant changes in energy consumption patterns now to deal with this potential problem amid all the scientific uncertainties would be premature in view of the severe impact such moves could have on the world's economies and societies.[27]

Additional internal documents from the late 1980s, drafted by Exxon spokesperson Joseph Carlson, asserts that the greenhouse effect could, "…be one of the most significant environmental issues for the 1990s,"[28] and acknowledges that fossil fuel combustion is the main contributor to greenhouse gasses. The memorandum goes on to highlight the scientific uncertainty surrounding the climate modelling at the time, which was all part of reasoned scientific method. The document recommends that Exxon take a position that emphasizes this uncertainty (*consensus denial*) and urges a balanced scientific approach, meaning equal attention being paid to both sides of the argument regardless of whether scientific consensus leans more heavily in one direction.

Directly calling out the position taken by Exxon in these historic documents, a highly sighted 2017 paper[29] by Harvard Department of the History of Science researchers compared peer-reviewed internal scientific research funded by the oil company, that clearly proved the anthropogenic origins and significance of climate change, against

---

[25] Banerjee, Song, and Hasemyer, 'Exxon's Own Research Confirmed Fossil Fuels' Role in Global Warming Decades Ago'.
[26] Glaser, M.B., 'CO2 "Greenhouse Effect"' (Exxon Research and Engineering Company, 12 November 1982), https://www.climatefiles.com/exxonmobil/1982-memo-to-exxon-management-about-co2-greenhouse-effect/.
[27] Glaser, M.B., 2.
[28] Carlson, Joseph, 'The Greenhouse Effect' (Exxon, 3 August 1988), 2, https://www.climatefiles.com/exxonmobil/566/.
[29] Geoffrey Supran and Naomi Oreskes, 'Assessing ExxonMobil's Climate Change Communications (1977-2014)', *Environmental Research Letters* 12, no. 8 (2017).

advertorials (paid, editorial style advertisements) that aimed to discredit and cause doubt on similar research being conducted in the public realm. In this paper and an addendum published in 2020,[30] Supran and Oreskes determined with a high degree of confidence that ExxonMobil deliberately misled the public.

In a more recent paper,[31] Supran and fellow researchers Rahmstoff and Oreskes built on their previous work to quantitatively assess the research conducted by ExxonMobil scientists between 1977 and 2003 and found that "...most of their projections accurately forecast warming that is consistent with subsequent observations."[32] Supran et al also found that ExxonMobil generated and buried scientific data that contradicted some of the common climate change disinformation strategies including that the world was actually cooling and would enter a mini ice age (impact denial) and that there was uncertainty about when the effects of anthropogenic climate change would be observed.

> ExxonMobil worked to deny it—including overemphasizing uncertainties, denigrating climate models, mythologizing global cooling (*trend denial)*, feigning ignorance about the discernibility of human-caused warming (*attribution denial)*, and staying silent about the possibility of stranded fossil fuel assets in a carbon constrained world.[33]

In addition to oil and gas, the coal industry knew about the ability of CO_2 emissions to warm the atmosphere as early as 1966.[34] A 1966 article in the Mining Congress Journal identified that as, "…the CO_2 envelope reduces radiation, the temperature of the earth's atmosphere will increase and that vast changes in the climates of the earth will result."[35] The article goes on to posit that the melting of the polar ice caps will cause sea levels to rise inundating cities like New York and London. Unsurprisingly, large automakers like Ford and GM had internal scientists raising warnings to senior executives about the effects of CO_2 and the impact on earth's climate in the 1970s, information these companies purposefully ignored increasing the size and thus emissions of their product instead.[36]

Industry groups representing electrical power generating utilities have known about the possibility of anthropogenic climate change since as early as 1968 when the US President's science advisor briefed an industry convention on the threat of CO_2. At least

---

[30] Geoffrey Supran and Naomi Oreskes, 'Addendum to "Assessing ExxonMobil's Climate Change Communications (1977-2014)"', *Environmental Research Letters* 15, no. 11 (2020).
[31] Geoffrey Supran, S. Rahmstoff, and N. Oreskes, 'Assessing ExxonMobil's Global Warming Projections', *Science* 379, no. 6628 (2023).
[32] Supran, Rahmstoff, and Oreskes, 1.
[33] Supran, Rahmstoff, and Oreskes, 0.
[34] Young, Elan, 'Coal Knew, Too', *Huffpost*, 22 November 2019, https://www.huffpost.com/entry/coal-industry-climate-change_n_5dd6bbebe4b0e29d7280984f.
[35] Garvey, James, 'Air Pollution and the Coal Industry', *Mining Congress Journal* 25, no. 8 (August 1966).
[36] Winters, Joseph, 'Ford and GM Knew about Climate Change - and Covered It up for Decades', *Grist*, 27 October 2020, https://grist.org/climate/ford-and-gm-knew-about-climate-change-and-covered-it-up-for-decades/.

one major industry group, the Edison Electric Institute (EEI), even coordinated funding from various electric utilities to conduct more in-depth research into the effects of CO_2. Despite knowledge from various sources about the impacts of climate change, these industry groups decided in the late 1980s to transition to sowing doubt around the scientific consensus of climate change, including EEI leading an ad campaign that aimed to frame global warming as more theoretical than it was (*consensus denial*).[37]

In what could be considered one of the most significant historical records of the oil and energy industry's early concerted efforts to counter global initiatives to respond to anthropogenic climate change, a group led by the API drafted a comprehensive action plan in response climate change actions agreed to in Kyoto, Japan in December 1997. The Global Science and Communications Action Plan (referred to as the Plan below) was generated with input from industry (Exxon, Chevron, Southern Company, etc.) and think tanks (Science and Environmental Policy Project, Americans for Tax Reform, etc.) and set out specific actions to take to leverage the uncertainty surrounding climate change to their benefit.[38] The situational analysis at the beginning of the Plan highlights that the Clinton Administration agreed to the Kyoto Protocol despite there not being consensus that climate change was real and that opposing scientific views had not been provided a suitable level of attention.

The basic premise underlying the Plan that there was no consensus is incorrect as research in 2004 that looked at 928 abstracts from reviewed scientific journals surrounding this period found that 75% fell into a category that accepted a consensus view that climate change exists and is human caused with the remaining papers taking no position and none disagreeing on the consensus.[39] Further research conducted in 2013 looked at a broader sample of nearly 12 000 abstracts with the topic of climate change or global warming and found that of those that expressed a clear position on global warming, over 97% attributed it to anthropogenic origins with only a very small (and diminishing over time) number of papers rejecting human causes.[40]

As the foundation of the Plan is formed around scientific uncertainty, it's important to define the term. In common language, uncertainty can be defined as, "the state of being uncertain; doubt; hesitancy,"[41] about a subject or topic. From a scientific perspective uncertainty, "…conveys the degree to which something is known."[42] The difference in meaning of the word uncertainty in science and general use was found to be

---

[37] 'Utilities Knew: Documenting Electric Utilities' Early Knowledge and Ongoing Deception on Climate Change From 1968-2017', *Energy and Policy Institute* (blog), accessed 31 January 2023, https://www.energyandpolicy.org/utilities-knew-about-climate-change/.
[38] Walker, Joseph et al., 'Global Climate Science Communications - Action Plan', 3 April 1998, https://www.climatefiles.com/trade-group/american-petroleum-institute/1998-global-climate-science-communications-team-action-plan/.
[39] Naomi Oreskes, 'The Scientific Consensus on Climate Change', *Science* 306, no. 5702 (3 December 2004).
[40] John Cook et al., 'Quantifying the Consensus on Anthropogenic Global Warming in the Scientific Literature', *Environmental Research Letters* 8, no. 2 (May 2013).
[41] 'Definition of Uncertainty | Dictionary.Com', www.dictionary.com, accessed 26 February 2023, https://www.dictionary.com/browse/uncertainty.
[42] 'Scientific Uncertainty', *Nature Climate Change* 9, no. 11 (1 November 2019).

used in popular press articles about global warming to form a boundary of sorts between the general public and climate scientists, contributing to a lack of consensus on the issues and thus limited political will to act.[43] As science will never state that something is definitively known, there will always be an element of uncertainty, but this does not mean there can't be broad consensus on a topic, as there is with climate change. The tactic of using scientific uncertainty to significantly delay legislative action on any number of issues until the science is 'proven' has been proposed as an aptly named political-economic tactic, Scientific Certainty Argumentation Methods,[44] a term that has unfortunately not picked up significant traction within the scientific community.

The Plan built on the idea that the theories at the heart of global climate change had not been suitably challenged and set out the goal to both ensure the Kyoto protocol isn't endorsed by American law makers and that, "...there are no further initiatives to thwart the threat of climate change."[45] The language in the Plan demonstrates a nefarious approach to protecting the vested interests of the organizations its drafters represent, including building relationships with scientists working in the climate field that support, "...**our position**," and looking for opportunities to, "...maximize the impact of scientific **views consistent with ours** with Congress, the media and other key audiences."[46] While purporting to have the aims of providing a more balanced view of the independent science surrounding climate change the Plan very clearly identifies promoting a one sided, guided view of the subject including identifying and recruiting and training less well known scientists to contribute to media outreach.

Most worrying is a section of the plan titled "Victory Will be Achieved When" that includes a number of concerning bullet points such as (quotation marks taken directly form the document):

- Average citizens [and the media] "understand" (recognize) uncertainties in climate science; recognition of uncertainties becomes part of the "conventional wisdom"

- Media coverage reflects balance on climate science and recognition of the validity of viewpoints that challenge the current "conventional wisdom"

- Those promoting the Kyoto treaty on the basis of extant science appear to be out of touch with reality.[47]

---

[43] Stephen C. Zehr, 'Public Representations of Scientific Uncertainty about Global Climate Change', *Public Understanding of Science* 9, no. 2 (1 April 2000).
[44] William R. Freudenburg, Robert Gramling, and Debra J. Davidson, 'Scientific Certainty Argumentation Methods (SCAMs): Science and the Politics of Doubt', *Sociological Inquiry* 78, no. 1 (18 January 2008).
[45] Walker, Joseph et al., 'Global Climate Science Communications - Action Plan', 3.
[46] Walker, Joseph et al., 6.
[47] Walker, Joseph et al., 3.

While the Plan identified funding envelopes of over $6 million directed to 4 detailed strategies, including the establishment of a Global Climate Science Data Center, all with the aim of disrupting consensus prior to the UN Climate Conference in Buenos Aires in late 1998, it's not clear whether the Plan was officially implemented. Regardless of the status though, the tactics and strategies set out in the document clearly formed the basis of industrial efforts to confuse the general public, erode consensus and stymie necessary action to combat climate change for the decades to follow.

Further Denial Variant Discussion

While the Plan clearly set out ambitious plans to put considerable efforts towards consensus denial, it's worth exploring the other denial variants a bit further. Trend denial, that no significant warming is taking place, is in the modern era of misleading information the least common of the denial categories.[48] It's use historically though formed the foundation for the political narrative discouraging taking suitable action on climate change. Jacques et al looked at nearly 150 English language books published between 1972 and 2005 that took an environmentally skeptical stance and found that over 90% were generated by conservative think tanks with the aim of countering a growing environmental movement.[49] Through analysis of the contents of the books and the political climate in the US during the time these sources were published, it was determined that they, "...contributed to the decline of US support for environmental protection in [the preceding decade]."[50] That the early efforts of trend denial are solidified in the belief system of specific populations is reinforced by further research that found overall levels of denial increased in the first decade of the 21st century and that conservative white males are most likely to espouse views that climate change is not something to be concerned about through a phenomenon called identity-protective cognition.[51] "[The] relevant literature suggests that the campaign to deny the reality and significance of anthropogenic climate change has been a crucial factor contributing to the current policy stalemate."[52]

Attribution denial (or skepticism) as a category is attributed to Rahmstorf[53] and includes those persons who ascribe to the idea that while the earth's climate may be changing, it's not due to human activities. An early contributing idea to this category was that CO_2 was being released by the world's oceans, something that has been completely debunked[54] with the opposite being true that the oceans are absorbing carbon to the detriment of marine vegetation. A further theory espoused by those who deny that

---

[48] Aaron M. McCright, 'Anti-Reflexivity and Climate Change Skepticism in the US General Public', *Human Ecology Review* 22, no. 2 (2016).
[49] Peter J. Jacques, Riley E. Dunlap, and Mark Freeman, 'The Organisation of Denial: Conservative Think Tanks and Environmental Scepticism', *Environmental Politics* 17, no. 3 (1 June 2008).
[50] Jacques, Dunlap, and Freeman, 351.
[51] Aaron M. McCright and Riley E. Dunlap, 'Cool Dudes: The Denial of Climate Change among Conservative White Males in the United States', *Global Environmental Change* 21, no. 4 (1 October 2011).
[52] Riley E. Dunlap and Robert J. Brulle, *Climate Change and Society: Sociological Perspectives* (Oxford University Press, 2015), 302.
[53] Rahmstorf, 'The Climate Sceptics'.
[54] Roger Revelle and Hans E. Suess, 'Carbon Dioxide Exchange between Atmosphere and Ocean and the Question of an Increase of Atmospheric CO2 during the Past Decades', *Tellus* 9, no. 1 (1957).

human activity is at the heart of climate change is that CO_2 does not lead to warming as atmospheric bands are saturated to the point that further re-emission of infrared energy[55] back to earth isn't possible.[56] The primary idea used to propagate attribution denial is that there are other natural phenomenon causing warming including volcanic activity and variations in solar radiation. While it is true solar and volcanic activity do influence the earth's atmosphere, extensive scientific research into their impact has found that they are, "...much smaller than the estimated radiative force due to anthropogenic changes."[57] While there are still some think tanks or institutions that continue to distribute small amounts of propaganda pushing the attribution narrative, it has generally been debunked to the extent that it's no longer an effective delaying tactic.

As an example of an organization that continues to employ these tactics, the Heartland Institute recently aimed at discrediting climate science by distributing eight thousand copies of a book it produced "Climate at a Glance" to secondary schools across the United States. Statements from the institute indicate that the book provides data to show that the impact of any potential change to the climate is not significant and that the information is being provided to supplement existing material the teachers are using. Fortunately, previous similar and much larger book distributions in 2017 (350k copies) seem to have been sufficiently ineffective, with most teachers choosing instead to use them to teach about disinformation, that Heartland committed a much more modest effort in this instance.[58]

Impact denial, or perhaps more broadly uncertainty about how climate change will impact humans, other species and the natural environment, is more prevalent than the previously discussed forms of denial. Studies looking at the UK, which has a broader societal consensus regarding the need to take action to counter climate change, found that even amongst those that agree human activities are modifying the climate, there is confusion about what, or how significant, the impacts might be.[59] While it's easy to understand how there can be doubt surrounding the possible impacts of anthropogenic climate change, given the extremely long timeframe surrounding when these effects will be encountered, the concern is that this uncertainty is leveraged by those that benefit from inaction. The climate skeptics that push impact denial as a means of delaying action on climate change tend to highlight the potential positive consequences of a warmer climate, such as increased arable at higher latitudes, but tend to ignore the rapidity at which these changes will take place, especially from the perspective of a society with infrastructure and systems very much built for the current climate.[60]

---

[55] Sarah Fecht, 'How Exactly Does Carbon Dioxide Cause Global Warming?', *State of the Planet* (blog), 25 February 2021.
[56] Rahmstorf, 'The Climate Sceptics', 78.
[57] Lesley J. Gray et al., 'Solar Influences on Climate', *Reviews of Geophysics* 48, no. 4 (2010): para. 164.
[58] Blanca Begert, 'Climate Denial Campaign Goes Retro with New Textbook', Grist, 6 February 2023, https://grist.org/science/climate-denial-campaign-goes-retro-with-new-textbook/.
[59] Wouter Poortinga et al., 'Uncertain Climate: An Investigation into Public Scepticism about Anthropogenic Climate Change', *Global Environmental Change* 21, no. 3 (2011): 1020.
[60] Rahmstorf, 'The Climate Sceptics', 79.

A further strategy of those that seek to misinform the broader public through impact denial is to make the case that the high-level science surrounding climate change, including documents like the International Panel on Climate Change (IPCC) reports, exaggerate the potential impacts of climate change.[61] Beyond being simply misleading, these actions have been found to have potential secondary detrimental effects. As the science underpinning the knowledge of climate change is constantly scrutinized it becomes biased by the Asymmetry of Scientific Challenge, which means that scientists become more cautious about the results they publish.[62] From a climate change perspective this would mean that the effects of climate change in the future could be worse than what is currently being predicted. In a similar vein, groups like the Heartland Institute's extreme propaganda contributes to the radical flank effect, which means by espousing more extreme positions with respect to disinformation on climate change, more moderate yet still misinforming positions can be found to be more plausible.[63]

While the use of tactics of outright denial surrounding climate change have waned in recent years, the long term damage caused by these efforts persist and will be very difficult to reverse. Treen et al in there 2020 literature review about online misinformation and climate change highlight that a significant number of researchers have posited that the doubt created by misinformation surrounding climate change has directly contributed to lack of support for the necessary political action to enact mitigation policies. The paper goes on to identify that there are a smaller number of researchers that do not believe that clearer information for the electorate would lead to broader motivation to implement the significant policy changes required to mitigate climate change, proposing the debate is closer to politics than science at this point.[64]

3. CLIMATE CHANGE DENIAL STAKEHOLDERS

Having considered some of the historical strategies used to prevent action in response to climate change from a denial framework the paper will now review the interests and efforts of the key players in the misinformation space. Björnberg et al in looking at who denies climate change introduced six categories (with some overlap) of actors[65] that provide a further useful framework in discussing historic and ongoing efforts to mislead. These categories of actors are:

- Scientists;
- Governments;
- Think tanks, institutes and lobbyists (referred to as Political and Religious organizations by Björnberg et al);

---

[61] William R. Freudenburg and Violetta Muselli, 'Reexamining Climate Change Debates: Scientific Disagreement or Scientific Certainty Argumentation Methods (SCAMs)?', *American Behavioral Scientist* 57, no. 6 (1 June 2013).
[62] John Cook et al., 'America Misled - How the Fossil Fuel Industry Deliberately Misled Americans about Climate Change', October 2019, 4.
[63] Begert, 'Climate Denial Campaign Goes Retro with New Textbook'.
[64] Treen, Williams, and O'Neill, 'Online Misinformation about Climate Change', 9.
[65] Björnberg et al., 'Climate and Environmental Science Denial: A Review of the Scientific Literature Published in 1990–2015'.

- Industry (often coal and oil extraction, but also steel, mining and automotive);
- Media (particularly those with right wing affiliation);
- Public (particularly conservative white males).

Scientists

While the vast majority of peer reviewed scientific literature (over 99%[66]) agrees that anthropogenic climate change exists, there remains a small group of scientists that undermine efforts to take the necessary action. These efforts are often quite subtle, research investigating over 170 blogs found efforts by scientists to make existing climate research more accessible, but while doing so re-interpreting the results to enable doubt in a climate skeptical audience.[67]

Notably, while conducting research for this paper a number of what could be considered misleading scientific papers[68] were discovered as 'Recommended Articles' listed directly alongside reputable peer reviewed sources found through CFC's recommended search tool Summon. At first glance, these articles appear to be legitimate, especially due to their having been sourced through reputable academic sources. The lack of, or limited, cited references is the key identifier of their questionable integrity, but the papers serve their purpose as both a 'scientific' source for a counter narrative directed at a non-discerning audience and to muddy the waters of scientific debate.

> There have always been experts willing to back up a 'profitably mistaken viewpoint'; there have always been efforts 'to cover the issue in a thick fog of sophistry and uncertainty' and to 'unearth yet one more reason why the status quo is best for us'[69]

While the primary reason for scientists to promote the narrative that climate change is not a concern is that they work for think tanks like the Marshall Institute in the

---

[66] Mark Lynas, Benjamin Z Houlton, and Simon Perry, 'Greater than 99% Consensus on Human Caused Climate Change in the Peer-Reviewed Scientific Literature', *Environmental Research Letters* 16, no. 11 (19 October 2021).
[67] Amelia Sharman, 'Mapping the Climate Sceptical Blogosphere', *Global Environmental Change* 26, no. Journal Article (2014).
[68] Jon Austin, 'Global Warming "Is FAKE": Volume of Ice Caps Is INCREASING, Claims Top Geologist', *Express (Online)*, 7 October 2015; Tom Bethell, 'The False Alert of Global Warming', *The American Spectator* (Bloomington: American Spectator, May 2005); Patrick J Buchanan, 'Global Warming: Hoax of the Century', *Human Events* (Washington: Human Events Publishing, Inc., 8 March 2010); Ed Hiserodt and Rebecca Terrell, 'Is Global Warming a Hoax?', *The New American* (Appleton: The New American, 5 January 2015); Andrew McIntyre and Chris Berg, 'WAKE UP: THEY'RE MISLEADING YOU', *Review - Institute of Public Affairs* 57, no. 1 (March 2005).
[69] Hjorth and Adler-Nissen, 'Ideological Asymmetry in the Reach of Pro-Russian Digital Disinformation to United States Audiences', 37–38.

US[70] or the Institute for Public Affairs in Australia,[71] there exist other motivators for contrarian scientists. The dwindling few scientists questioning the majority are predominantly experts outside the field of climate science (physicists or meteorologists) who take the opposing view in response to shifting research focus and funding that sees their role being reduced.[72]

Governments

As mentioned, various disinformation efforts have had the effect of preventing sufficient public political will to accept policy change that would counter climate change, thus limiting options for the politicians. Politicians themselves and the governments they lead are also culpable in spreading the narrative dismissing action on climate change.

The US Supreme Court's Citizens United decision in early 2010, whereby they removed legislation that prevented unlimited elections spending by corporations or special interest groups, can be considered a critical turning point in the fight against climate change by the country most responsible for cumulative historic levels of CO_2 emissions.[73] Prior to 2010 there was bipartisan acknowledgement of the threat of climate change and various legislative efforts underway to combat the issue as demonstrated by the We Can Solve It advertisement that aired in 2006 featuring Democratic and Republican Speakers of the House.[74] A drastic change was observed in the 2012 presidential elections where funding from fossil fuel interests surged in support of the Republican challenger and attacks on the incumbent president's record on energy issues. In total, industry spending on advertising bested that spent by clean energy advocates by a factor of 4, a sharp contrast from the 2008 election.[75]

Politicians sometimes get in the way of taking action to counter climate change despite there being strong public opinion in favor of it as was the case with conservative Prime Ministers Stephen Harper of Canada and John Howard of Australia. Both leaders, likely influenced by fossil fuel lobbying, spent their terms acknowledging climate change but acting in an impact skeptical manner to take minimal action.[76] Leading the US around the same period, George Bush junior's administration significantly undermined

---

[70] Dieter Plehwe, 'Think Tank Networks and the Knowledge–Interest Nexus: The Case of Climate Change', *Critical Policy Studies* 8, no. 1 (2014).
[71] Elaine McKewon, 'Talking Points Ammo: The Use of Neoliberal Think Tank Fantasy Themes to Delegitimise Scientific Knowledge of Climate Change in Australian Newspapers', *Journalism Studies* 13, no. 2 (2012).
[72] Myanna Lahsen, 'Experiences of Modernity in the Greenhouse: A Cultural Analysis of a Physicist "Trio" Supporting the Backlash against Global Warming', *Global Environmental Change* 18, no. 1 (2008).
[73] Hannah Ritchie, Max Roser, and Pablo Rosado, 'CO_2 and Greenhouse Gas Emissions', *Our World in Data*, 11 May 2020.
[74] 'WeCanSolveIt.Org Ad - Gingrich & Pelosi', POLITICO, 13 May 2011, https://www.politico.com/video/2011/05/wecansolveitorg-ad-gingrich-pelosi-018436.
[75] Eric Lipton and Clifford Krauss, 'Fossil Fuel Ads Dominate TV In Campaign', *New York Times*, 14 September 2012, Late Edition (East Coast) edition, 1039308607, https://www.nytimes.com/2012/09/14/us/politics/fossil-fuel-industry-opens-wallet-to-defeat-obama.html.
[76] Nathan Young and Aline Coutinho, 'Government, Anti-Reflexivity, and the Construction of Public Ignorance about Climate Change: Australia and Canada Compared', *Global Environmental Politics* 13, no. 2 (2013).

any efforts to combat climate change, often allowing fossil fuel funded think tanks to directly provide input on policy. The Bush government espoused consensus denial ideas throughout and suppressed government scientific work that went counter to these efforts,[77] something the Harper government was known to do as well.[78]

The Trump administration did significant damage to efforts to reduce emissions and tackle climate change. Just one early example was employing Myron Ebell, an impact denialist who ran the anti-climate campaign of the Competitive Enterprise Institute (CEI) that consistently opposes legislation to limit carbon pollution, as the transition team lead for the Environmental Protection Agency (EPA).[79] The list of regressive actions taken under President Trump's leadership is lengthy, but perhaps most concerning is the significant resurgence of denial efforts in the US during his tenure and unfortunately other Republican presidential front runners appear to benefit from taking a stance denying science in which climate change is a key target.[80]

The other branches of US government, including the judiciary, have been influenced by industry to get in the way of effective action on climate change. In 2015 President Obama's administration set out a comprehensive Clean Power Plan that included significant measures to reduce demand through efficiency while incentivizing alternative forms of power generation. Despite taking industry comments into account while developing the new law, when it was released, a group consisting of twenty-seven states, coal producers, electrical utilities and various business interests sued the Environmental Protection Agency to stop the implementation of the plan. In what was an unprecedented act the US Supreme Court, with a conservative majority at the time, stayed the implementation of the Clean Power Plan without any other single court adjudicating on its merits.[81]

Think Tanks, Institutes and Lobbyists

Carbon emitting industries have several trade associations to represent their interests in politics through lobbying. One of the first and most obtrusive, the Heartland Institute was founded in 1984 and through its first couple of decades received hundreds of thousands of dollars from fossil fuel companies and the billionaire Koch brothers. As blatantly denying climate change became no longer desirable, direct funding from big oil dried up by 2007, though the institute still received millions of donations from undisclosed donors and continue to utilize proven, yet debunked, messaging.[82] More

---

[77] Riley E. Dunlap and Aaron M. McCright, 'Organized Climate Change Denial', *The Oxford Handbook of Climate Change and Society* 1 (2011): 154.
[78] Chris Turner, *The War on Science: Muzzled Scientists and Willful Blindness in Stephen Harper's Canada* (Greystone Books Ltd, 2013).
[79] Nell Greenfieldboyce, 'Trump Says He Has "Open Mind" On Climate, But Staff Pick Raises Questions', *NPR*, 23 November 2016, sec. The Two-Way, https://www.npr.org/sections/thetwo-way/2016/11/23/503156456/trump-says-he-has-open-mind-on-climate-but-staff-pick-raises-questions.
[80] Elesa Zehndorfer, 'The Weaponisation of Climate Change: Environmental Leadership in the Age of Trump', in *Rethinking Leadership for a Green World* (Routledge, 2022).
[81] Daniel Poneman, *Double Jeopardy: Combating Nuclear Terror and Climate Change*, Book, Whole (London, England;Cambridge, Mass; MIT Press, 2019).
[82] Begert, 'Climate Denial Campaign Goes Retro with New Textbook'.

subtle in their approach, the API that has spent between $5 and $9 million each of the last 10 years.[83] Beyond lobbying efforts to weaken legislation that would limit carbon emissions or modify existing environmental protections that impact the fossil fuel industry[84], the API also spends millions of dollars touting the 'efforts' of the industry to contribute to the fight against climate change.[85]

By far the biggest lobbying organization by money spent is the US Chamber of Commerce (Chamber) averaging over $75 million per year (more than 3 times the next largest spender cumulatively).[86] The amount spent by the organization isn't surprising given that it is the largest representative of business interests in the world. Worrying is that the Chamber has been identified as standing out for having a significant negative impact on climate policy, consistently ranking in the top 3 most influential industry associations in the Corporate Climate Policy Footprint report that quantitatively scores stakeholders based on their influence over climate policy.[87] Significantly, the Chamber's score is consistently worse than the scores of most petroleum companies and is bested only by petroleum industry associations for the worst ranking overall. As the Chamber does not disclose its funding sources, it's difficult to determine exactly how much it is influenced by carbon emitting industries, but its track record of promoting fossil fuels would surprise and concern its broad membership base.

Beyond dark money contributions to political candidates who oppose action on climate change, the Chamber also regularly enters into legal challenges with the EPA, including attempting to block legislation to counter the public health effects of emissions and the Clean Power Plan aimed at reducing emissions from power generation.[88] In addition to legislation, the Chamber has funded high level reports looking at economic impacts of regulation, including one[89] that was found to make extreme assumptions and result in financial estimates that were implausibly high, but was used nonetheless as justification by President Trump in withdrawing from the Paris Climate Accord.[90]

---

[83] 'American Petroleum Institute Lobbying Profile', OpenSecrets, accessed 16 March 2023, https://www.opensecrets.org/federal-lobbying/clients/summary?cycle=2012&id=D000031493.
[84] Howard Feldman, 'Input to EPA Regulatory Reform Task Force', 15 May 2017, https://www.api.org/~/media/Files/News/Letters-Comments/2017/5-15-17-API-EPA-reg-reform-final-comments.pdf.
[85] API, 'API Launches New National Campaign "Energy for Progress"', 7 January 2020, https://www.api.org/news-policy-and-issues/news/2020/01/07/soae-2020-release.
[86] 'Top Spenders', OpenSecrets, accessed 16 March 2023, https://www.opensecrets.org/federal-lobbying/top-spenders?cycle=a.
[87] InfluenceMap, 'Corporate Climate Policy Footprint, 2022', accessed 16 March 2023, https://influencemap.org/report/Corporate-Climate-Policy-Footprint-2022-20196.
[88] Brian Schatz, 'The Case for Climate Action - Building a Clean Economy for the American People' (Senate Democrats Special Committee on the Climate Crisis, 25 August 2020), 210, https://www.democrats.senate.gov/about-senate-dems/climate/report.
[89] Paul Bernstein et al., 'Impacts of Greenhouse Gas Regulations on the Industrial Sector' (Institute for 21st Century Energy - US Chamber of Commerce, March 2017), https://www.globalenergyinstitute.org/sites/default/files/NERA%20Final%20Report%202.pdf.
[90] Bob Ward and Alex Bowen, 'An Analysis of the Trump Administration's Economic and Policy Arguments for Withdrawal of the United States from the Paris Agreement on Climate Change', Policy Report (Grantham Institute - Climate Change and the Environment - Imperial College London, August

The Real Estate industry isn't discussed with any sort of regularity within climate policy research but was found by Culhane et al to have played a role in degrading regulatory efforts meant to improve energy efficiency of residential buildings. The industry lobbied against legislation that would drive greater energy efficiency into new construction and would require energy efficiency information to be available for prospective buyers, under the guise that all of this would make housing unaffordable, stating that, "...homeowners should move in this direction at their own pace."[91]

There is a significant disconnect between public desire to take meaningful action on climate change and the legislation that ends up being passed by the lawmakers that represent them. Research looking at legislative testimony in Massachusetts, a traditionally green leaning state and one that allows broader public consultation on laws being considered (a key reason law making at the state level was studied), found that over 90% of the testimony delivered by individuals supported prioritizing protecting the environment and taking action on climate change.[92] Despite this strong public consensus, during the period studied there were, "...no major advances in the legislature on climate, and no obvious focusing events."[93] The research goes on to investigate the influence that lobbying and special interest groups had on blunting the effects of any proposed legislation and found that professional and well-funded lobbyists had significant more influence in the late stages of the law making process, with bills that are passed showing a bias to the interests of industry. In fact, despite those in favor of environmental protection laws outnumbering industry representatives nine to one, they were outspent by over 350%.[94]

Unfortunately, the effective lobbying effort that has stymied the necessary legislation in the US has expanded to have broader influence. The most recent Conference of Parties (COP27) that took place in Egypt in late 2022 saw an unprecedented number of industry lobbyists attend with an overall increase of over 25%, a trend that is expected to continue.[95] The significant funding and expert one sided influence these stakeholders bring to a meeting that is critical for building global consensus is very concerning. US conservative think tanks have also been found to have increasing influence in the legislative efforts of other countries. A study looking at books denying climate change, several of which are produced by individuals with no scientific training and less than 10% are published with any peer review, have been found to spread

---

2020), https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2020/08/GRI_An-analysis-of-the-Trump-Administration%E2%80%99s-economic-and-policy-arguments-for-withdrawal-of-the-United-States-from-the-Paris-Agreement-1.pdf.

[91] Trevor Culhane, Galen Hall, and J. Timmons Roberts, 'Who Delays Climate Action? Interest Groups and Coalitions in State Legislative Struggles in the United States', *Energy Research & Social Science* 79, no. Journal Article (2021): 10.

[92] Culhane, Hall, and Roberts, 8.

[93] Culhane, Hall, and Roberts, 2.

[94] Culhane, Hall, and Roberts, 12.

[95] 'Deny, Deceive, Delay - Exposing New Trends in Climate Mis- and Disinformation at COP27', 7.

misinformation to other nations with conservative media and politicians citing the incorrect claims found within.[96]

Industry

The fossil fuel industry started to get organized in the late 1980s when, "…the public [became] increasingly concerned about climate change [and] they saw momentum gather in Congress and the White House for action to reduce demand for [their] products."[97] Prior to this inflection point, various fossil fuel companies actively contributed to research looking at the impacts of CO_2 in the earth's atmosphere, but once their bottom line was threatened, they copied the tobacco industry's misinformation playbook and employed many of the same PR firms and advertising agencies to counter political efforts.[98] Of note, the efforts to sow confusion around climate change evolved from the strategies used to counter the science that smoking cigarettes causes cancer in that the tactics employed include accusing climate researchers of being part of a mass conspiracy that generates fake data to prove particular results.[99]

Beyond the ever-changing strategies to sow doubt surrounding climate change, a key strategy employed by industry was setting up various front groups to disseminate the disinforming messaging. These front groups allow companies to advertise the altruism of their brands, protecting their corporate reputation and social license to operate, while simultaneously undermining informed political debate on topics that would impact their business. The anti-climate front groups which number well over 100 are stood-up or disbanded based on utility or need and are purposefully funded through various middlemen using dark money to give the companies an acceptable level of deniability as to their involvement.[100] The funding, and thus impact, of these various groups is significant; one piece of research determined that over $7 billion of funding was collected cumulatively by 91 anti-climate groups over an 8 year period, with the sources of most of this funding being difficult to determine as it's funneled through donor directed philanthropies.[101]

> This network was created by fossil fuel industry leaders to create the illusion of an organic grassroots movement; and to have more shells to hide behind, creating a "front group whack-amole" apparatus; all to better mislead the public, the press, and policymakers.[102]

---

[96] Riley E. Dunlap and Peter J. Jacques, 'Climate Change Denial Books and Conservative Think Tanks: Exploring the Connection', *American Behavioral Scientist* 57, no. 6 (2013).
[97] Schatz, 'The Case for Climate Action - Building a Clean Economy for the American People', 205.
[98] Naomi Oreskes, Testimony for the US Select Committee on Climate Change, Testimony, 23 October 2019, 6, https://www.democrats.senate.gov/imo/media/doc/Naomi_Oreskes_Testimony.pdf.
[99] Jim Salinger, 'The Climate Journey over Three Decades: From Childhood to Maturity, Innocence to Knowing, from Anthropocentrism to Ecocentrism', *Climatic Change* 100, no. 1 (2010).
[100] Justin Farrell, Kathryn McConnell, and Robert Brulle, 'Evidence-Based Strategies to Combat Scientific Misinformation', *Nature Climate Change* 9, no. 3 (March 2019).
[101] Robert Brulle, 'Institutionalizing Delay: Foundation Funding and the Creation of U.S. Climate Change Counter-Movement Organizations', *Climatic Change* 122, no. 4 (1 February 2014).
[102] Schatz, 'The Case for Climate Action - Building a Clean Economy for the American People', 211.

In September 2021, the US House of Representatives Committee on Oversight and Reform started an "…investigation into the fossil fuel industry's decades-long climate disinformation and greenwashing campaign… requesting documents from Exxon, Chevron, BP [British Petroleum], Shell, API and the Chamber of Commerce."[103] Evidence collected by the Committee further proves that the image advertised by these companies and organizations directly contradicts their operations that continue with limited actual change. The committee found that recent claims by oil companies about their aim to be 'greener' by investing in alternative energy sources for the future have at their core the intent only to provide sufficient plausible coverage that they're doing something to allow them continue business as usual, resulting in record profits[104] well into the future. These greenwashing efforts, identified in internal correspondence gathered by the committee, include touting reductions in CO_2 emissions from production by reducing gas flaring[105] and production equipment efficiencies, all the while actively neglecting, "...taking accountability for the emissions of [their] products."[106] As specific example, Chevron has committed to a 5% reduction in operating emissions by 2028 all while continuing exploration that will increase overall production and emissions.[107]

Even determining the extent of the duplicity proved difficult due to the lack of reasonable cooperation. At an initial hearing for the investigation in October 2021, executives from all six entities acknowledged the significant threat of anthropogenic climate change, admitted to the notable greenhouse gas contributions of their operations and pledged to act to improve the situation. Despite this initial cooperation, all the industry players failed to cooperate further with the investigation, not responding to the Committee's initial voluntary request for documents and failing to appear at subsequent meetings in February and September 2022. Even when subpoenaed to provide documentation to the Committee, these companies obfuscated considerably, using the excuse of First Amendment rights [freedom of speech] or business information sensitivities, neither of which were legally valid. When large volumes of documentation were eventually provided, the Committee found that key documents were either missing or important information was redacted. As example, Exxon and Shell withheld or redacted minutes from important board meetings, while Chevron heavily redacted a slide that detailed planned company expenditures out to 2030 and BP redacted internal

---

[103] Maloney, Caroline and Khanna, Ro, 'House Oversight Committee - Investigation of Fossil Fuel Industry Disinformation', Memorandum (Congress of the US - House of Representatives, 9 December 2022), 26, https://web.archive.org/web/20221210081803/https://oversight.house.gov/sites/democrats.oversight.house.gov/files/2022-12-09.COR_Supplemental_Memo-Fossil_Fuel_Industry_Disinformation.pdf.

[104] Oliver Milman, '"Monster Profits" for Energy Giants Reveal a Self-Destructive Fossil Fuel Resurgence', *The Guardian*, 9 February 2023, sec. Environment, https://www.theguardian.com/environment/2023/feb/09/profits-energy-fossil-fuel-resurgence-climate-crisis-shell-exxon-bp-chevron-totalenergies.

[105] Burning off, rather than collecting, natural gas found when oil is being extracted.

[106] Maloney, Caroline and Khanna, Ro, 'House Oversight Committee - Investigation of Fossil Fuel Industry Disinformation', 2.

[107] Maloney, Caroline and Khanna, Ro, 5.

correspondence that detailed the company's guiding principles on methane, a gas with a large global warming potential.[108]

The industry groups were perhaps more nefarious in their eventual participation, with API redacting important emails with other trade groups that had the subject line "reconciliation coordination" a reference to aims to influence the budget reconciliation bill that would lead to the Inflation Reduction Act a signature piece of US legislation to counter climate change. The Chamber of Commerce inundated the Committee with large volumes of irrelevant information like mass mailers and emails, copies of press releases and print outs of websites, while refusing to provide any of the internal documents requested in the subpoena.[109] This sort of behavior certainly points to organizations with a lot to hide and questions the validity of pledges to be trusted partners in the fight against climate change.

Media

Corporate control of the media in the United States has been leveraged to skew the discussion around climate change in many ways. Based on journalistic norms, for a significant duration of the early discussion around climate change, media aimed to provide balance by seeking counter opinions from the far smaller community of scientists that rebut anthropogenic climate change and are often funded by think-tanks usually associated with the fossil fuel industry.[110] This strategy had the effect of portraying that the consensus around the causes of climate change was split roughly down the middle when in fact by the mid-2000s approximately 97% of the scientific community supported that human activity was at the heart of climate change. Since most of the general public receives their information surrounding climate change from mass media, vice academically scrutinized papers or lengthy IPCC reports, the misinforming effect can be significant. Quantitative analysis completed by Boykoff found that 70% of US television news coverage included balanced coverage between scientists proving anthropogenic climate change and those espousing that it wasn't a human caused phenomenon.[111] Fortunately this false balance has dissipated, but some right leaning media still provide an amount of coverage to climate contrarian views, likely driven by moneyed interests steering the priorities of these forums.[112]

While traditional news media, save for those networks with a financial interest in sowing doubt like Breitbart, the Washington Times and the Daily Wire,[113] have shifted to

---

[108] Maloney, Caroline and Khanna, Ro, 'House Oversight Committee - Investigation of Fossil Fuel Industry Disinformation'.
[109] Maloney, Caroline and Khanna, Ro.
[110] Liisa Antilla, 'Climate of Scepticism: US Newspaper Coverage of the Science of Climate Change', *Global Environmental Change* 15, no. 4 (1 December 2005): 340.
[111] Maxwell T Boykoff, 'Lost in Translation? United States Television News Coverage of Anthropogenic Climate Change, 1995-2004', *Climatic Change* 86, no. 1–2 (January 2008).
[112] Michael Brüggemann and Sven Engesser, 'Beyond False Balance: How Interpretive Journalism Shapes Media Coverage of Climate Change', *Global Environmental Change* 42 (2017).
[113] Kari Paul, '"Super Polluters": The Top 10 Publishers Denying the Climate Crisis on Facebook', *The Guardian*, 2 November 2021, sec. Technology,

providing a more accurate representation of the significance and consensus surrounding climate change, the advent and pervasiveness of social media has played an outsized role in sowing disinformation and delaying critical action. Significant money is spent on advertising by fossil fuel-linked entities, usually aligned with the lead up to major climate conferences or when potentially restricting legislation is being discussed. As an example, in the lead up to and during COP27, Meta determined that there were 3781 advertisements active across Facebook and Instagram worth a total estimated expenditure of $4 million, with most of the messaging aiming to impact emotions surrounding livelihoods, national security and energy sovereignty.[114] Research looking at disinformation and the 2016 US federal election found that over 62% of adults use social media as their primary source of information, meaning that any disinformation shared in this space has a significant impact.[115]

Though a very difficult area to research, as all social media and tech companies fiercely protect the intellectual property of their algorithms, there appears to be financial influence in what information gains prominence on some platforms. Again, as part of the lead up to the COP27, the Twitter hashtag #ClimateScam spiked in popularity gathering 362k mentions by the close of the conference. The term achieved a level of prominence on the Twitter interface when searching '#climate', over the more regularly popular terms like #ClimateCrisis and #ClimateEmergency, to a level that, "…cannot be explained through personalization (e.g. browsing history), volume of content (i.e. prevalence of the phrase) or popularity."[116]

Perhaps the biggest challenge with social media being used to spread disinformation that delays action on climate change is how difficult it is for most people to discern fact from fiction in the online space. Even discerning individuals who are aware of the manipulating effects of the algorithms that underpin social media will find it difficult to find alternate points of view to challenge their beliefs, as search results often limit the information that's presented to that which best aligns with previous browsing habits.[117] As part of a subconscious effort to determine the validity of information encountered online, researchers found that most people assess the truthfulness of information based on how much they trust the individual sharing the information on social media.[118] For the most part this is not an effective strategy as social media tends to exacerbate the problematic aspects of homophily in that like-minded users tend to form echo chambers where dissenting voices are challenged, with those users likely to just leave the group.[119]

---

https://www.theguardian.com/technology/2021/nov/02/super-polluters-the-top-10-publishers-denying-the-climate-crisis-on-facebook.

[114] 'Deny, Deceive, Delay - Exposing New Trends in Climate Mis- and Disinformation at COP27', 5.

[115] Hunt Allcott and Matthew Gentzkow, 'Social Media and Fake News in the 2016 Election', *The Journal of Economic Perspectives* 31, no. 2 (2017).

[116] 'Deny, Deceive, Delay - Exposing New Trends in Climate Mis- and Disinformation at COP27', 6.

[117] McKay and Tenove, 'Disinformation as a Threat to Deliberative Democracy', 706.

[118] Freelon and Wells, 'Disinformation as Political Communication', 147.

[119] Jieun Shin et al., 'Political Rumoring on Twitter during the 2012 US Presidential Election: Rumor Diffusion and Correction', *New Media & Society* 19, no. 8 (2017).

Public

The final climate denial player is the public that is targeted with disinformation and then further shares it as misinformation, which has resulted in ingrained polarization leading to limited meaningful action. The right left polarization is an important factor when considering someone's likelihood to believe and spread misinformation. Likely due to the historical influence of misinformation campaigns, polling data from the early 2000s shows a very clear split between liberals and conservatives on the subject of climate change with the latter significantly more likely to deny its existence, downplay its severity and question the science.[120] This divide in beliefs has forced Republican politicians in the US to take a position inimical to the agreed science, with those that won't losing election funding support and often their office. While the general population in the UK is far more certain about climate change and thus grants the political will for more drastic emission reduction efforts, there still exists a skeptical element of the population. Research looking at postal surveys in the UK has found that the those that were skeptical were more likely to be older, poorer, conservative and male. Worryingly, this same research found that roughly 40% of the survey respondents incorrectly believed that climate scientists were divided on the anthropogenic nature of climate change, showing the far-reaching impact of denial efforts.[121] That there exists even a strong minority of individuals who hold difficult to challenge beliefs contrary to climate change is very concerning given the amplifying power of modern social media.

As an example of how pervasive, omnipresent, and self-developing climate change misinformation has become, over the course of drafting this paper, an entirely new conspiracy narrative has arisen surrounding an urban planning concept called the 15-minute city. The idea first proposed in 2016 and attributed to Carlos Moreno suggests that cities be planned in such a way that people can walk or cycle to the services they use every day like shopping, restaurants, social spaces, schools and as much as possible their place of employment.[122] In addition to the goal of reducing the need for un-necessary trips by car with an associated reduction in CO_2 emissions, the concept also promotes improved human health due to reduced pollution and improved quality of life with more connected communities.

Unfortunately, in early 2023 this seemingly beneficial concept became the foundation of a conspiracy narrative that people would be confined to their 15-minute zone in future climate change lockdowns or would be forced to buy credits to travel beyond their allocated region.[123] While it's difficult to attribute this conspiracy to a particular disinforming actor, one potential explanation is a conflation with traffic

---

[120] Aaron M. McCright, Riley E. Dunlap, and Chenyang Xiao, 'Increasing Influence of Party Identification on Perceived Scientific Agreement and Support for Government Action on Climate Change in the United States, 2006–12', *Weather, Climate, and Society* 6, no. 2 (2014).
[121] Lorraine Whitmarsh, 'Scepticism and Uncertainty about Climate Change: Dimensions, Determinants and Change over Time', *Global Environmental Change* 21, no. 2 (2011).
[122] Zaheer Allam et al., 'The 15-Minute City Offers a New Framework for Sustainability, Liveability, and Health', *The Lancet Planetary Health* 6, no. 3 (March 2022).
[123] Isabella Fertel, 'Fact Check: False Claim "15-Minute Cities" Are Actually "Climate Lockdowns"', USA TODAY, 6 February 2023, https://www.usatoday.com/story/news/factcheck/2023/02/06/fact-check-false-claim-15-minute-cities-plan-confine-residents/11179132002/.

calming measures being rolled out in Oxford and the 15-minute concept, which led to 2000 people protesting in that city and even a British MP sharing the conspiracy online.[124] The conspiracy, which has resulted in Moreno receiving death threats,[125] has spread to the extent that the notions of climate lockdowns and the need to buy credits were discussed in serious conversation amongst dining JCSP students. How quickly these narratives develop and how far reaching they can become shows how damaging false information can be.

4. DISCOURSES IN DELAY

While the tactics of outright denial of climate change as a phenomenon or its human causation have generally waned, there continues to be ongoing efforts to delay sufficient action being taken to mitigate the effects of climate change. While the tactics being used are varied and constantly being adapted, a useful framework developed by a large group of researchers, looking at climate related media content in Germany, Norway, the UK and the US, and published by Cambridge University provides a useful means of investigating the topic. Lamb *et al'*s paper introduces 12 climate delay discourses, that is strategies that leverage discussion about what should be done, who should be responsible, how the costs should be covered, etc. in such a manner as to reach an impasse about what to do or make it seem like action isn't possible. These discourses are divided into 4 categories; those that redirect responsibility, push non-transformative solutions, emphasize the downsides and argue for surrender to the effects.[126] That these delay discourses are so effective can be attributed to the foundation laid by decades of denialism efforts that have left broad sections of the population and lawmakers skeptical or confused about the significance of climate change.[127] The discourses within each of these categories are summarized in Figure 1 below and discussed in the following section.

---

[124] Feargus O'Sullivan and Daniel Zuidijk, 'The 15-Minute City Freakout Is a Case Study in Conspiracy Paranoia', *Bloomberg.Com*, 2 March 2023, https://www.bloomberg.com/news/articles/2023-03-02/how-did-the-15-minute-city-get-tangled-up-in-a-far-right-conspiracy.

[125] Tiffany Hsu, 'He Wanted to Unclog Cities. Now He's "Public Enemy No. 1."', *The New York Times*, 28 March 2023, sec. Technology, https://www.nytimes.com/2023/03/28/technology/carlos-moreno-15-minute-cities-conspiracy-theories.html.

[126] William Lamb et al., 'Discourses of Climate Delay', *Global Sustainability* 3, no. Journal Article (2020): 1.

[127] Michael Andrew Ranney and Dav Clark, 'Climate Change Conceptual Change: Scientific Information Can Transform Attitudes', *Topics in Cognitive Science* 8, no. 1 (2016): 49–75.

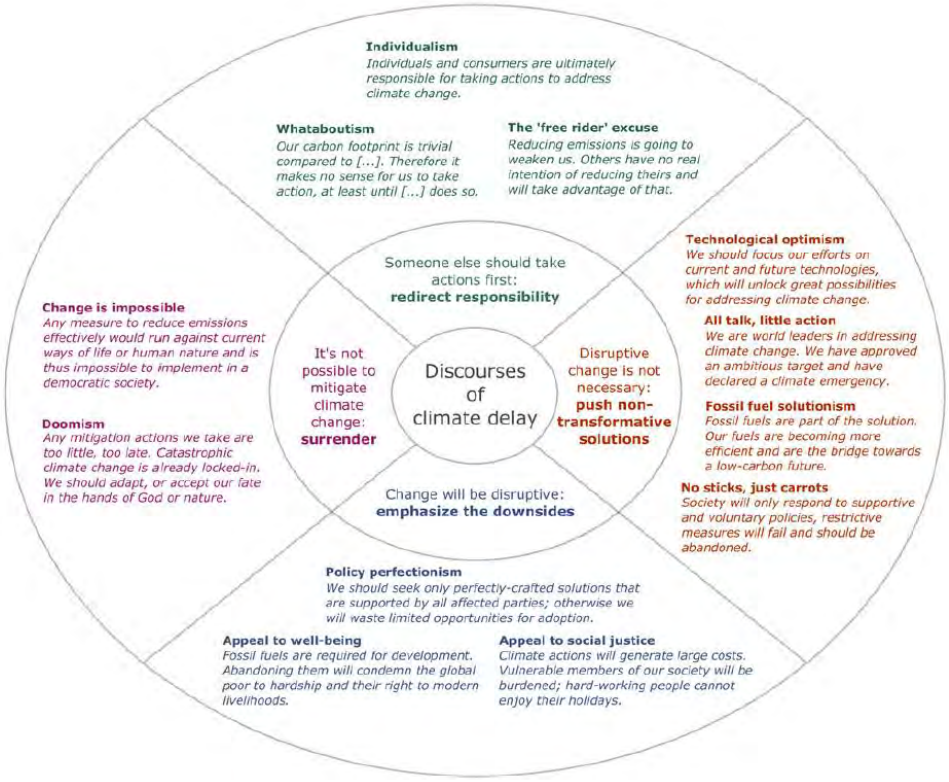

Figure 1 – Summary of Discourses of Delay[128]

Redirect Responsibility Discourses

The Individualism discourse, "…narrows the solution space to personal consumption choices, obscuring the role of powerful actors and organizations in shaping those choices and driving fossil fuel emissions."[129] Perhaps the most significant example of the individualism discourse is the term Carbon Footprint which was popularized in an early 2000s advertising campaign designed for British Petroleum (BP) by the powerhouse public relations firm Ogilvy and Mather. As part of the Beyond Petroleum campaign, a carbon footprint calculator was developed where individuals could determine what their personal impact was, thereby creating the idea that climate change was an individual responsibility and less so that of large oil producing companies.[130] While individual responsibility is important, the individualism narrative obscures the fact that there is a limit to how much someone can reduce their consumption given the established environment in which they live their life. As an example, it is very difficult to live a car free life in most North American cities designed with sprawling suburbs, inadequate public transit and poor infrastructure alternatives for cycling or walking. Lamb et al posit that it would be more productive to, "...focus attention on the collective potential of

[128] Lamb et al., 'Discourses of Climate Delay', 2.
[129] Lamb et al., 3.
[130] J. R. Flaherty, 'How Clever Marketing Sold the World The Myth of the Carbon Footprint', Medium, 12 November 2021, https://bettermarketing.pub/how-clever-marketing-sold-the-world-the-myth-of-the-carbon-footprint-b628448c4bd2.

individual actions to stimulate normative shifts and build pressure towards regulations."[131] Notably when conducting research for this paper, looking into strategies to encourage a population level reduction of CO_2 emissions, it took numerous changes in search terms to get away from results solely aimed at actions individuals can take to reduce their 'carbon footprint'.

A second discourse within the redirect responsibility category, and one that is used extensively in Canadian conversation on the topic of climate change, is whataboutism, whereby the case is made that countries that produce greater amounts of greenhouse gasses aren't taking significant action so we shouldn't either. While there is some truth to the argument that large emitters need to do their part in reducing emissions, this discourse is inadequate when you consider that both Canada's per capita and total cumulative emissions place the country in the top 10 worst polluting countries.[132] For a wealthy industrialized country there should be a desire to take a leadership role in developing policy and technology to reduce emissions and become a role model for other countries. Whataboutism is also employed below the nation state level, with various industries or sectors calling each other out when proposed legislation might provide well considered exemptions for certain emitters.[133]

The final discourse in the redirect category is the free rider dilemma which posits that certain industries or countries stand to benefit by not taking action to reduce their emissions, when their competition is making investments and changes in business direction to reduce theirs.[134] The free rider discourse is at the heart of President Trump withdrawing the US from the Paris Climate Accord, citing in a press release the significant financial cost and loss of jobs affecting American competitiveness.[135] Unfortunately the free rider issue is not imagined, with documents collected by the US House of Representatives investigating fossil fuel industry disinformation showing that Chevron strategy documents stated that they will continue to invest in fossil fuels to, "...take advantage of consolidation in the industry."[136]

Push Non-Transformative Solutions Discourses

The discourses in the push non-transformative solutions category all aim to make the case that disruption to our current way of life isn't necessary to combat climate change. The first and probably most prevalent discourse involves significant optimism that there will be a technological solution to the climate crisis.[137] Technological optimism includes both over praising the impacts of technological improvements, such as

---

[131] Lamb et al., 'Discourses of Climate Delay', 3.
[132] 'CO2 Emissions per Capita - Worldometer', accessed 26 February 2023, https://www.worldometers.info/co2-emissions/co2-emissions-per-capita/.
[133] Lamb et al., 'Discourses of Climate Delay', 3.
[134] Lamb et al., 3.
[135] 'President Trump Announces U.S. Withdrawal From the Paris Climate Accord – The White House', accessed 26 February 2023, https://trumpwhitehouse.archives.gov/articles/president-trump-announces-u-s-withdrawal-paris-climate-accord/.
[136] Maloney, Caroline and Khanna, Ro, 'House Oversight Committee - Investigation of Fossil Fuel Industry Disinformation', 2.
[137] Lamb et al., 'Discourses of Climate Delay', 3.

the progress made in rolling out significant renewable energy generating infrastructure or the subsidization of electric vehicles. While renewable energy will play a critical role in a carbon free future, without policy changing how we use resources there is a very real possibility Jevon's paradox[138] will result in any net reductions in emissions simply being undone by ever increasing consumption.

Electric vehicles (EV) subsidization, as it's being rolled out in North America, has missed an opportunity to sway the public to drive more reasonably sized vehicles rather than just electrifying the unnecessarily large SUVs and trucks that currently dominate the streets. While electric versions of these vehicles will be better than their internal combustion counterparts during operation, they do require additional energy during manufacture. Producing a battery for an average sized sedan of approximately 1500kg requires an additional 33% more energy and generates an additional 1000kgs of CO_2,[139] values that only increase for a larger vehicle. Energy consumption for electric vehicles in use increases between 40% and 60% with each doubling of mass,[140] so again larger vehicles with heavy battery packs increase electricity demand unnecessarily. It has also been assessed that the increased weight of EVs will contribute to more rapid degradation of road infrastructure, requiring more regular carbon intensive resurfacing and other maintenance,[141] to say nothing about the safety concerns surrounding heavier vehicles.[142]

Techo-optimism also includes so called silver bullet technologies including carbon capture and storage (CCS) and nuclear fusion. While there was recent success in the realm of nuclear fusion, in that a net-positive energy reaction was achieved in late 2022,[143] it's still unlikely the technology will be ready for major implementation in the medium or even long term. CCS, while theoretically a reasonable idea, appears in its current guise to be primarily a greenwashing strategy used by the oil industry to justify continued operations as nearly three quarters of the carbon captured in current operations is used for enhanced oil recovery, meaning there is no net reduction in carbon in the atmosphere.[144] Further research by the Institute for Energy Economics and Financial Analysis into what it considered 13 flagship CCS projects accounting for 55% of total capture technology worldwide found that the majority either failed or were

---

[138] 'Jevons Paradox', in *Wikipedia*, 19 February 2023, https://en.wikipedia.org/w/index.php?title=Jevons_paradox&oldid=1140227989.
[139] J.L. Sullivan, A. Burnham, and M. Wang, 'Energy-Consumption and Carbon-Emission Analysis of Vehicle and Component Manufacturing' (Energy Systems Division, Argonne National Laboratory, September 2010), 22, https://greet.es.anl.gov/files/vehicle_and_components_manufacturing.
[140] Martin Weiss, Kira Christina Cloos, and Eckard Helmers, 'Energy Efficiency Trade-Offs in Small to Large Electric Vehicles', *Environmental Sciences Europe* 32, no. 1 (18 March 2020).
[141] Mark Pittman, 'Electric Vehicles And The Impact On Infrastructure', Forbes, accessed 3 May 2023, https://www.forbes.com/sites/forbestechcouncil/2022/12/29/electric-vehicles-and-the-impact-on-infrastructure/.
[142] Nathan Bomey, 'EVs Are Much Heavier than Gas Vehicles, and That's Posing Safety Problems', Axios, 28 April 2023, https://www.axios.com/2023/04/28/evs-weight-safety-problems.
[143] Tim De Chant, 'Breakthrough Fusion Power Announcement Expected Tomorrow. Here's What It Means | TechCrunch', *TechCrunch*, 12 December 2022, https://techcrunch.com/2022/12/12/breakthrough-fusion-power-announcement-expected-tomorrow-heres-what-it-means/.
[144] Bruce Robertson and Milad Mousavian, 'The Carbon Capture Crux: Lessons Learned' (Institute for Energy Economics and Financial Analysis, 1 September 2022), https://ieefa.org/resources/carbon-capture-crux-lessons-learned.

underperforming.[145] Unfortunately, the plans of a number of countries that are party to the Paris Climate Accord rely heavily on solutions like CCS to meet their obligations, but experts have identified that, "…such technologies do not yet exist at nearly the scale or sophistication needed but are increasingly used as a 'silver-bullet' solution to negate other critical targets."[146] The danger that technological optimism will lead to a false sense that more significant transformative solutions won't be needed is substantial.

All talk, little action is something a number of government leaders can be accused of when they over exaggerate achievements in lowering emissions or highlight ambitious targets, often with limited concrete actions, when making a case that they're doing their part.[147] This particular discourse was at the heart of Greta Thunberg's famous speech at the Youth 4 Climate conference in Milan that preceded COP26 in Glasgow.

> "Build back better" blah blah blah.
>
> "Green economy" blah blah blah.
>
> "Net zero by 2050" blah blah blah.
>
> "Net zero" blah blah blah.
>
> "Climate neutral" blah blah blah.
>
> This is all we hear from our so-called leaders: words - words that sound great, but so far have led to no action.
>
> Our hopes and dreams drown in their empty words and promises.
>
> Of course we need constructive dialogue, but they've now had 30 years of blah blah blah and where has that led us?[148]

Major companies in the fossil fuel industry are exceptionally guilty of this discourse as they continue to play up the significance of their green investments, when most only plan to spend around 10% of all capital expenditures on low carbon technologies, meaning the vast majority of their significant resources still go towards continued exploration of fossil fuels. Even BP, which appears to be the most environmentally conscious of the major companies only plans to spend 17% on alternative energy projects. A lot of the emission reducing investments by fossil fuel companies focuses on unproven technologies such as CCS or buying credits in carbon offset markets of questionable effectiveness.[149] When addressing COP27 delegates, UN Secretary General António Guterres highlighted that, "…using bogus 'net-zero' pledges to cover up massive fossil fuel expansion is reprehensible. It is rank deception."[150]

---

[145] Robertson and Mousavian.
[146] 'Deny, Deceive, Delay - Exposing New Trends in Climate Mis- and Disinformation at COP27', 7.
[147] Lamb et al., 'Discourses of Climate Delay', 3.
[148] Greta Thunberg, 'Greta Thunberg's "Blah Blah Blah" Speech, Milan 2021', 28 September 2021, https://www.carbonindependent.org/119.html.
[149] Maloney, Caroline and Khanna, Ro, 'House Oversight Committee - Investigation of Fossil Fuel Industry Disinformation', 5.
[150] 'Deny, Deceive, Delay - Exposing New Trends in Climate Mis- and Disinformation at COP27', 14.

The third non-transformative solution discourse is fossil fuel solutionism which has the fossil fuel industry positioning themselves as part of the solution to climate change through the use of 'clean' fuels such as natural gas. A prime example of this strategy can be seen with the 'Power Past Impossible' campaign organized by API and launched during the 2017 Superbowl.[151] The campaign arose following President Obama's signing of the Paris Agreement and aimed at convincing American citizens that the petroleum industry not only powers their lifestyle, but improves their lives with all types of consumer products.[152]

Another strategy used by some fossil fuel companies to appear to be reducing their greenhouse gas emissions is divestment where they sell less profitable oil producing assets to another, usually smaller, company thereby reducing the CO_2 emissions on their balance sheet. Aside from the fact that this strategy doesn't result in a net reduction in CO_2 emissions for the planet, just for the major oil producer, there are other negative consequences including greater difficulty in tracking the emissions of these smaller companies.[153] These divestments can also result in beneficial renewable energy projects being cancelled because their contribution to the company's carbon reduction ambitions are no longer necessary. Furthermore, internal documents collected by the US House of Representatives show that it's clear that fossil fuel executives are completely aware that these divestments don't actually reduce carbon emissions.[154]

The final discourse that is used to avoid having to take transformative solutions to reduce emissions and combat climate change is no sticks, just carrots, which aims to avoid any punitive or restricting measures that might be politically undesirable (carbon taxes or more stringent regulations) and instead focuses solely on measures to entice people to reduce emissions (better bicycle or public transit infrastructure) when the two approaches are complementary and will both need to be used to meet the difficult challenge or reducing emissions.[155]

Emphasize the Downsides Discourses

The next category of discourses is generally attributed to policy statements that, "…emphasize the downsides of climate action and imply that these carry an even greater burden for society than the consequences of inaction."[156] Within this

---

[151] Michael Tadao, 'API Launches Power Past Impossible Campaign during Super Bowl Showing Natural Gas and Oil Benefit to Consumers in Everyday Life', 5 February 2017, https://www.api.org/news-policy-and-issues/news/2017/02/05/api-launches-power-past-impossible-campa.
[152] Kim Sheehan, 'This Ain't Your Daddy's Greenwashing: An Assessment of the American Petroleum Institute's Power Past Impossible Campaign', in *Intellectual Property and Clean Energy*, Book, Section vols (Singapore: Springer Singapore, 2018).
[153] 'Tracking Carbon Emissions Becomes Harder When Big Oil Isn't Involved', *Bloomberg.Com*, 15 April 2021, https://www.bloomberg.com/graphics/2021-tracking-carbon-emissions-BP-hilcorp/.
[154] Maloney, Caroline and Khanna, Ro, 'House Oversight Committee - Investigation of Fossil Fuel Industry Disinformation', 19.
[155] Lamb et al., 'Discourses of Climate Delay', 4.
[156] Lamb et al., 4.

category, the appeal to social justice discourse focuses attention on the costs of action by highlighting how this will create excess burden on the general public while overlooking or ignoring the potential benefits to public health or generation of new fields for employment. While the concerns raised in these discourses are based in the truth, in that there will be inevitable societal changes to how we live to meet the challenges of climate change, it's the lack of a wholistic look at the problem to include both the upsides and an appropriate consideration of the downsides that makes this sort of discourse a problem.

Where this discourse tends to focus on the very real downsides of taking the necessary action, the appeal to well-being variation takes a more extreme view of the challenge. Discourses of this second type in the emphasize the downsides category take the drastic stance that society as we know it will collapse if the necessary actions to combat climate change are taken, as our modern way of life simply can't exist in any manner without fossil fuels. This more extreme narrative, which also makes the case that mitigation will disallow social advancement for poor and developing countries, completely discounts proposals that exist to allow for an orderly, though not without some sacrifice, transition to a more sustainable way of life.[157]

In an extreme variation of this discourse, well-funded think tanks have twisted loss and damage agreements, between those countries most responsible for climate change and those more susceptible which were formally negotiated for the first time during COP27, into anti-woke conspiracy movements which will delay these critical reparations that are needed to ensure a balanced response to climate change.[158] As a specific example, around the time of Black Lives Matter protests, a public relations firm that regularly works for Chevron, in an effort that could be considered woke-washing, emailed journalists to highlight that environmental groups back policies that would economically hurt minority communities.[159]

The final discourse in the emphasize the downsides category is policy perfectionism, which seems to be complementary to the stance that acting is simply too costly. If lawmakers cannot develop policy that satisfies all of the many valid concerns of your average citizen surrounding climate change and the difficult actions to counter it then it becomes extremely difficult to take any tangible action at all.[160]

---

[157] Lamb et al., 4.
[158] 'Deny, Deceive, Delay - Exposing New Trends in Climate Mis- and Disinformation at COP27', 4.
[159] Amy Westervelt, 'Big Oil's "Wokewashing" Is the New Climate Science Denialism', *The Guardian*, 9 September 2021, sec. Environment, https://www.theguardian.com/environment/2021/sep/09/big-oil-delay-tactics-new-climate-science-denial.
[160] Lamb et al., 'Discourses of Climate Delay', 4.

Surrender Discourses

The final discourses of delay category is surrender, which includes policy statements that question whether the change required is even possible. The first narrative in this category includes stances that the changes required are so extreme that they're bound to fail politically, financially or socially and overlooks human ability to conduct significant transformation because change is impossible. This narrative ignores that broad sweeping society level changes, like the Marshal Plan in Europe or changes in Japan led by General MacArthur were achieved in somewhat recent history. This discourse can be seen increasingly underlying government policy that tends to focus on adaptation with mitigation efforts having taken a significantly lesser priority.[161]

The second discourse in the surrender category is doomism which takes a notably more negative position about change to mitigate the climate catastrophe being impossible because it's already occurring and cannot be corrected. The narrative includes policy statements or media editorials that make the case that the only thing we can do is focus on adaptation or just leave it to fate to decide what the future looks like.[162]

5. CLIMATE CHANGE AS A NATIONAL SECURITY THREAT

Human activity has caused changes to the climate to the extent that it is now considered a worldwide national security threat. In response to the significance of this threat, the recent Canadian budget contained $40.4 million over 5 years to build the NATO Climate Change and Security Centre of Excellence in Montreal[163] an initiative first announced during the June 2022 organization summit.[164] This commitment by NATO is recognition that even if emissions of carbon into the atmosphere were to stop immediately, an unlikely scenario, the effects of historic pollution will continue to be experienced, resulting in threats to national security that will require complicated and expensive government responses including military resources. A recent news article in CBC[165] highlighted that the threat to Canada from climate change is being considered at the highest levels of Canada's intelligence apparatus, with the article siting a report gained through access to information. That report was a Canadian Security Intelligence Service (CSIS) analytical brief that looked at 10 security factors from a climate change

---

[161] Lamb et al., 4.
[162] Lamb et al., 5.
[163] Department of Finance Canada, 'Chapter 5: Canada's Leadership in the World | Budget 2023', 28 March 2023, https://www.budget.canada.ca/2023/report-rapport/chap5-en.html#a2.
[164] Global Affairs Canada, 'NATO Climate Change and Security Centre of Excellence', GAC, 21 March 2022, https://www.international.gc.ca/world-monde/international_relations-relations_internationales/nato-otan/centre-excellence.aspx?lang=eng.
[165] Jim Bronskill, 'Climate Change Threatens Canadian Security, Prosperity, Warns Stark Spy Agency Brief', CBC, 5 March 2023, https://www.cbc.ca/news/politics/csis-climate-change-threats-canada-1.6768803.

perspective and identified it as, "… a strategic, intergenerational and intersectional global security theme."[166]

The security factors[167] looked at in the CSIS analytical brief provide a useful framework for better understanding how climate change will affect Canadian security and prosperity, each of which will be discussed in this section of the paper.

IPCC AR6 Terminology and Modelling

As the IPCC Working Group II's (WGII) contribution to AR6, Impacts, Adaptation and Vulnerability[168], is a definitive reference when considering the myriad of potential threats from climate change and was used as a key reference in this section. As such, it's beneficial to both define some of the terminology used in the report and summarize the modelling scenarios and timeframes used in assessing the potential future threat. The first term defined in WGII's work and a common framework across all of the research efforts underpinning AR6 is Risk, which in this instance is defined as, "…the potential for adverse consequences for human or ecological systems, recognizing the diversity of values and objectives associated with such systems."[169] Beyond the definition, risk in the context of the IPCC efforts serves to comprehend the progressively severe, interrelated, and increasingly permanent consequences of climate change on ecological and human systems; it helps to identify the varying effects on different regions, industries, and communities, and to determine the most effective ways to minimize the impact on both present and future generations.

The factors considered in the IPCC risk framework are hazards, exposure and vulnerability. Hazards which are identified through the efforts of IPCC Working Group I as climatic impact-drivers is defined as, "…the potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts."[170] The Hazard definition also considers the potential for such physical events to effect human built systems and environments, people's livelihoods and also natural resources and the environment writ large. The IPCC considers Exposure to be presence of people, infrastructure, natural and human made systems including social and cultural assets in locations where they could be impacted by physical events. Lastly, Vulnerability looks at, "…the propensity or predisposition [for something] to be adversely affected [and includes] sensitivity or susceptibility to harm and lack of capacity to cope and adapt."[171] Vulnerability and exposure vary by region, population and country, are a key focus of WGII and provide a useful framework for government and military planners to consider adaptation measures and efforts to improve resilience.

---

[166] 'CSIS Scene Setter: Climate Change Security Factors', Analytic Brief (Canadian Security Intelligence Service, 6 April 2021), 1.
[167] In alphabetical order: Arctic, Border, Coastal, Domestic, Energy, Health, Financial Capacity, Food, Security Accelerant and Water.
[168] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*
[169] Pörtner et al., 5.
[170] Pörtner et al., 5.
[171] Pörtner et al., 5.

In order to consistently assess the elements of risk, the IPCC makes use of an integrated Shared Socio-Economic Pathways (SSP) and Representative Concentration Pathways (RCP) model initially proposed in 2013 by van Vuuren et al.[172] A combined matrix of these two elements introduced during AR5 and have been regularly used in other climate research over the last decade. SSPs describe, "…plausible alternative trends in the evolution of society and ecosystems over a century timescale, in the absence of climate policy."[173] The model as proposed and used by climate researchers includes 5 SSP narratives that consider variations on the levels of mitigation (efforts to achieve desired climate outcomes) and adaptation (efforts to prepare for the likely impacts of climate change). SSP1 is the ideal outcome where low mitigation and adaptation efforts will be required because sufficient sustainable development efforts were taken to both lessen inequality and move to low carbon energy sources. SSP3 is the worst-case scenario requiring both high mitigation and adaptation as limited action was taken to counter climate change. SSP2 can be found as an intermediate level between SSP1 and SSP3. SSP4 requires high adaptation, but low mitigation and is the scenario where sufficient technological development occurred to lower carbon emissions, but economic development proceeded in an unequal manner with global economies isolated. Lastly SSP5 requires high levels of mitigation due to inadequate climate and energy policies to reduce emissions by the necessary amount, but with the resultant economic growth being more equitably distributed leading to more climate adaptable populations.[174] Figure 2 below provides a visual representation of the differences between the SSPs.

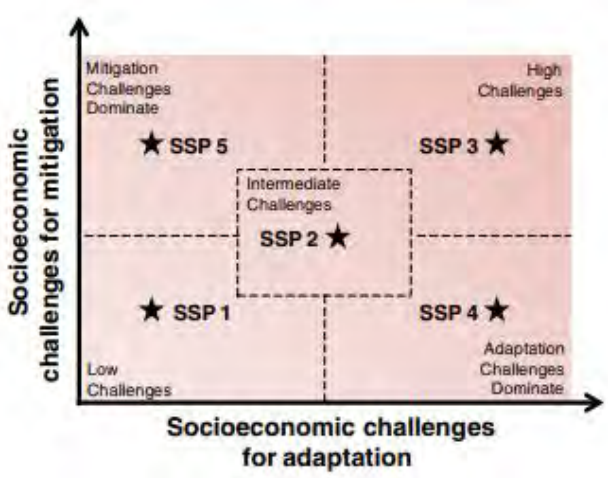

Figure 2 – Challenge Space of Share Socio-Economic Pathways[175]

RCPs are a set of 4 pathways used in climate modelling that identify the range of emissions mitigation actions that could be taken leading to potential radiative forcing values, from 2.6 to 8.5 watts per square meter (W/m^2), that could be reached by the year

[172] Detlef van Vuuren et al., 'A New Scenario Framework for Climate Change Research: Scenario Matrix Architecture', *Climatic Change* 122, no. 3 (1 February 2014).
[173] Brian O'Neill et al., 'A New Scenario Framework for Climate Change Research: The Concept of Shared Socioeconomic Pathways', *Climatic Change* 122, no. 3 (1 February 2014): 387.
[174] O'Neill et al., 398.
[175] O'Neill et al., 391.

2100.[176] The 4 pathway scenarios were generated by the scientific community, stemming from a request by the IPCC to better standardize the climate research their work is based on. The 4 pathways are RCP8.5 (1370), RCP6 (850), RCP4.5 (650) and RCP2.6 (490), with the values listed in brackets identifying the estimated atmospheric CO_2 equivalent concentration by the year 2100. The worst-case scenario of RCP8.5 estimates radiative forcing would be continuing to rise by 2100, the middle two pathways see the forcing stabilizing by 2100 while RCP2.6 estimates forcing would peak before 2100 and be declining and in the region of 2.6 W/m^2 by 2100.[177] Beyond the concentration of emissions, the RCPs also consider land use in the modelling.

The IPCC AR6 work combines the RCP climate projections with the various challenges in the SSPs in an integrated assessment model that takes into consideration climate policy assumptions to generate combined designations. As example, SSP1-2.6 would identify an idealized pathway where climate policy ensures there are limited adaptation and mitigation requirements in the future and the overall climate warming potential by 2100 is limited to 2.6 W/m^2.[178]

Finally, various timeframes are used by the IPCC in their work, with the period of 1850-1900 representing the pre-industrial global average temperatures. When referring to the future in the IPCC reporting, the near term looks out to 2040, the midterm from 2040 to 2060 and the long term beyond these out to the year 2100.[179]

Arctic Security

Global polar regions, and in particular the Arctic, are experiencing by far the greatest amount of change due to global warming and at a much faster pace than was previously projected. In all warming scenarios the Arctic will be significantly different and more accessible by the mid-century.[180] CSIS's assessment of the Arctic as a security issue highlights that the decreasing amounts of sea ice will both allow for increased maritime transit, with the associated risks and benefits.[181] With the volume of multi-year sea ice in the Arctic reducing there will be a longer ice free navigable shipping season which will benefit northern communities, but the trade-off will be the more hospitable waters and increased shipping traffic increasing the amounts of invasive species being introduced into the region.[182]

Perhaps more significant from both an economic and security perspective is the increasingly viable access to the natural resources in the region, melting sea ice will enable.[183] Considering the current great power competition, Russia's seeming disinterest in following rules based international norms and China's self-proclaimed status as a 'near-

---

[176] Detlef van Vuuren et al., 'The Representative Concentration Pathways: An Overview', *Climatic Change* 109, no. 1 (5 August 2011): 5.
[177] van Vuuren et al., 12.
[178] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 2918.
[179] Pörtner et al., 6.
[180] Pörtner et al., 2321.
[181] 'CSIS Scene Setter: Climate Change Security Factors', 1.
[182] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 1950.
[183] 'CSIS Scene Setter: Climate Change Security Factors', 1.

Arctic state',[184] combined with elements of Canada's sovereign claims over the region challenged by even its closest allies[185] the country will be challenged to defend its vast northern frontier. IPCC projections are that the rate of sea ice loss will only increase in the future along with the many security challenges this brings.

Border Security

Neither the anthropogenic causes, nor the associated impacts of climate change recognize international borders, yet very, "…few countries so far have integrated inter-regional aspects into their climate change risk assessments," and most still plan their adaptation and response in isolation if at all.[186] The highly interconnectedness of globalized economies will lead to inevitable conflict, as was experienced during the first years of the COVID pandemic, when certain resources, which can include manufactured items, became scarce. These scarcities will only be more pronounced in the future due to changes in growing seasons or more regular weather-related disasters. Many key water supplying rivers cross international borders and when water volumes reduce from historic amounts due to atmospheric changes there will be increased likelihood of conflict with those states upstream claiming more rights over the waters. This will lead to complex diplomatic posturing as was witnessed surrounding the Grand Ethiopian Renaissance Dam, by those countries claiming their share of the Nile River waters.[187]

The flow of climate migrants is where national security from a border perspective could most affect Canada. CSIS's assessment considers that climate change may cause human migration to expand considerably for many reasons and that Canada is likely to be a desirable target destination for migrants due to political stability and natural resource abundance.[188] While Canada currently has a very welcoming migration stance, with ambitious targets to bring new people into the country, there exists significant concern about people seeking asylum at irregular border crossings like Roxham Road where nearly 40k people entered in 2022. The problem was so significant that a response, in the form of a revised Safe Third Country Agreement with the US, was one of the major announcements during President Biden's visit to Canada in March 2023.[189]

Regardless of these sorts of agreements, the number of people seeking opportunity for a better life in more prosperous countries like Canada is staggering at

---

[184] Swee Lean Collin Koh, 'China's Strategic Interest in the Arctic Goes beyond Economics', Defense News, 12 May 2020, https://www.defensenews.com/opinion/commentary/2020/05/11/chinas-strategic-interest-in-the-arctic-goes-beyond-economics/.
[185] Uchechukwu Okoye, 'What Is the Status of the Northwest Passage in the Arctic Under International Law of the Sea?', SSRN Scholarly Paper (Rochester, NY, 20 February 2022), https://papers.ssrn.com/abstract=4103818.
[186] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 2441.
[187] 'Grand Ethiopian Renaissance Dam', in *Wikipedia*, 29 March 2023, https://en.wikipedia.org/wiki/Grand_Ethiopian_Renaissance_Dam#Controversies.
[188] 'CSIS Scene Setter: Climate Change Security Factors', 1.
[189] Louis Blouin, Alexander Panetta, and Richard Raycraft · CBC News ·, 'After Years of Stalled Talks, Canada and U.S. Reach Border Deal on Irregular Migrants: Sources | CBC News', CBC, 23 March 2023, https://www.cbc.ca/news/politics/deal-roxham-road-migrants-biden-trudeau-1.6788358.

around 3.5% of the global population in 2019[190] a number that exceeded the global birth rate and one that is quite likely to increase in an uncertain climate disrupted future.

Notably, the IPCC report identified that it's not clear that climate change will directly drive migration volumes, beyond rising sea levels forcing abandonment of low-lying island nations and coastal communities, as research shows quality of governance is a greater factor in driving the likelihood of migration. That said, the challenges presented by a warming environment is expected to overwhelm those countries with weaker governance or smaller economies leading to armed conflict which is the major driver of forced migration.[191]

Coastal Security

Canada's maritime interests and infrastructure are increasingly under threat due to the effects of climate change making hurricanes more destructive with significantly heavier precipitation and higher sea levels contributing to larger storm surges, as was experienced with tropical storm Fiona in Newfoundland.[192] Fiona also caused extensive damage to other maritime provinces, including significant rapid erosion of Prince Edward Island's sand dunes that protect the low lying island and have already been retreating at a rate of 0.3m a year due to rising sea levels.[193]

Responding to rising sea levels will require considerable infrastructure investment and is something that can't be neglected given the significant amount of population in North America that lives proximate to the coast.[194] The CSIS report identifies that in some instances it may be impractical to mitigate against the ever-increasing flood risk for some coastal communities, which will certainly create some sizeable challenges in forcing the relocation of entire towns.[195]

Domestic Security

Both urban and rural citizens are, and will continue to be affected, by climate change in many complex and different ways. In urban settings, built up infrastructure absorbs and radiates heat and the types of measures that dampen this effect including trees for shade and green spaces are often inequitably distributed amongst neighborhoods of various income levels.[196] In the future the class based internal conflicts amongst citizens that already exists due to increasing inequality will only be exacerbated by climate change. Rural communities will be impacted by the higher future temperatures

---

[190] UN Department of Economic and Social Affairs, 'The Number of International Migrants Reaches 272 Million, Continuing an Upward Trend in All World Regions, Says UN', accessed 1 April 2023, https://www.un.org/development/desa/en/news/population/international-migrant-stock-2019.html.
[191] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 2465.
[192] Pörtner et al., 8.
[193] Cloe Logan, 'Hurricane Fiona Washed Away P.E.I. Coastline in Hours', Canada's National Observer, 29 September 2022, https://www.nationalobserver.com/2022/09/29/news/hurricane-fiona-washed-away-pei-coastline-hours.
[194] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 1963.
[195] 'CSIS Scene Setter: Climate Change Security Factors', 1.
[196] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 1962.

due to climate change as small towns often have limited resources to respond to high heat events, including places that could act as cooling centers or sufficient medical capacity to respond to heat related injuries.[197]

Ecologically, there have already been irreversible impacts, meaning beyond the ability of what is affected to adapt, on both natural and human systems caused by the increasing frequency of extreme weather events that can be attributed to climate change. As biodiversity plays a significant role in many systems that support domestic life, it's important to note that in AR6, climate change has been found to have increased the mortality of trees due to drought issues, which has the knock-on effect of an increase in the area burned and intensity of wildfires in certain regions.[198] A warming climate has also resulted in certain diseases, and novel means of them being spread, being introduced into more northern latitudes where the local human and animal populations may not have a natural resistance. As warming is occurring at a more rapid rate in the colder climates near the poles or at higher elevations in mountains, arctic habitats have been significantly impacted for species that rely on the tundra and ice, such as the caribou and polar bear, with the associated effect of human populations living in Canada's north losing a historic food source and cultural resource.[199] IPCC reporting forecasts, with a very high level of confidence, that the rapid climate driven ecosystem changes that are already affecting species will continue into the future.[200]

CSIS identifies espionage and theft of intellectual property from Canadian companies in the clean technology industry as a notable domestic security threat with impacts to the knowledge-based economy.[201] That said Canada could and should leverage its relatively well-educated population to seek out and share novel solutions to climate change as readily as possible to help other countries mitigate and adapt. A further future climate related domestic threat identified by CSIS is the increased potential for Ideologically Motivated Violent Extremism (IMVE). This IMVE has the potential to arise from both sides of the political spectrum, either from those who feel that sufficient action isn't being taken to counter climate change or from those that see the inevitable change as degrading their perceived social standing.[202]

Energy Security

The details in CSIS's assessment of energy security risks are minimal, but the report does identify that the requirement to remove carbon from energy sources will have a significant impact on the balance of energy supply sources with broader implications for geopolitical dynamics.[203] Arguably, it's these dynamics that are at the heart of ongoing efforts to delay taking the necessary action to counter climate change.

---

[197] Pörtner et al., 1962.
[198] Pörtner et al., 8.
[199] Pörtner et al., 45.
[200] Pörtner et al., 1945.
[201] 'CSIS Scene Setter: Climate Change Security Factors', 1.
[202] 'CSIS Scene Setter: Climate Change Security Factors', 2.
[203] 'CSIS Scene Setter: Climate Change Security Factors', 2.

At a time when electricity production will need to be increased, due to the increasing electrification of previously fossil fuel powered capabilities, IPCC projects with medium confidence that changes to snow pack and glacier contributions to hydro power basins could be reduced in certain regions.[204] Extreme heat events will continue to increase the demand on electrical production and distribution, as a greater proportion of the population will demand air condition for both comfort or just to avoid the potential medical complications of excess heat exposure.[205] This demand runs the risk of over stressing the electrical grids and contributing to widespread power outages similar to the 2003 blackout that affected 55 million people in Ontario and a number of North Eastern US states.[206]

Health Impacts

IPCC's AR6 determined that in the nearly 10 years since the previous assessment was published there has been an increase in heat-related human deaths in North America that can be attributed to climate change. IPCC projects, with a very high confidence, that heat related mortality will increase in all emissions scenarios, with the elderly population and those that live in urban settings at the greatest risk.[207] Any actions taken to limit emissions and the effects of climate change could prove very beneficial from a mortality perspective, with estimates of a 50% reduction from the RCP8.5 to the RCP4.5 scenarios. Human health is also impacted indirectly by the hotter temperatures brought about by climate change; the significant and widespread smoke from more regular and intense wildfires has been associated with respiratory distress and increased hospital visits.[208]

A warming climate has been found, with very high confidence, to have increased exposure to diseases like lyme disease due to longer seasons where exposure to ticks is possible and less winter dye off of the insects.[209] Projections indicate that other insect borne diseases have and will continue to increase, though the significance for Canadian populations is uncertain.[210] The tick problem in North America is just one example of how climate change and loss of animal habitat will lead to greater human / animal interaction and with that increased risk of transmission of infectious disease that could lead to COVID level or worse pandemics.[211]

Warmer air temperatures and extreme weather changes including heavy precipitation has been found to increase the likelihood of pathogens or environmental contaminants entering into foods, which increases the risk of food borne disease. The

---

[204] Lee et al., 'Synthesis Report of the IPCC Sixth Assessment Report (AR6) - Summary for Policymakers', 603.
[205] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 1963.
[206] 'Northeast Blackout of 2003', in *Wikipedia*, 20 March 2023, https://en.wikipedia.org/w/index.php?title=Northeast_blackout_of_2003&oldid=1145732976.
[207] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 1968.
[208] Pörtner et al., 1969.
[209] Igor Dumic and Edson Severnini, '"Ticking Bomb": The Impact of Climate Change on the Incidence of Lyme Disease', ed. Paola Di Carlo, *Canadian Journal of Infectious Diseases and Medical Microbiology* 2018 (24 October 2018): 5719081, https://doi.org/10.1155/2018/5719081.
[210] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 1969.
[211] 'CSIS Scene Setter: Climate Change Security Factors', 2.

increased risk to food supplies could be notably more prevalent in northern communities as the more significant temperature changes may introduce novel pathogens into locally produced foods.[212] Mental health continues to be increasingly impacted by climate change, whether due to stressors of living through extreme weather events or by the health degrading effects of climate anxiety stemming from feelings of being unable to do anything to counter or prepare for such a significant threat.[213]

Financial and Economic Security

The CSIS assessment of security risks due to climate change identifies that the insurance industry is already responding to the increased weather-related natural disasters with higher premiums and that this trend is likely to continue to the extent that certain infrastructure may be too cost prohibitive to insure, with citizens expecting government to then bear those costs. The report also identifies that there is a risk that the significant economic impact of COVID and associated high government debt levels may delay appropriate response to climate change, potentially beyond tipping points.[214]

Multiple sectors that the Canadian economy relies upon, including agriculture, forestry, fishing, energy and tourism, have been identified as being climate exposed and have already been subject to economic damage.[215] One high confidence assessment within the IPCC's AR6 work is that there have already been measurable impacts to economies, certain livelihoods and changes to cultural practices as a result of changes to ecosystems as a result of climate change.[216] A highly visible example of the economic impacts of climate change in Canada's Western provinces is the mountain pine beetle, which started to become a prominent concern in the late 1990s. While the beetle has always been native to British Columbia, its population was usually killed off a significant amount with the cold temperatures each winter. A warming climate however led to an explosion in the beetle population and combined with historic forestry practices that resulted in an unnaturally large mature pine concentration resulted in over 18 million hectares of forest being affected by 2012.[217] The impact of the dead forests, large swaths of which are visible from the air, has been more extreme wildfires and from an economic perspective closures of pulp and paper mills, once the main economic driver for some BC towns.[218]

Also, from a financial perspective, the dead or burned out forests that cover large areas of the BC interior can be considered as being a contributing factor to the landslides that cutoff Vancouver and the lower mainland from the rest of the country in late 2021.

---

[212] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 1970.
[213] Pörtner et al., 1971.
[214] 'CSIS Scene Setter: Climate Change Security Factors', 2.
[215] Lee et al., 'Synthesis Report of the IPCC Sixth Assessment Report (AR6) - Summary for Policymakers', 6.
[216] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 45.
[217] Natural Resources Canada, 'Mountain Pine Beetle (Factsheet)' (Natural Resources Canada, 25 October 2013), https://natural-resources.canada.ca/forests/fire-insects-disturbances/top-insects/13397.
[218] Andrew Kurjata, 'More than 20 Years Ago, a Tiny Insect Changed B.C.'s Forestry Future. The Fallout Is Still Happening.', CBC, 13 January 2023, https://www.cbc.ca/news/canada/british-columbia/british-columbia-forestry-future-pine-beetle-1.6712576.

The wildfires that occurred in the summer of 2021 left in their wake a hydrophobic crust that inhibited the absorption of the atmospheric event level rains that caused the flooding and landslides. The dead standing weakened trees and rock fractured by the heat are also contributing factors to the landslides that caused extensive damage.[219] The environmental catastrophe caused initial panic in the province over food and water supplies and required CAF intervention, that was reported on internationally, with aircraft rescuing stranded travelers from between numerous mudslides. It also cut-off Canada's largest port by volume of cargo handled[220] (and third largest in North America) from the country by rail for 10 days[221] and by road for over two months with limited access for commercial traffic roughly a month after the washouts.[222] Long-term repairs of the major highway systems in southern BC are still ongoing. North American development norms that result in vast swaths of land being covered in asphalt and concrete further exacerbates the problem of changing rain patterns when greater volumes of water fall on a region than the storm drains can manage, highly damaging flooding is inevitable.

The economic costs of both responding to and recovering from these climate-driven, or at a minimum exacerbated, natural disasters is significant. The Fort McMurray wildfires, that led to the evacuation of the entire community of 90 000 people, many through terrifying infernos, cost an estimated $3.58 billion in insured losses.[223] This was bested as Canada's most expensive natural disaster by the flooding and landslides that occurred in southwest BC in 2021, which is estimated will cost nearly $9 billion to rebuild all that was lost,[224] and doesn't account for economic impacts due to trade being hindered. The annual cost of both preventive and reactive measures to combat the increasing threat of wildfires in Canada has been between $800 million and $1.4 billion from 2008 to 2017.[225] IPCC AR6 projections show these amounts increasing by a minimum of 60% under the RCP2.6 scenario and potentially by 119% should the RCP8.5 scenario occur.[226]

---

[219] Emily Chung, 'One-Two Punch: Why Floods Pummel Wildfire-Ravaged Areas', CBC, 18 November 2021, https://www.cbc.ca/news/science/post-wildfire-floodring-1.6253544.
[220] Transport Canada, 'Freight Transportation', Transport Canada, accessed 23 March 2023, https://tc.canada.ca/en/corporate-services/transparency/corporate-management-reporting/transportation-canada-annual-reports/freight-transportation.
[221] Christopher Reynolds, 'Trains Roll into Vancouver after CP Rail Restores Limited Service Following Mudslides', thestar.com, 24 November 2021, https://www.thestar.com/business/2021/11/24/trains-roll-into-vancouver-after-cp-rail-restores-limited-service-following-mudslides.html.
[222] BC Ministry of Transport, 'B.C. Highway Flood Recovery Projects - Highway 5 - Coquihalla' (Province of British Columbia), accessed 23 March 2023, https://www2.gov.bc.ca/gov/content/transportation-projects/bc-highway-flood-recovery/2021-flood-road-recovery-projects-highway-5.
[223] Reuters, 'Factbox: Canada's 10 Costliest Natural Disasters by Insurance Claims', *Reuters*, 17 November 2021, sec. Americas, https://www.reuters.com/world/americas/canadas-10-costliest-natural-disasters-by-insurance-claims-2021-11-17/.
[224] Justine Hunter, 'Cost of Rebuilding B.C. after Flooding Nears $9-Billion', *The Globe and Mail*, 19 February 2022, https://www.theglobeandmail.com/canada/british-columbia/article-cost-of-rebuilding-bc-after-november-storms-nears-9-billion/.
[225] Natural Resources Canada, 'Cost of Wildland Fire Protection' (Natural Resources Canada, 18 September 2015), https://natural-resources.canada.ca/climate-change/impacts-adaptations/climate-change-impacts-forests/forest-change-indicators/cost-fire-protection/17783.
[226] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 1949.

IPCC AR6 projects that wildfire activity will increase in many parts of North America in the future due to longer fire seasons caused by warmer temperatures and changing precipitation patterns, exacerbated by more frequent lightning strikes. What's more worrying from a Canadian perspective is that more frequent and significant fires have occurred in the Arctic tundra in recent years a trend that is expected to continue with continued warming.[227]

Food Security

Though difficult to determine what the impact will be for the fishing industry / fish stocks in Canada, the impacts of climate change has caused roughly half to two-thirds of marine species to shift their ranges to higher latitudes and move the timing of biological events (phenology) like the spawning season earlier in the year.[228] Even if this continued movement results in greater fish stocks in Canadian territorial waters, there will inevitably be conflict over access to these migrating fish stocks, especially given the significant amount of captured fishery production in South-East Asia compared to any other region in the world.[229]

IPCC AR6 projects, with a very high confidence, that changes to water temperatures due to climate change, including loss of cold-water inputs from glaciers, will reduce the suitable river habitats for salmon and trout species in the northwestern North America. Warming waters in the North Atlantic, off the coast of Nova Scotia, have led to an 85% reduction in the biomass of kelp, that forms an important marine habitat, over the last 40 to 60 years.[230] It's not just warming waters that are affecting marine life, increased concentrations of CO_2 in the water have resulted in reduced growth in some halibut species in the Atlantic. Though less significant in Canadian waters thus far, climate change has been found to partially influence hypoxic events which result in areas of the ocean with significantly reduced oxygen levels.[231]

Land based food production has been affected in both positive and negative ways because of climate change with changes in growing seasons and what crops will grow in certain regions, drought and extreme rain events. Overall, "...climate change has generally reduced agricultural productivity by 12.5% since 1961,"[232] with the greatest reduction happening in more southerly regions. Changing rainfall patters have meant that irrigation is increasingly needed to be used in farming regions that could traditionally rely on rainfall. Interestingly, the impact denial stance that CO_2 will benefit plant growth is somewhat true as higher levels of atmospheric carbon have been found to increase crop yield, but with a trade-off in reduction of nutrient value of many food items. The warmer climate will also affect meat production with higher temperatures resulting in additional

---

[227] Lee et al., 'Synthesis Report of the IPCC Sixth Assessment Report (AR6) - Summary for Policymakers', 1948.
[228] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 45.
[229] 'Fish and Overfishing', Our World in Data, accessed 23 March 2023, https://ourworldindata.org/fish-and-overfishing.
[230] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 1947.
[231] Pörtner et al., 1951.
[232] Pörtner et al., 1956.

heat stress, disease and greater amounts of pests affecting livestock.[233] Ironically, the animal farming density that modern agriculture provides to enable large human populations, risks fish stock and impacts other aquatic life as the excess nutrient runoff from these industrial farms during atmospheric river type rainfall events leads to large algae blooms.[234]

Though limited in detail, CSIS's assessment of food security threats specific to Canada aligns with the various findings of the IPCC report.

Climate Change as a Security Accelerant

It can be expected that all current geopolitical security challenges will only be exacerbated by the impacts of climate change whether that's effects on critical infrastructure, reduced human populations or degradation of health or resource scarcity. CSIS assessed that, "...climate change compounds all... known security issues and serves as an accelerant towards negative security outcomes."[235] The highly cited research of Burke et al. determined that for every increase in temperature by a standard deviation, relative to the baseline of the region being considered, there will be an increase in interpersonal conflict of 2.4% with intergroup conflict increasing by 11.3%.[236]

There have already been examples of climate change contributing to the severity of contemporary and recent conflicts. Vice News reporting on the recent drought in Syria, determined by NASA to be the worst in the past 900 years, caused 75% of the country's farms to fail and 85% of the livestock to die between 2006 and 2011. This significant collapse of the farming sector led to the migration of 1.5 million rural Syrians to large urban centers where resources were already scarce. The stressors of this massive migration are believed to have been a significant catalyst in the Syrian civil war.[237] The desperation of farmers impacted by successive droughts in Northern Iraq is believed to have been a contributing factor to portions of that population being recruited by ISIS, who in similar fashion to other terrorist groups leverage such hardships to their advantage.[238] In Yemen droughts, rising sea levels and depleted fish stocks have exacerbated the challenges the country's citizens face in trying to survive the ongoing civil war and make it much more difficult to find any form of resolution to the conflict.[239]

---

[233] Pörtner et al., 1956.
[234] Pörtner et al., 1946.
[235] 'CSIS Scene Setter: Climate Change Security Factors', 2.
[236] Marshall Burke, Solomon M. Hsiang, and Edward Miguel, 'Climate and Conflict', *Annual Review of Economics* 7, no. Journal Article (2015).
[237] Elaisha Stokes, 'The Drought That Preceded Syria's Civil War Was Likely the Worst in 900 Years', 3 March 2016, https://www.vice.com/en/article/3kw77v/the-drought-that-preceded-syrias-civil-war-was-likely-the-worst-in-900-years.
[238] Peter Schwartzstein, 'Climate Change and Water Woes Drove ISIS Recruiting in Iraq', National Geographic Science, 14 November 2017, https://www.nationalgeographic.com/science/article/climate-change-drought-drove-isis-terrorist-recruiting-iraq.
[239] Susan Schulman, 'Yemenis' Daily Struggles Between Conflict and Climate Change', *The RUSI Journal* 166, no. 1 (2 January 2021).

Water Security

The CSIS security threat examination posits that it is very likely that water will transition from an unseen commodity to a vital and contested resource in the future due to the effects of climate change.[240] Fortunately, Canada is in an advantageous position from a freshwater perspective with the fourth largest volume of renewable fresh water by country[241] and a significant amount on a per capita basis. This abundance however is a potential cause for conflict in the future as this increasingly scarce and essential resource could be reason to challenge the country's sovereignty.

A current example of the types of conflict over water resources that could arise in the future is the ongoing dispute over water rights of the Colorado River, that has arisen over the recent decade due to an ongoing drought affecting the river's tributaries. The river provides water for agriculture, industry and millions of people across 7 states in the southwest US and into Mexico, but due to the effects of excess usage and the drought, its waters don't often reach the mouth in the Pacific Ocean. The Colorado River Compact agreed in 1922 identified yearly water allocations across the 7 states,[242] but did not account for variations in river levels or consider potential population growth rates. Unable to agree on suitable reductions or re-allocations of water rights amongst the states, the US federal government was forced to intervene and issues cuts.[243] Should such a disagreement arise in the future between countries, when water resources are limited, it's uncertain whether a similar peaceful agreement could be reached or enforced.

While dams and water systems in Canada and North America have significantly reduced flooding risk and help to ensure safe access to water supplies, a lot of this infrastructure is quite dated and not designed for the increased volumes of water anticipated with future climate driven rain events, meaning these beneficial systems present a real risk into the future.[244]

Also, of potential concern from a fresh water perspective is the arctic warming leading to permafrost thaw that is expected to affect hydrological cycles with uncertain consequences.[245] Thawing permafrost is considered a critical tipping point, meaning once triggered it is self-reinforcing and likely to accelerate at a rate that natural and even human systems would be challenged to adapt to. Fortunately, the current assessment is that these critical tipping points are only at greatest risk of occurring in the scenarios

---

[240] 'CSIS Scene Setter: Climate Change Security Factors', 3.
[241] 'Which Country Has the Most Fresh Water?', WorldAtlas, 24 September 2018, https://www.worldatlas.com/articles/countries-with-the-most-freshwater-resources.html.
[242] 'Colorado River Compact', in *Wikipedia*, 20 March 2023, https://en.wikipedia.org/w/index.php?title=Colorado_River_Compact&oldid=1145718875.
[243] Gabrielle Canon and Richard Luscombe, 'US Issues Western Water Cuts as Drought Leaves Colorado River near "Tipping Point"', *The Guardian*, 17 August 2022, sec. US news, https://www.theguardian.com/us-news/2022/aug/16/drastic-water-cuts-expected-as-megadrought-grips-western-us-states.
[244] Pörtner et al., *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability.*, 1952.
[245] Pörtner et al., 1945.

where insufficient carbon reduction and change mitigation measures are instituted (SSP5 8.5).[246]

Fresh water supply is also at risk due to snow coverage decreasing by around 20% by 2060 and stabilizing under RCP2.6 scenarios or continuing to degrade to 60% by 2100 under the worst case RCP8.5 scenario, the latter could lead to consecutive snow drought years that would make water management planning very difficult with reduced and earlier meltwater flows.[247] Glacial ice melt can pose a risk to plants, animals and people that might be exposed to the melt waters as some have locked away hazardous materials and pollutants for significant lengths of time.[248]

> Water serves a wide variety of environmental functions and human uses as it moves through North America's river basins, so the impacts of climate change are expected to be widespread and multifaceted.[249]

Adding to the challenge of climate change as a security threat is the uncertainty surrounding when these myriad of impacts will be experienced. Many changes are already underway with the risk building over significant periods of time with timescales not conducive to human populations initiating a suitable response. CSIS assessment of the problem identified climate change as, "...a complex, long-term threat to Canada's safety, security and prosperity,"[250] now and into the future.

6. INFORMATION OPERATIONS DOCTRINE

Given the significant national security issues that have arisen and will continue to worsen as a result of climate change and the pervasive and ever adapting nature of the disinformation / delaying campaign enacted by industry and other actors, it is beneficial to compare these efforts with military Information Operations (IO) doctrine to better understand the challenge in responding to this existential threat. For this comparison work, four doctrinal documents were reviewed. The first document reviewed was Canadian Forces Joint Publication (CFJP) 3-10 Information Operations, which was published in 1998. As the information contained within can be considered extremely dated in an operating space that has changed significantly in the last 25 years, its replacement was sought for review. A draft copy of CFJP 3-10 Operations in the Information Environment was obtained from military colleagues and will be used as the primary reference for this comparison work. Using an as yet to be published doctrinal document is justified as it draws heavily upon and closely aligns with NATO's Allied Joint Publication (AJP) 10.1 – Allied Joint Doctrine for Information Operations, the current version of which was published in January 2023. The final document reviewed for this work is US Joint Publication 3-13 – Information Operations, but will be used

---

[246] Pörtner et al., 2351.
[247] Pörtner et al., 603.
[248] Pörtner et al., 2331.
[249] Pörtner et al., 1955.
[250] 'CSIS Scene Setter: Climate Change Security Factors', 3.

sparingly in this comparison as only an older version from 2014 could be readily obtained.

Definitions and Terminology

Comparing the historic and ongoing efforts to sow false information around climate change with information operations is justified based on a number of concepts and definitions within the doctrine. The extant version of CFJP 3-10 identifies that, "IO can be used to influence decision-makers at all levels… on either or both sides of a dispute, [and that information] is the means [and] decision makers the objective."[251] The 40 plus years of disinformation efforts put forth by the petroleum industry and loosely disconnected lobbying groups and think tanks has left a long term impact on political decision makers, but more importantly the voting public, making building consensus to take the required action nearly impossible.

The updated draft of CFJP 3-10 includes the concept of Information Warfare (IW) and states that, "…its importance lies in how… words or actions are perceived or translated to influence behaviour."[252] The updated doctrine further defines IW to include a, "…range of offensive and defensive efforts… to inform public opinion, influence some audiences and to impose others to take specific action."[253] Historic and ongoing efforts to sow doubt around climate change should be considered IW against the general population as still in 2022, despite broad scientific agreement, there exists as much as 14.8% of the US population that don't believe climate change exists.[254] Beyond outright denial there are many others who have been influenced to doubt the impacts or need to take action as discussed in the previous section looking at variations of denial.

Perhaps the most applicable term defined within NATO's AJP-10.1 and pulled into the updated CFJP 3-10 is the concept of deception. In both documents the word deceive is given the definition of being, "To mislead an entity by **manipulating its perceptions** in order to induce it to react in a manner **prejudicial to its interests**."[255] It is readily apparent how deception can provide military advantage, but the definition very clearly encapsulates the efforts and objectives of climate disinformation. Continued large scale, and for most of recent history increasing, emissions of CO_2 will be extremely prejudicial to the interests of a majority of the global population yet building political will to take the necessary action to avoid the worst impacts is extremely difficult due to historic and ongoing manipulation.

---

[251] J6 Information Operations, 'CFJP 3-10 - CF Information Operations (Extant)' (Government of Canada, 15 April 1998), 6.
[252] Joint Warfare Development Branch, 'CFJP 3-10 - Operations in the Information Environment (Draft)' (Government of Canada, 2023), 14.
[253] Joint Warfare Development Branch, 14.
[254] Jianxun Yang et al., 'The Social Anatomy of Climate Change Denial in the United States (Preprint)', *Research Square*, 2022.
[255] Director Development, Concepts and Doctrine Centre, 'NATO Standard AJP-10.1 - Allied Joint Doctrine for Information Operations' A-2.

Information Operations to Counter Disinformation

There are various frames of reference from which to consider how IO doctrine helps to understand the climate misinformation space. The first potential framework for considering IO is using Operations in the Information Environment (OIE) to counter the societal damage done by the decades long disinformation campaigns by providing a counter narrative espousing the need to institute societal level changes (reduced unnecessary consumption, more efficient homes and vehicles, stricter regulations for industry, etc.) to meet the significant challenges of responding to climate change. There is a case to be made for an OIE campaign targeted at the broader Canadian (and more significantly US) public as providing, "…a truth-based alternative is necessary but insufficient to counter 'fake news.'"[256]

This idea from doctrine that presenting facts to the misinformed is insufficient to correct their understanding of a topic is highlighted in academic research. Chan et al. conducted a meta-analysis of nearly 7000 studies looking at the persistence of misinformation when people were presented with debunking information and found that false narratives were highly persistent against factual information. They further found that there was greater success in countering misinformation when people received information in a manner that enabled them to update the mental model they developed to justify the deceptive messaging.[257]

That those that have internalized a misinformed and factually incorrect narrative cannot readily be swayed by being presented with clear evidence of the truth is at the heart of the term 'post-truth' being made Oxford Dictionary's word of the year in 2016. The term rose to prominence surrounding Donald Trump's election as US President but is equally relevant in the various disinformation spaces that persist. Oxford defines post-truth as, "…relating to or denoting circumstances in which objective facts are less influential in shaping public opinion than appeals to emotion and personal belief."[258]

Clearly a dedicated IO based climate counter narrative campaign is needed to better convince the public to support significant lifestyle changes, many of which could also result in improved quality of life, to reduce emissions. There has been a history of the Canadian government using propaganda to improve public support for war efforts, such as posters encouraging the purchase of Victory Bonds during WW1[259] or the use of radio and film in WW2 to encourage national identity and backing of the war.[260] Despite the threat from climate change being as significant as previous global conflicts, modern efforts now by the government to manipulate the public to curb their consumption would

---

[256] Joint Warfare Development Branch, 'CFJP 3-10 - Operations in the Information Environment (Draft)', 17.
[257] Man-pui Sally Chan et al., 'Debunking: A Meta-Analysis of the Psychological Efficacy of Messages Countering Misinformation', *Psychological Science* 28, no. 11 (1 November 2017).
[258] 'Oxford Word of the Year 2016', Oxford Languages, 16 November 2016, https://languages.oup.com/word-of-the-year/2016/.
[259] 'Canadian Wartime Propaganda - First World War', accessed 1 May 2023, https://www.warmuseum.ca/cwm/exhibitions/propaganda/first_e.html.
[260] John Tattrie, 'Propaganda in Canada', 16 July 2019, https://www.thecanadianencyclopedia.ca/en/article/propaganda-in-Canada.

be highly controversial and would certainly backfire if they were uncovered by those who already disbelieve climate change. In addition to uncertain efficacy, there are also legal limitations to conducting what would be considered psychological operations (PSYOPS) inside Canada or on Canadian citizens, outside of exceptional circumstances to protect Canadians or to defend the continent.[261] Due to the controversial nature of looking at, and illegal nature of conducting, IO from this perspective it can be considered too large in scope to consider in great detail in this section, but perhaps is something for future research or a tool to be considered by climate activist organizations.

Climate Disinformation as Information Operations

The remainder of this section will look at IO doctrine from the frame of reference of industry, think tanks and lobby groups (Actors) using these strategies to manipulate the general population and by extension their political leaders (Audiences) and thus continually delay meaningful action on climate change. The first concept to consider is what draft Canadian doctrine refers to as the Information Environment (IE) conditions of Will, Understanding and Capability and which in NATO doctrine are considered functions that determine the effectiveness of IO on an audience group. Both documents identify that Will is the element against which an influencing actor operates and, "…includes factors such as motivation, perception, attitude, beliefs and values and encompasses the intent to act or resist."[262] While there are many disinforming efforts that could be identified as acting on the Will of the audience, perhaps the most entrenched is the narrative that an ever-increasing use of fossil fuels is essential for a good quality of life. While it can't be denied that the energy provided by fossil fuels has greatly improved living standards worldwide, there also exists a close connection between ever increasing consumption, driven by advertising, and climate change.[263] While advertising doesn't specifically count as misinformation, the lifestyle image generated by it is leveraged by industry as an emotional reason why fossil fuels are needed.

The Understanding information environment condition encompasses the cognition of individuals to perceive and interpret information and IO actor efforts that aim to shape an audience's understanding to affect their decision-making.[264] Understanding is at the heart of nearly all historic and current climate disinformation campaigns whereby industry seeks to sow enough plausible doubt surrounding climate change origins (attribution denial), whether it's taking place (trend denial), that there is no agreement (consensus denial) or that it won't affect the planet (impact denial) to prevent action that might cut into the financial bottom line.

---

[261] Joint Warfare Development Branch, 'CFJP 3-10 - Operations in the Information Environment (Draft)', 40.
[262] Joint Warfare Development Branch, 17; Director Development, Concepts and Doctrine Centre, 'NATO Standard AJP-10.1 - Allied Joint Doctrine for Information Operations', 16.
[263] Zoe Gannon and Neal Lawson, 'The Advertising Effect', *How Do We Get the Balance of Advertising Right*, 2010, 4, https://www.bl.uk/britishlibrary/~/media/bl/global/social-welfare/pdfs/non-secure/a/d/v/advertising-effect-how-do-we-get-the-balance-of-advertising-right.pdf.
[264] Joint Warfare Development Branch, 'CFJP 3-10 - Operations in the Information Environment (Draft)', 17.

The last condition or measure of effectiveness involves an actor's Capability to take action in the IE. From a military doctrine perspective this primary includes the physical capabilities to, "…degrade, disrupt, deceive, destroy or deny those capabilities that allow adversary decision-makers to increase their understanding."[265] While industry doesn't possess the ability nor social license to disrupt physical communications infrastructure, their extensive employment of high end public relations firms[266] using significant financial resources proves that they have significant capability to affect adversary (or audience) decision-making capabilities. Brulle's analysis of the financial resources of what have been termed Climate Change Counter Movement organizations, which include think tanks, trade associations and grassroots lobby firms, found the 91 such entities had an average annual income of $900 million and receive an additional $64 million in philanthropic (anti-climate change) support, so the resources capability available is significant.[267]

AJP-10.1 describes a number of principles that can be used when planning IOs to help ensure their execution achieves the desired aims.[268] The draft version of the updated Canadian doctrine includes these same concepts as OIE principles.[269] The first principle is Comprehensive Understanding, the definition of which varies slightly between documents in that NATO doctrine identifies the need to understand the commander's objectives, the information environment being operated in and the audience that inhabits that environment, while Canadian doctrine doesn't specifically refer to commander's intent. While the pervasiveness of climate change false narratives demonstrates that actors have historically held a strong understanding of the space, that most disinformation is targeted at a conservative audience, who have less trust in traditional media and are more likely to believe conspiracy theories,[270] might be the best example of comprehensive understanding.

The next OIE principle is Narrative Led, which is described in both documents as the words, images and actions that form the information narrative and highlights that these must be coherent across the strategic, operational and tactical levels. While it's difficult to identify strategic through tactical levels amongst climate change denying actors, this paper has described how narratives have changed over the 40-year disinforming campaign from outright denialism in various guises to discourses that accept change is happening but delay meaningful action. Though briefly discussed in the emphasize the downsides discourse, it appears that the latest narrative preventing meaningful action involves incorporating climate change into the ongoing culture wars through woke washing.[271] Investigations into online narratives leading up to COP27

---

[265] Joint Warfare Development Branch, 17.
[266] Robert J Brulle and Werthman Carter, 'The Role of Public Relations Firms in Climate Change Politics', *Climatic Change* 169, no. 1–2 (November 2021).
[267] Brulle, 'Institutionalizing Delay', 1.
[268] Director Development, Concepts and Doctrine Centre, 'NATO Standard AJP-10.1 - Allied Joint Doctrine for Information Operations', 15.
[269] Joint Warfare Development Branch, 'CFJP 3-10 - Operations in the Information Environment (Draft)', 37.
[270] Sander van der Linden, Costas Panagopoulos, and Jon Roozenbeek, 'You Are Fake News: Political Bias in Perceptions of Fake News', *Media, Culture & Society* 42, no. 3 (2020).
[271] The adoption of 'progressive' rhetoric to oppose climate action.

found that anti-woke messaging was the most prominent, with conspiracy theories, "…presenting climate action as part of a plot by 'global elites' to exert control [or] claiming that climate change has been 'engineered' to destroy capitalism."[272]

Though definitions vary slightly between doctrinal documents, the next principle Integrated explains the idea that IO will result in a cognitive behavioral change amongst the audience and that actors must constantly monitor and be accountable for these changes. While the flexibility of misinforming actors over the years demonstrate that they are monitoring the impacts of their campaigns it is unlikely they will take any level of responsibility for the long-term impacts of either climate change or the societal elements of misinformation, so this element of doctrine doesn't compare well.

The next two OIE principles are that IO must be Focused on the objective and selecting the most appropriate means to achieve it and that these plans must have a level of Agility to respond to the ever-changing information environment. The focus of the myriad of disinforming efforts has been to spread uncertainty amongst the population and elected officials to prevent or limit legislation that might impact the extensive profits of polluting industries. It's the agility of the various actors in this space that have made achieving their objectives, leaving "…[US] federal energy policy… in a virtual stalemate for three decades, due in part to the waves of lobbying, public relations, and campaign contributions that ramp up every time new regulations appear possible"[273]

The principle of Centralized Planning and Decentralized Execution likely doesn't align well with long-term disinformation efforts. While there would have certainly been strategy meetings held at high levels of various polluting companies to discuss corporate direction and maximizing profits, any sort of planning on how to prevent legislation that would cut into the bottom line would be managed by PR firms or industry groups like API or the Heartland Institute. While the centralized planning element of this principle doesn't really apply, decentralized execution by a variety of conservative foundations and think tanks supported by contrarian scientists and conservative media outlets is likely a key feature in providing plausible deniability to the key industry players that benefit the most.[274]

The final OIE principle is Assessment which both doctrinal documents identify as critical as the behavioral change sought out through IO efforts is not immediate (as might be the case with traditional kinetic military effects). CFJP 3-10 identifies indicators of the desired change of an audience occurring as, "…attitude of the civilian population, political activity and expressions of unrest,"[275] with AJP-10.1 adding changes in the perception of the civilian population to this list, but with no indication how that might be measured. While no sources could readily be found identifying how climate change

---

[272] 'Deny, Deceive, Delay - Exposing New Trends in Climate Mis- and Disinformation at COP27', 6.
[273] Culhane, Hall, and Roberts, 'Who Delays Climate Action? Interest Groups and Coalitions in State Legislative Struggles in the United States', 1.
[274] Riley E. Dunlap, 'Climate Change Skepticism and Denial: An Introduction', ed. Riley E. Dunlap, *The American Behavioral Scientist (Beverly Hills)* 57, no. 6 (2013): 1.
[275] Joint Warfare Development Branch, 'CFJP 3-10 - Operations in the Information Environment (Draft)', 38.

disinforming actors might be assessing the effectiveness of their efforts, the previously mentioned agility with which messaging efforts have changed and the culturally embedded success their enduring efforts have achieved would indicate some degree of monitoring has occurred over time. While many parallels can be drawn between IO doctrine and the decades long climate change disinformation efforts, an argument could be made that military IW planners have a lot to learn from the experienced actors in this space.

7. CONCLUSION

This research project investigated the decades long campaign to disinform the general public and their elected leaders about the origins, severity and impacts of climate change. It provided a summary of the historic efforts to sow confusion on the topic using a number of denial variants and made the case that various industrial leaders in the fields most responsible for CO_2 emissions were fully aware that they were lying to the public for their own financial interest. The paper further looked at the various actors in the climate change denial space from ill-informed scientists to industry and the think tanks and institutes it sponsors through to the media and general public that help spread the misinformation. Finally, within the misinformation space it was discussed how the narrative surrounding climate change has moved from one of denial to various discourses that seek to delay taking any meaningful action to counter the significant threat.

The significance of the climate change threat to national security was presented, basing the discussion on a CSIS analytic brief and leveraging the work of the IPCC in their AR6 report. The paper finished by looking at information operations doctrine from Canada, NATO and the US to both determine parallels between doctrine and the historic and ongoing efforts to confuse the general public, and to investigate whether a case could be made to leverage doctrine to develop suitable counter narratives in the war against disinformation.

While the latter idea was only briefly contemplated, there is a case to be made that some of the tools contained within IO doctrine, and likely the more sophisticated methods used by modern advertising agencies, should be further researched as a means to undo some of the seemingly entrenched beliefs created by the disinforming actors. Other areas for potential further research would be looking at how advertising drives excessive and in a lot of cases un-necessary consumption, which contributes to greenhouse gas emissions and other environmental degradation.

The disinformation surrounding climate change has been a difficult topic to research as a level of plausible deniability as to being the source of the misleading information is a key element of its effectiveness. There is also a lack of consistency in the arguments used to sow doubt as they shift with time to adapt to the public gaining understanding of the tactics and to where they can best cause the most confusion. While it does appear that an ever-increasing portion of the population is becoming wise to these disinforming efforts, it remains exceptionally important to continue to try to shed light on

the nefarious players in this space otherwise, "…[t]he damage, deaths, and harm to people will continue to worsen if we don't expose and discredit denial."[276]

[276] Cook et al., 'America Misled', 12.

BIBLIOGRAPHY

Allam, Zaheer, Mark Nieuwenhuijsen, Didier Chabaud, and Carlos Moreno. 'The 15-Minute City Offers a New Framework for Sustainability, Liveability, and Health'. *The Lancet Planetary Health* 6, no. 3 (March 2022): e181–83. https://doi.org/10.1016/S2542-5196(22)00014-6.

Allcott, Hunt, and Matthew Gentzkow. 'Social Media and Fake News in the 2016 Election'. *The Journal of Economic Perspectives* 31, no. 2 (2017): 211–35.

Antilla, Liisa. 'Climate of Scepticism: US Newspaper Coverage of the Science of Climate Change'. *Global Environmental Change* 15, no. 4 (1 December 2005): 338–52. https://doi.org/10.1016/j.gloenvcha.2005.08.003.

API. 'API Launches New National Campaign "Energy for Progress"', 7 January 2020. https://www.api.org/news-policy-and-issues/news/2020/01/07/soae-2020-release.

Austin, Jon. 'Global Warming "Is FAKE": Volume of Ice Caps Is INCREASING, Claims Top Geologist'. *Express (Online)*, 7 October 2015. 1719976483. ProQuest Central.

Banerjee, Neela, Lisa Song, and David Hasemyer. 'Exxon's Own Research Confirmed Fossil Fuels' Role in Global Warming Decades Ago'. *Inside Climate News*, 16 September 2015. https://insideclimatenews.org/news/16092015/exxons-own-research-confirmed-fossil-fuels-role-in-global-warming/.

BC Ministry of Transport. 'B.C. Highway Flood Recovery Projects - Highway 5 - Coquihalla'. Province of British Columbia. Accessed 23 March 2023. https://www2.gov.bc.ca/gov/content/transportation-projects/bc-highway-flood-recovery/2021-flood-road-recovery-projects-highway-5.

Begert, Blanca. 'Climate Denial Campaign Goes Retro with New Textbook'. Grist, 6 February 2023. https://grist.org/science/climate-denial-campaign-goes-retro-with-new-textbook/.

Bernstein, Paul, David Montgomery, Bharat Ramkrishnan, and Sugandha Tuladhar. 'Impacts of Greenhouse Gas Regulations on the Industrial Sector'. Institute for 21st Century Energy - US Chamber of Commerce, March 2017. https://www.globalenergyinstitute.org/sites/default/files/NERA%20Final%20Report%202.pdf.

Bethell, Tom. 'The False Alert of Global Warming'. *The American Spectator*, Bloomington: American Spectator, May 2005. 198636969. ProQuest Central.

Björnberg, Karin Edvardsson, Mikael Karlsson, Michael Gilek, and Sven Ove Hansson. 'Climate and Environmental Science Denial: A Review of the Scientific Literature Published in 1990–2015'. *Journal of Cleaner Production* 167 (2017): 229–41.

Black, James. ‘The Greenhouse Effect’. Exxon Research and Engineering Company, 6 June 1978. https://www.climatefiles.com/exxonmobil/1978-exxon-memo-on-greenhouse-effect-for-exxon-corporation-management-committee/.

Bloomberg.com. ‘Tracking Carbon Emissions Becomes Harder When Big Oil Isn’t Involved’. 15 April 2021. https://www.bloomberg.com/graphics/2021-tracking-carbon-emissions-BP-hilcorp/.

Blouin, Louis, Alexander Panetta, and Richard Raycraft · CBC News ·. ‘After Years of Stalled Talks, Canada and U.S. Reach Border Deal on Irregular Migrants: Sources | CBC News’. CBC, 23 March 2023. https://www.cbc.ca/news/politics/deal-roxham-road-migrants-biden-trudeau-1.6788358.

Bomey, Nathan. ‘EVs Are Much Heavier than Gas Vehicles, and That’s Posing Safety Problems’. Axios, 28 April 2023. https://www.axios.com/2023/04/28/evs-weight-safety-problems.

Boykoff, Maxwell T. ‘Lost in Translation? United States Television News Coverage of Anthropogenic Climate Change, 1995-2004’. *Climatic Change* 86, no. 1–2 (January 2008): 1–11. https://doi.org/10.1007/s10584-007-9299-3.

Bronskill, Jim. ‘Climate Change Threatens Canadian Security, Prosperity, Warns Stark Spy Agency Brief’. CBC, 5 March 2023. https://www.cbc.ca/news/politics/csis-climate-change-threats-canada-1.6768803.

Brüggemann, Michael, and Sven Engesser. ‘Beyond False Balance: How Interpretive Journalism Shapes Media Coverage of Climate Change’. *Global Environmental Change* 42 (2017): 58–67.

Brulle, Robert. ‘Institutionalizing Delay: Foundation Funding and the Creation of U.S. Climate Change Counter-Movement Organizations’. *Climatic Change* 122, no. 4 (1 February 2014): 681–94. https://doi.org/10.1007/s10584-013-1018-7.

Brulle, Robert J, and Werthman Carter. ‘The Role of Public Relations Firms in Climate Change Politics’. *Climatic Change* 169, no. 1–2 (November 2021). https://doi.org/10.1007/s10584-021-03244-4.

Buchanan, Patrick J. ‘Global Warming: Hoax of the Century’. *Human Events*, Washington: Human Events Publishing, Inc., 8 March 2010. 235877893. Military Database; ProQuest Central.

Burke, Marshall, Solomon M. Hsiang, and Edward Miguel. ‘Climate and Conflict’. *Annual Review of Economics* 7, no. Journal Article (2015): 577–577ff. https://doi.org/10.1146/annurev-economics-080614-115430.

‘Canadian Wartime Propaganda - First World War’. Accessed 1 May 2023. https://www.warmuseum.ca/cwm/exhibitions/propaganda/first_e.html.

Canon, Gabrielle, and Richard Luscombe. ‘US Issues Western Water Cuts as Drought Leaves Colorado River near “Tipping Point”’. *The Guardian*, 17 August 2022, sec. US news. https://www.theguardian.com/us-news/2022/aug/16/drastic-water-cuts-expected-as-megadrought-grips-western-us-states.

Carlson, Joseph. ‘The Greenhouse Effect’. Exxon, 3 August 1988. https://www.climatefiles.com/exxonmobil/566/.

Chan, Man-pui Sally, Christopher R. Jones, Kathleen Hall Jamieson, and Dolores Albarracín. ‘Debunking: A Meta-Analysis of the Psychological Efficacy of Messages Countering Misinformation’. *Psychological Science* 28, no. 11 (1 November 2017): 1531–46. https://doi.org/10.1177/0956797617714579.

Chung, Emily. ‘One-Two Punch: Why Floods Pummel Wildfire-Ravaged Areas’. CBC, 18 November 2021. https://www.cbc.ca/news/science/post-wildfire-floodring-1.6253544.

‘CO2 Emissions per Capita - Worldometer’. Accessed 26 February 2023. https://www.worldometers.info/co2-emissions/co2-emissions-per-capita/.

‘Colorado River Compact’. In *Wikipedia*, 20 March 2023. https://en.wikipedia.org/w/index.php?title=Colorado_River_Compact&oldid=1145718875.

Cook, John, Dana Nuccitelli, Sarah A. Green, Mark Richardson, Bärbel Winkler, Rob Painting, Robert Way, Peter Jacobs, and Andrew Skuce. ‘Quantifying the Consensus on Anthropogenic Global Warming in the Scientific Literature’. *Environmental Research Letters* 8, no. 2 (May 2013): 024024. https://doi.org/10.1088/1748-9326/8/2/024024.

Cook, John, Geoffrey Supran, Lewandowski, Stephan, Oreskes, Naomi, and Maiback, Edward. ‘America Misled - How the Fossil Fuel Industry Deliberately Misled Americans about Climate Change’, October 2019.

‘CSIS Scene Setter: Climate Change Security Factors’. Analytic Brief. Canadian Security Intelligence Service, 6 April 2021.

Culhane, Trevor, Galen Hall, and J. Timmons Roberts. ‘Who Delays Climate Action? Interest Groups and Coalitions in State Legislative Struggles in the United States’. *Energy Research & Social Science* 79, no. Journal Article (2021): 102114. https://doi.org/10.1016/j.erss.2021.102114.

De Chant, Tim. ‘Breakthrough Fusion Power Announcement Expected Tomorrow. Here’s What It Means | TechCrunch’. *TechCrunch*, 12 December 2022. https://techcrunch.com/2022/12/12/breakthrough-fusion-power-announcement-expected-tomorrow-heres-what-it-means/.

‘Deny, Deceive, Delay - Documenting and Responding to Climate Disinformation at COP26 and Beyond’, June 2022. https://www.isdglobal.org/wp-content/uploads/2022/06/Summative-Report-COP26.pdf.

‘Deny, Deceive, Delay - Exposing New Trends in Climate Mis- and Disinformation at COP27’, January 2023. https://www.isdglobal.org/isd-publications/deny-deceive-delay-vol-2-exposing-new-trends-in-climate-mis-and-disinformation-at-cop27/.

Department of Finance Canada. ‘Chapter 5: Canada’s Leadership in the World | Budget 2023’, 28 March 2023. https://www.budget.canada.ca/2023/report-rapport/chap5-en.html#a2.

Director Development, Concepts and Doctrine Centre. ‘NATO Standard AJP-10.1 - Allied Joint Doctrine for Information Operations’. NATO Standardization Office, January 2023.

Dumic, Igor, and Edson Severnini. ‘“Ticking Bomb”: The Impact of Climate Change on the Incidence of Lyme Disease’. Edited by Paola Di Carlo. *Canadian Journal of Infectious Diseases and Medical Microbiology* 2018 (24 October 2018): 5719081. https://doi.org/10.1155/2018/5719081.

Dunlap, Riley E. ‘Climate Change Skepticism and Denial: An Introduction’. Edited by Riley E. Dunlap. *The American Behavioral Scientist (Beverly Hills)* 57, no. 6 (2013): 691–98. https://doi.org/10.1177/0002764213477097.

Dunlap, Riley E., and Robert J. Brulle. *Climate Change and Society: Sociological Perspectives*. Oxford University Press, 2015.

Dunlap, Riley E., and Peter J. Jacques. ‘Climate Change Denial Books and Conservative Think Tanks: Exploring the Connection’. *American Behavioral Scientist* 57, no. 6 (2013).

Dunlap, Riley E., and Aaron M. McCright. ‘Organized Climate Change Denial’. *The Oxford Handbook of Climate Change and Society* 1 (2011): 144–60.

Energy and Policy Institute. ‘Utilities Knew: Documenting Electric Utilities’ Early Knowledge and Ongoing Deception on Climate Change From 1968-2017’. Accessed 31 January 2023. https://www.energyandpolicy.org/utilities-knew-about-climate-change/.

Engels, Anita, Otto Hüther, Mike Schäfer, and Hermann Held. ‘Public Climate-Change Skepticism, Energy Preferences and Political Participation’. *Global Environmental Change* 23, no. 5 (2013): 1018–27.

Faris, Robert, Hal Roberts, and Yochai Benkler. *Network Propaganda - Manipulation, Disinformation and Radicalization in American Politics*. Book, Whole. New York, US: Oxford University Press, 2018.

Farrell, Justin, Kathryn McConnell, and Robert Brulle. 'Evidence-Based Strategies to Combat Scientific Misinformation'. *Nature Climate Change* 9, no. 3 (March 2019): 191–95. https://doi.org/10.1038/s41558-018-0368-6.

Fecht, Sarah. 'How Exactly Does Carbon Dioxide Cause Global Warming?' *State of the Planet* (blog), 25 February 2021. https://news.climate.columbia.edu/2021/02/25/carbon-dioxide-cause-global-warming/.

Feldman, Howard. 'Input to EPA Regulatory Reform Task Force', 15 May 2017. https://www.api.org/~/media/Files/News/Letters-Comments/2017/5-15-17-API-EPA-reg-reform-final-comments.pdf.

Fertel, Isabella. 'Fact Check: False Claim "15-Minute Cities" Are Actually "Climate Lockdowns"'. USA TODAY, 6 February 2023. https://www.usatoday.com/story/news/factcheck/2023/02/06/fact-check-false-claim-15-minute-cities-plan-confine-residents/11179132002/.

Flaherty, J. R. 'How Clever Marketing Sold the World The Myth of the Carbon Footprint'. Medium, 12 November 2021. https://bettermarketing.pub/how-clever-marketing-sold-the-world-the-myth-of-the-carbon-footprint-b628448c4bd2.

Franta, Benjamin. 'Early Oil Industry Knowledge of CO2 and Global Warming'. *Nature Climate Change* 8, no. 12 (2018): 1024–25. https://doi.org/10.1038/s41558-018-0349-9.

Freelon, Deen, and Chris Wells. 'Disinformation as Political Communication'. *Political Communication* 37, no. 2 (3 March 2020): 145–56.

Freudenburg, William R., Robert Gramling, and Debra J. Davidson. 'Scientific Certainty Argumentation Methods (SCAMs): Science and the Politics of Doubt'. *Sociological Inquiry* 78, no. 1 (18 January 2008): 2–38. https://doi.org/10.1111/j.1475-682X.2008.00219.x.

Freudenburg, William R., and Violetta Muselli. 'Reexamining Climate Change Debates: Scientific Disagreement or Scientific Certainty Argumentation Methods (SCAMs)?' *American Behavioral Scientist* 57, no. 6 (1 June 2013): 777–95. https://doi.org/10.1177/0002764212458274.

Gannon, Zoe, and Neal Lawson. 'The Advertising Effect'. *How Do We Get the Balance of Advertising Right*, 2010. https://www.bl.uk/britishlibrary/~/media/bl/global/social-welfare/pdfs/non-secure/a/d/v/advertising-effect-how-do-we-get-the-balance-of-advertising-right.pdf.

Garvey, James. 'Air Pollution and the Coal Industry'. *Mining Congress Journal* 25, no. 8 (August 1966): 55–65.

Glaser, M.B. 'CO2 "Greenhouse Effect"'. Exxon Research and Engineering Company, 12 November 1982. https://www.climatefiles.com/exxonmobil/1982-memo-to-exxon-management-about-co2-greenhouse-effect/.

Global Affairs Canada. 'NATO Climate Change and Security Centre of Excellence'. GAC, 21 March 2022. https://www.international.gc.ca/world-monde/international_relations-relations_internationales/nato-otan/centre-excellence.aspx?lang=eng.

'Grand Ethiopian Renaissance Dam'. In *Wikipedia*, 29 March 2023. https://en.wikipedia.org/wiki/Grand_Ethiopian_Renaissance_Dam#Controversies.

Gray, Lesley J., Jürg Beer, Marvin Geller, Joanna D. Haigh, Michael Lockwood, Katja Matthes, Ulrich Cubasch, Dominik Fleitmann, G. Harrison, and L. Hood. 'Solar Influences on Climate'. *Reviews of Geophysics* 48, no. 4 (2010).

Greenfieldboyce, Nell. 'Trump Says He Has "Open Mind" On Climate, But Staff Pick Raises Questions'. *NPR*, 23 November 2016, sec. The Two-Way. https://www.npr.org/sections/thetwo-way/2016/11/23/503156456/trump-says-he-has-open-mind-on-climate-but-staff-pick-raises-questions.

Gutteres, Antonio. 'Secretary-General's Remarks to the Tenth Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons', 1 August 2022. https://www.un.org/sg/en/content/sg/statement/2022-08-27/statement-attributable-the-spokesperson-for-the-secretary-general-the-tenth-review-conference-of-the-treaty-the-non-proliferation-of-nuclear-weapons.

Hiserodt, Ed, and Rebecca Terrell. 'Is Global Warming a Hoax?' *The New American*, Appleton: The New American, 5 January 2015. 1656629669. ProQuest Central.

Hjorth, Frederik, and Rebecca Adler-Nissen. 'Ideological Asymmetry in the Reach of Pro-Russian Digital Disinformation to United States Audiences'. *Journal of Communication* 69, no. 2 (1 April 2019): 168–92. https://doi.org/10.1093/joc/jqz006.

Hsu, Tiffany. 'He Wanted to Unclog Cities. Now He's "Public Enemy No. 1."' *The New York Times*, 28 March 2023, sec. Technology. https://www.nytimes.com/2023/03/28/technology/carlos-moreno-15-minute-cities-conspiracy-theories.html.

Huddleston, Amara. 'Happy 200th birthday to Eunice Foote, hidden climate science pioneer', 17 July 2019. http://www.climate.gov/news-features/features/happy-200th-birthday-eunice-foote-hidden-climate-science-pioneer.

Hunter, Justine. 'Cost of Rebuilding B.C. after Flooding Nears $9-Billion'. *The Globe and Mail*, 19 February 2022. https://www.theglobeandmail.com/canada/british-columbia/article-cost-of-rebuilding-bc-after-november-storms-nears-9-billion/.

InfluenceMap. ‘Corporate Climate Policy Footprint, 2022’. Accessed 16 March 2023. https://influencemap.org/report/Corporate-Climate-Policy-Footprint-2022-20196.

J6 Information Operations. ‘CFJP 3-10 - CF Information Operations (Extant)’. Government of Canada, 15 April 1998.

Jacques, Peter J., Riley E. Dunlap, and Mark Freeman. ‘The Organisation of Denial: Conservative Think Tanks and Environmental Scepticism’. *Environmental Politics* 17, no. 3 (1 June 2008): 349–85. https://doi.org/10.1080/09644010802055576.

‘Jevons Paradox’. In *Wikipedia*, 19 February 2023. https://en.wikipedia.org/w/index.php?title=Jevons_paradox&oldid=1140227989.

Joint Warfare Development Branch. ‘CFJP 3-10 - Operations in the Information Environment (Draft)’. Government of Canada, 2023.

Koh, Swee Lean Collin. ‘China’s Strategic Interest in the Arctic Goes beyond Economics’. Defense News, 12 May 2020. https://www.defensenews.com/opinion/commentary/2020/05/11/chinas-strategic-interest-in-the-arctic-goes-beyond-economics/.

Kurjata, Andrew. ‘More than 20 Years Ago, a Tiny Insect Changed B.C.’s Forestry Future. The Fallout Is Still Happening.’ CBC, 13 January 2023. https://www.cbc.ca/news/canada/british-columbia/british-columbia-forestry-future-pine-beetle-1.6712576.

Lahsen, Myanna. ‘Experiences of Modernity in the Greenhouse: A Cultural Analysis of a Physicist “Trio” Supporting the Backlash against Global Warming’. *Global Environmental Change* 18, no. 1 (2008): 204–19.

Lamb, William, Giulio Mattioli, Sebastian Levi, Timmons Roberts, Stuart Capstick, Felix Creutzig, Jan C. Minx, Finn Müller-Hansen, Trevor Culhane, and Julia K. Steinberger. ‘Discourses of Climate Delay’. *Global Sustainability* 3, no. Journal Article (2020). https://doi.org/10.1017/sus.2020.13.

Lee, Hoesung, Katherine Calvin, Dipak Dasgupta, and Gerhard Krinner. ‘Synthesis Report of the IPCC Sixth Assessment Report (AR6) - Summary for Policymakers’. Sixth Assessment Report. The Intergovernmental Panel on Climate Change, 19 March 2023. https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_SPM.pdf.

Lee, Kyumin, Prithivi Tamilarasan, and James Caverlee. ‘Crowdturfers, Campaigns, and Social Media: Tracking and Revealing Crowdsourced Manipulation of Social Media’. *Proceedings of the International AAAI Conference on Weblogs and Social Media* 7, no. 1 (2021). https://doi.org/10.1609/icwsm.v7i1.14384.

Linden, Sander van der, Costas Panagopoulos, and Jon Roozenbeek. 'You Are Fake News: Political Bias in Perceptions of Fake News'. *Media, Culture & Society* 42, no. 3 (2020): 460–70.

Lipton, Eric, and Clifford Krauss. 'Fossil Fuel Ads Dominate TV In Campaign'. *New York Times*, 14 September 2012, Late Edition (East Coast) edition. 1039308607. https://www.nytimes.com/2012/09/14/us/politics/fossil-fuel-industry-opens-wallet-to-defeat-obama.html.

Logan, Cloe. 'Hurricane Fiona Washed Away P.E.I. Coastline in Hours'. Canada's National Observer, 29 September 2022. https://www.nationalobserver.com/2022/09/29/news/hurricane-fiona-washed-away-pei-coastline-hours.

Lynas, Mark, Benjamin Z Houlton, and Simon Perry. 'Greater than 99% Consensus on Human Caused Climate Change in the Peer-Reviewed Scientific Literature'. *Environmental Research Letters* 16, no. 11 (19 October 2021): 114005. https://doi.org/10.1088/1748-9326/ac2966.

Maloney, Caroline and Khanna, Ro. 'House Oversight Committee - Investigation of Fossil Fuel Industry Disinformation'. Memorandum. Congress of the US - House of Representatives, 9 December 2022. https://web.archive.org/web/20221210081803/https://oversight.house.gov/sites/democrats.oversight.house.gov/files/2022-12-09.COR_Supplemental_Memo-Fossil_Fuel_Industry_Disinformation.pdf.

McCright, Aaron M. 'Anti-Reflexivity and Climate Change Skepticism in the US General Public'. *Human Ecology Review* 22, no. 2 (2016): 77–107.

McCright, Aaron M., and Riley E. Dunlap. 'Cool Dudes: The Denial of Climate Change among Conservative White Males in the United States'. *Global Environmental Change* 21, no. 4 (1 October 2011): 1163–72. https://doi.org/10.1016/j.gloenvcha.2011.06.003.

McCright, Aaron M., Riley E. Dunlap, and Chenyang Xiao. 'Increasing Influence of Party Identification on Perceived Scientific Agreement and Support for Government Action on Climate Change in the United States, 2006–12'. *Weather, Climate, and Society* 6, no. 2 (2014): 194–201.

McIntyre, Andrew, and Chris Berg. 'WAKE UP: THEY'RE MISLEADING YOU'. *Review - Institute of Public Affairs* 57, no. 1 (March 2005): 8–11.

McKay, Spencer, and Chris Tenove. 'Disinformation as a Threat to Deliberative Democracy'. *Political Research Quarterly* 74, no. 3 (1 September 2021): 703–17.

McKewon, Elaine. 'Talking Points Ammo: The Use of Neoliberal Think Tank Fantasy Themes to Delegitimise Scientific Knowledge of Climate Change in Australian Newspapers'. *Journalism Studies* 13, no. 2 (2012): 277–97.

Mecklin, John. ‘A Time of Unprecedented Danger: It Is 90 Seconds to Midnight’. Bulletin of the Atomic Scientists, 24 January 2023. https://thebulletin.org/doomsday-clock/current-time/.

———. ‘Closer than Ever: It Is 100 Seconds to Midnight’. Bulletin of the Atomic Scientists, 23 January 2020. https://thebulletin.org/doomsday-clock/2020-doomsday-clock-statement/.

Milman, Oliver. ‘“Monster Profits” for Energy Giants Reveal a Self-Destructive Fossil Fuel Resurgence’. *The Guardian*, 9 February 2023, sec. Environment. https://www.theguardian.com/environment/2023/feb/09/profits-energy-fossil-fuel-resurgence-climate-crisis-shell-exxon-bp-chevron-totalenergies.

Morris, Chris. ‘World Economic Forum Lists Biggest Global Risks of 2022’, 7 February 2022. https://www.nasdaq.com/articles/world-economic-forum-lists-biggest-global-risks-of-2022.

Natural Resources Canada. ‘Cost of Wildland Fire Protection’. Natural Resources Canada, 18 September 2015. https://natural-resources.canada.ca/climate-change/impacts-adaptations/climate-change-impacts-forests/forest-change-indicators/cost-fire-protection/17783.

———. ‘Mountain Pine Beetle (Factsheet)’. Natural Resources Canada, 25 October 2013. https://natural-resources.canada.ca/forests/fire-insects-disturbances/top-insects/13397.

‘Northeast Blackout of 2003’. In *Wikipedia*, 20 March 2023. https://en.wikipedia.org/w/index.php?title=Northeast_blackout_of_2003&oldid=1145732976.

Okoye, Uchechukwu. ‘What Is the Status of the Northwest Passage in the Arctic Under International Law of the Sea?’ SSRN Scholarly Paper. Rochester, NY, 20 February 2022. https://papers.ssrn.com/abstract=4103818.

O’Neill, Brian, Elmar Kriegler, Keywan Riahi, Kristie Ebi, Stephane Hallegatte, Timothy R. Carter, Ritu Mathur, and Detlef P. van Vuuren. ‘A New Scenario Framework for Climate Change Research: The Concept of Shared Socioeconomic Pathways’. *Climatic Change* 122, no. 3 (1 February 2014): 387–400. https://doi.org/10.1007/s10584-013-0905-2.

OpenSecrets. ‘American Petroleum Institute Lobbying Profile’. Accessed 16 March 2023. https://www.opensecrets.org/federal-lobbying/clients/summary?cycle=2012&id=D000031493.

OpenSecrets. ‘Top Spenders’. Accessed 16 March 2023. https://www.opensecrets.org/federal-lobbying/top-spenders?cycle=a.

Oreskes, Naomi. Testimony for the US Select Committee on Climate Change. Testimony, 23 October 2019. https://www.democrats.senate.gov/imo/media/doc/Naomi_Oreskes_Testimony.pdf.

———. ‘The Scientific Consensus on Climate Change’. *Science* 306, no. 5702 (3 December 2004). https://doi.org/10.1126/science.1103618.

O’Sullivan, Feargus, and Daniel Zuidijk. ‘The 15-Minute City Freakout Is a Case Study in Conspiracy Paranoia’. *Bloomberg.Com*, 2 March 2023. https://www.bloomberg.com/news/articles/2023-03-02/how-did-the-15-minute-city-get-tangled-up-in-a-far-right-conspiracy.

Our World in Data. ‘Fish and Overfishing’. Accessed 23 March 2023. https://ourworldindata.org/fish-and-overfishing.

Oxford Languages. ‘Oxford Word of the Year 2016’, 16 November 2016. https://languages.oup.com/word-of-the-year/2016/.

Paul, Kari. ‘“Super Polluters”: The Top 10 Publishers Denying the Climate Crisis on Facebook’. *The Guardian*, 2 November 2021, sec. Technology. https://www.theguardian.com/technology/2021/nov/02/super-polluters-the-top-10-publishers-denying-the-climate-crisis-on-facebook.

Pittman, Mark. ‘Electric Vehicles And The Impact On Infrastructure’. Forbes. Accessed 3 May 2023. https://www.forbes.com/sites/forbestechcouncil/2022/12/29/electric-vehicles-and-the-impact-on-infrastructure/.

Plehwe, Dieter. ‘Think Tank Networks and the Knowledge–Interest Nexus: The Case of Climate Change’. *Critical Policy Studies* 8, no. 1 (2014): 101–15.

POLITICO. ‘WeCanSolveIt.Org Ad - Gingrich & Pelosi’, 13 May 2011. https://www.politico.com/video/2011/05/wecansolveitorg-ad-gingrich-pelosi-018436.

Poneman, Daniel. *Double Jeopardy: Combating Nuclear Terror and Climate Change*. Book, Whole. London, England;Cambridge, Mass; MIT Press, 2019. https://doi.org/10.7551/mitpress/11314.001.0001.

Poortinga, Wouter, Alexa Spence, Lorraine Whitmarsh, Stuart Capstick, and Nick F. Pidgeon. ‘Uncertain Climate: An Investigation into Public Scepticism about Anthropogenic Climate Change’. *Global Environmental Change* 21, no. 3 (2011): 1015–24.

Pörtner, Hans, Debra Roberts, Helen Adams, Carolina Adler, Paulina Aldunce, Elham Ali, Rawshan Ara Begum, Richard Betts, Rachel Bezner Kerr, and Robbert Biesbroek. *IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of*

the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, NY, USA: Cambridge University Press, 2022.

'President Trump Announces U.S. Withdrawal From the Paris Climate Accord – The White House'. Accessed 26 February 2023. https://trumpwhitehouse.archives.gov/articles/president-trump-announces-u-s-withdrawal-paris-climate-accord/.

Rahmstorf, Stefan. 'The Climate Sceptics'. *Weather Catastrophes and Climate Change*, 2004, 76–83.

Ranney, Michael Andrew, and Dav Clark. 'Climate Change Conceptual Change: Scientific Information Can Transform Attitudes'. *Topics in Cognitive Science* 8, no. 1 (2016): 49–75. https://doi.org/10.1111/tops.12187.

Reuters. 'Factbox: Canada's 10 Costliest Natural Disasters by Insurance Claims'. *Reuters*, 17 November 2021, sec. Americas. https://www.reuters.com/world/americas/canadas-10-costliest-natural-disasters-by-insurance-claims-2021-11-17/.

Revelle, Roger, and Hans E. Suess. 'Carbon Dioxide Exchange between Atmosphere and Ocean and the Question of an Increase of Atmospheric CO2 during the Past Decades'. *Tellus* 9, no. 1 (1957): 18–27.

Reynolds, Christopher. 'Trains Roll into Vancouver after CP Rail Restores Limited Service Following Mudslides'. thestar.com, 24 November 2021. https://www.thestar.com/business/2021/11/24/trains-roll-into-vancouver-after-cp-rail-restores-limited-service-following-mudslides.html.

Ritchie, Hannah, Max Roser, and Pablo Rosado. 'CO_2 and Greenhouse Gas Emissions'. *Our World in Data*, 11 May 2020. https://ourworldindata.org/co2-emissions#cumulative-co2-emissions.

Robertson, Bruce, and Milad Mousavian. 'The Carbon Capture Crux: Lessons Learned'. Institute for Energy Economics and Financial Analysis, 1 September 2022. https://ieefa.org/resources/carbon-capture-crux-lessons-learned.

Salinger, Jim. 'The Climate Journey over Three Decades: From Childhood to Maturity, Innocence to Knowing, from Anthropocentrism to Ecocentrism'. *Climatic Change* 100, no. 1 (2010): 49–57. https://doi.org/10.1007/s10584-010-9844-3.

Sample, Ian. 'The Father of Climate Change'. *The Guardian*, 30 June 2005, sec. Environment. https://www.theguardian.com/environment/2005/jun/30/climatechange.climatechangeenvironment2.

Schatz, Brian. 'The Case for Climate Action - Building a Clean Economy for the American People'. Senate Democrats Special Committee on the Climate Crisis,

25 August 2020. https://www.democrats.senate.gov/about-senate-dems/climate/report.

Schulman, Susan. 'Yemenis' Daily Struggles Between Conflict and Climate Change'. *The RUSI Journal* 166, no. 1 (2 January 2021): 82–92. https://doi.org/10.1080/03071847.2021.1922196.

Schwartzstein, Peter. 'Climate Change and Water Woes Drove ISIS Recruiting in Iraq'. National Geographic Science, 14 November 2017. https://www.nationalgeographic.com/science/article/climate-change-drought-drove-isis-terrorist-recruiting-iraq.

'Scientific Uncertainty'. *Nature Climate Change* 9, no. 11 (1 November 2019): 797–797. https://doi.org/10.1038/s41558-019-0627-1.

Sharman, Amelia. 'Mapping the Climate Sceptical Blogosphere'. *Global Environmental Change* 26, no. Journal Article (2014): 159–70. https://doi.org/10.1016/j.gloenvcha.2014.03.003.

Sheehan, Kim. 'This Ain't Your Daddy's Greenwashing: An Assessment of the American Petroleum Institute's Power Past Impossible Campaign'. In *Intellectual Property and Clean Energy*, 301–21. Singapore: Springer Singapore, 2018. https://doi.org/10.1007/978-981-13-2155-9_11.

Shin, Jieun, Lian Jian, Kevin Driscoll, and François Bar. 'Political Rumoring on Twitter during the 2012 US Presidential Election: Rumor Diffusion and Correction'. *New Media & Society* 19, no. 8 (2017): 1214–35. https://doi.org/10.1177/1461444816634054.

Stokes, Elaisha. 'The Drought That Preceded Syria's Civil War Was Likely the Worst in 900 Years', 3 March 2016. https://www.vice.com/en/article/3kw77v/the-drought-that-preceded-syrias-civil-war-was-likely-the-worst-in-900-years.

Sullivan, J.L., A. Burnham, and M. Wang. 'Energy-Consumption and Carbon-Emission Analysis of Vehicle and Component Manufacturing'. Energy Systems Division, Argonne National Laboratory, September 2010. https://greet.es.anl.gov/files/vehicle_and_components_manufacturing.

Supran, Geoffrey, and Naomi Oreskes. 'Addendum to "Assessing ExxonMobil's Climate Change Communications (1977-2014)"'. *Environmental Research Letters* 15, no. 11 (2020). https://doi.org/10.1088/1748-9326/ab89d5.

———. 'Assessing ExxonMobil's Climate Change Communications (1977-2014)'. *Environmental Research Letters* 12, no. 8 (2017): 84019. https://doi.org/10.1088/1748-9326/aa815f.

Supran, Geoffrey, S. Rahmstoff, and N. Oreskes. 'Assessing ExxonMobil's Global Warming Projections'. *Science* 379, no. 6628 (2023).

Tadao, Michael. 'API Launches Power Past Impossible Campaign during Super Bowl Showing Natural Gas and Oil Benefit to Consumers in Everyday Life', 5 February 2017. https://www.api.org/news-policy-and-issues/news/2017/02/05/api-launches-power-past-impossible-campa.

Tattrie, John. 'Propaganda in Canada', 16 July 2019. https://www.thecanadianencyclopedia.ca/en/article/propaganda-in-Canada.

Theohary, Catherine A. 'Defense Primer: Information Operations'. *Congressional Research Service*, 15 December 2020. https://apps.dtic.mil/sti/pdfs/AD1169650.pdf.

Thunberg, Greta. 'Greta Thunberg's "Blah Blah Blah" Speech, Milan 2021', 28 September 2021. https://www.carbonindependent.org/119.html.

Transport Canada. 'Freight Transportation'. Transport Canada. Accessed 23 March 2023. https://tc.canada.ca/en/corporate-services/transparency/corporate-management-reporting/transportation-canada-annual-reports/freight-transportation.

Treen, Kathie, Hywel Williams, and Saffron O'Neill. 'Online Misinformation about Climate Change'. *WIREs Climate Change* 11, no. 5 (September 2020). https://doi.org/10.1002/wcc.665.

Turner, Chris. *The War on Science: Muzzled Scientists and Willful Blindness in Stephen Harper's Canada*. Greystone Books Ltd, 2013.

UN Department of Economic and Social Affairs. 'The Number of International Migrants Reaches 272 Million, Continuing an Upward Trend in All World Regions, Says UN'. Accessed 1 April 2023. https://www.un.org/development/desa/en/news/population/international-migrant-stock-2019.html.

Vuuren, Detlef van, Jae Edmonds, Mikiko Kainuma, Keywan Riahi, Allison Thomson, Kathy Hibbard, George C. Hurtt, et al. 'The Representative Concentration Pathways: An Overview'. *Climatic Change* 109, no. 1 (5 August 2011): 5. https://doi.org/10.1007/s10584-011-0148-z.

Vuuren, Detlef van, Elmar Kriegler, Brian O'Neill, Kristie Ebi, Keywan Riahi, Timothy R. Carter, Jae Edmonds, et al. 'A New Scenario Framework for Climate Change Research: Scenario Matrix Architecture'. *Climatic Change* 122, no. 3 (1 February 2014): 373–86. https://doi.org/10.1007/s10584-013-0906-1.

Walker, Joseph, Adams, John, Crandall, Candace, Rothbard, David, Salmon, Jeffrey, Garrigaro, Lee, Bouchey, Lynn, et al. 'Global Climate Science Communications - Action Plan', 3 April 1998. https://www.climatefiles.com/trade-group/american-petroleum-institute/1998-global-climate-science-communications-team-action-plan/.

Ward, Bob, and Alex Bowen. 'An Analysis of the Trump Administration's Economic and Policy Arguments for Withdrawal of the United States from the Paris Agreement on Climate Change'. Policy Report. Grantham Institute - Climate Change and the Environment - Imperial College London, August 2020. https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2020/08/GRI_An-analysis-of-the-Trump-Administration%E2%80%99s-economic-and-policy-arguments-for-withdrawal-of-the-United-States-from-the-Paris-Agreement-1.pdf.

Webb, Steve, James Caverlee, and Calton Pu. 'Social Honeypots: Making Friends With A Spammer Near You.' In *CEAS*. San Francisco, CA, 2008.

Weiss, Martin, Kira Christina Cloos, and Eckard Helmers. 'Energy Efficiency Trade-Offs in Small to Large Electric Vehicles'. *Environmental Sciences Europe* 32, no. 1 (18 March 2020): 46. https://doi.org/10.1186/s12302-020-00307-8.

Westervelt, Amy. 'Big Oil's "Wokewashing" Is the New Climate Science Denialism'. *The Guardian*, 9 September 2021, sec. Environment. https://www.theguardian.com/environment/2021/sep/09/big-oil-delay-tactics-new-climate-science-denial.

Whitmarsh, Lorraine. 'Scepticism and Uncertainty about Climate Change: Dimensions, Determinants and Change over Time'. *Global Environmental Change* 21, no. 2 (2011): 690–700.

Winters, Joseph. 'Ford and GM Knew about Climate Change - and Covered It up for Decades'. *Grist*, 27 October 2020. https://grist.org/climate/ford-and-gm-knew-about-climate-change-and-covered-it-up-for-decades/.

WorldAtlas. 'Which Country Has the Most Fresh Water?', 24 September 2018. https://www.worldatlas.com/articles/countries-with-the-most-freshwater-resources.html.

www.dictionary.com. 'Definition of Uncertainty | Dictionary.Com'. Accessed 26 February 2023. https://www.dictionary.com/browse/uncertainty.

Yang, Jianxun, Dimitrios Gounaridis, Miaomiao Liu, and Joshua Newell. 'The Social Anatomy of Climate Change Denial in the United States (Preprint)'. *Research Square*, 2022. https://doi.org/10.21203/rs.3.rs-2163106/v1.

Young, Elan. 'Coal Knew, Too'. *Huffpost*, 22 November 2019. https://www.huffpost.com/entry/coal-industry-climate-change_n_5dd6bbebe4b0e29d7280984f.

Young, Nathan, and Aline Coutinho. 'Government, Anti-Reflexivity, and the Construction of Public Ignorance about Climate Change: Australia and Canada Compared'. *Global Environmental Politics* 13, no. 2 (2013): 89–108.

Zehndorfer, Elesa. ‘The Weaponisation of Climate Change: Environmental Leadership in the Age of Trump’. In *Rethinking Leadership for a Green World*, 120–42. Routledge, 2022.

Zehr, Stephen C. ‘Public Representations of Scientific Uncertainty about Global Climate Change’. *Public Understanding of Science* 9, no. 2 (1 April 2000): 85–103. https://doi.org/10.1088/0963-6625/9/2/301.