# NDCA: Marist MM AFF

### Contention 1 – Proliferation

#### Global demand for nuclear energy is being driven by Russia and China. The U.S. is woefully behind.

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As countries race to meet decarbonization targets while still ensuring reliable power for growing energy demands, nuclear energy is emerging as a key solution. Over 20 countries have pledged to triple nuclear power by 2050, increasingly turning to nuclear for energy security amid global instability. The US, a pioneer in the nuclear industry with numerous advanced nuclear projects currently in works, is poised to meet this commercial demand.

However, countries like Russia and China are encroaching on the global nuclear marketplace. Leveraging state-backed financing and government influence to secure nuclear partnerships, Russia and China are using nuclear exports for long-term economic and diplomatic gains, leaving the US behind. Currently, China has 26 reactors under construction domestically, far outpacing other countries. Russia is building 23 reactors across seven nations, including China, India, Turkey, and Iran.1 In contrast, the US has only constructed two reactors, Vogtle Units 3 and 4, in the past several decades, and has just broken ground on one new reactor construction. Despite pioneering the nuclear industry, America is now trailing these authoritarian regimes that use nuclear exports for geopolitical leverage.

#### U.S. export dominance is key to keeping nonprolif strings attached. Otherwise, countries will divert nuclear materials.

Lovering and Morgan 21 – Co-founder of the Good Energy Collective and fellow with the Energy for Growth Hub with a Ph.D. in Engineering and Public Policy from Carnegie Mellon University; Hamerschlag University Professor of Engineering at Carnegie Mellon University. Jessica Lovering and M. Granger Morgan, “As US nuclear exports decline, experts fear international safeguards will too,” Bulletin of the Atomic Scientists, 08-27-2021, <https://thebulletin.org/2021/08/as_us_nuclear_exports_decline_experts_fear_international_safeguards_will_too/>

“China and other countries are closing in fast,” President Biden said in his first speech to Congress earlier this year. “We have to develop and dominate the products and technologies of the future… There is simply no reason the blades for wind turbines can’t be built in Pittsburgh instead of Beijing.” The same argument could be made about commercial nuclear reactors, yet the implications go far beyond pure economic competitiveness. Over the last decade, think tank reports from the Center for Strategic and International Studies, the Atlantic Council, and the Energy Futures Initiative have sounded alarms; these organizations have argued that declining US commercial nuclear exports are eroding the ability of the United States to play a major role in maintaining adequate international safeguards against the diversion of nuclear materials. Historically, the United States was the dominant exporter of nuclear technology, and those exports came with a lot of safety, security, and nonproliferation strings attached. Now that Russia is and soon China will be the leading exporters of nuclear technologies, a growing number of experts are worried about the international security knock-on effects in these emerging markets. While it is unlikely that the United States will add significant new nuclear capacity in the next few decades, the international market may. A Third Way and Energy for Growth Hub study projected that global electricity demand would double by 2050, with over 90 percent of that growth coming from outside current high-income countries. Much of that growth is projected to be in countries that are interested in hosting their first nuclear power plant by 2030, according to the Third Way study. In the past, nearly every country that has started a commercial nuclear power program has imported the technology from a big vendor country, and this will likely remain the case moving forward. Russia and China see this market and are preparing to supply newcomer countries. Most aspiring nuclear newcomer countries already have nuclear cooperation agreements in place with Russia, China, or both—but not with the United States. For example, the Russian state corporation Rosatom is currently constructing two large nuclear power reactors in Bangladesh and three in Turkey. While revitalizing nuclear power has often been linked to national security, several experts in the national security space have told us that they are skeptical about calls for the United States to regain dominance in the global nuclear market. They suspect that such calls are a stealth attempt to prop up or bail out a failing domestic nuclear sector. They argue that there are more direct pathways for positive US influence in global nuclear security regimes that do not rely on commercial exports. Experts we covened judged two of those pathways—the creation of a US-South Korea consortium to build new power projects and progress on addressing the problem of US domestic nuclear waste—to be both effective at strengthening US influence and feasible policies to implement. Evaluating strategies to restore US leadership. To sort the rhetoric from the reality and find solutions that strengthen international control of nuclear materials, we convened a 2018 workshop, together with Ahmed Abdulla (then at Carnegie Mellon University, now at Carlton University) and Mike Ford (then at Harvard University, now at Argonne National Laboratory), that brought together experts from the nuclear energy and security fields to work through assumptions about this problem and evaluate potential solutions. Experts who participated in the workshop agreed that the US commercial nuclear industry has played a significant role in facilitating US leadership in international control regimes. They also believed that, with diminished presence in civilian nuclear power, US influence with respect to these regimes is likely to decline—particularly for the next generation of nuclear technologies.

#### And, it’s reverse-casual. Other countries want American tech, but revitalizing our domestic industry is key.

Graham 20 – Former Senior U.S. Diplomat. Executive Chairman of Lightbridge Corporation and Co-Chairman of the Atlantic Council’s Nuclear Energy and National Security Coalition. Principle negotiator for CTBT and effort to indefinitely extend the NPT. Ambassador Thomas Graham Jr., “US nuclear energy leadership: The way forward,” Atlantic Council, 06-03-2020, https://www.atlanticcouncil.org/blogs/energysource/us-nuclear-energy-leadership-the-way-forward/

Although the United States began the atomic age as the global leader in nuclear energy, the US government stopped its domestic reactor program at 102 reactors following the 1979 Three Mile Island Accident.

The US nuclear energy industry was cut off in its prime, ceding primacy to fossil fuel production. After decades of misguided policy, the DOE’s report puts the United States back on track in leading a worldwide nuclear energy system that is effective, reliable, and carbon free. To meet these goals, the recommendations in this report must be implemented as quickly as possible. Global energy demand has risen steadily, and it will soon be augmented by the need to support an electricity-powered transportation sector as well as large seawater desalination plants as desertification intensifies as result of climate change. The US government has always insisted that strong nonproliferation standards be applied to international nuclear reactors. A strong, reliable, and capable US nuclear energy industry, both at home and abroad, that provides baseload, safeguarded, and carbon-free energy everywhere is much needed. This initiative is vital for US national security. As the DOE report recommends, domestic nuclear power infrastructure should be expanded and significantly more power generators should be built—along the lines of what was envisaged in the past, most notably under the Atoms for Peace program. US global leadership in nuclear energy can be reestablished by funding the development of advanced nuclear fuels, investing in the national test reactor program, and supporting research and development of US advanced nuclear reactor technology, especially Generation IV reactors, of which there are several promising candidates. Furthermore, the US government can help bring small modular reactors and micro nuclear reactors to demonstration and use these technologies to power military facilities. Ultimately, the United States can take steps to strengthen its civil nuclear export program to reach additional foreign markets. Second, the United States must level the playing field against its foreign competitors. Russia and China will be building two-thirds of the 107 currently planned nuclear power reactors around the world between now and 2030. Of course, many more reactors will have to be built in order to avoid the truly catastrophic effects of climate change while meeting increased global energy demand. Through their state-owned nuclear enterprises, Russia and China are able to offer seemingly attractive financing packages to new-to-nuclear countries. Russia and China are likely also using the sale of their nuclear technologies to exert geopolitical pressure, and purchasing countries may ultimately find themselves entangled in disadvantageous debt relationship with the exporting states. Conversely, countries that enter into civil nuclear agreements with the United States and its allies stand to reap the intangible benefits of those agreements, such as closer political and economic relationships. Thus, it is imperative that the United States empowers, through government funding, its financial institutions to enable US nuclear companies to offer competitive financing. If the United States can leverage the full weight of its export financing institutions, it will not be long before it is back in a global leadership position. US civil nuclear technology is the best on the market, and the United States remains far more trusted on safety and nonproliferation standards than Russia or China. Interested third countries will buy US reactors if the United States can coordinate its institutions—from the Export-Import Bank and US International Development Finance Corporation to the Departments of State and Commerce—and offer American-made technology. The DOE Nuclear Fuel Working Group report is the first step in regaining US nuclear leadership.

#### Otherwise, Russian and Chinese exports make diversion of nuclear materials and nuclear terrorism likely.

Carless 20 – President’s Postdoctoral Fellow, Carnegie Mellon University. Ph.D. in Engineering and Public Policy from Carnegie Mellon University. M.S. in Industrial Engineering from the University of Pittsburgh. Travis Carless, former Stanton Nuclear Security Fellow at RAND, “The US Shouldn’t Abandon the Nuclear Energy Market,” Issues in Science and Technology, Vol. XXXVI, No. 2, Winter 2020, <https://issues.org/the-us-shouldnt-abandon-the-nuclear-energy-market/>

As a pioneer in the nuclear power sector, the United States shaped the international regulatory regime that established norms and agreements to promote the peaceful use of nuclear energy. However, US competitiveness in the development and deployment of nuclear reactors within the commercial nuclear power sector is in decline, resulting in the erosion of its leadership in global nuclear safety and security. As a number of countries, including Germany, Belgium, Spain, and Switzerland, reconsidered their policy toward nuclear energy and planned the retirement of their entire nuclear fleet, an estimated 28 nations are making plans to add nuclear power to their energy portfolio. These nations view nuclear power as a way to increase their energy independence, address growing energy demands, and reduce greenhouse gas emissions. And with the US nuclear sector in retreat, these emerging markets now rely on Russia and China for advanced nuclear technology, training, and expertise, as well as favorable financial terms. This shift will likely create strategic disadvantages for the United States and its allies. The US Senate recently reintroduced a bill aimed at spurring innovation and helping the United States reclaim its leadership position in the commercial nuclear energy sector. Through incentives and additional funding for the development of advanced reactors, the Nuclear Energy Leadership Act would create more certainty in the domestic market and support next-generation reactors able to compete with emerging technologies from Russia and China. In a hearing of the Senate Energy and Natural Resources Committee, Ashley Finan, executive director of the Nuclear Innovation Alliance, stated that “past participation in nuclear markets gave the United States leverage in influencing global nonproliferation, safety, and security norms; if we are not a major supplier, we cede that influence.” This shift from US-based reactor suppliers to those in Russia and China, in conjunction with a large-scale deployment of nuclear power plants in nations with very little experience with nuclear power, will lead to increased nuclear security and safety risks—both in those countries and on a global scale. How did we get here? RISE OF RUSSIA AND CHINA Between 1969 and 1990, 41% of the nuclear power reactors operating in the global nuclear fleet had been supplied by US-based vendors. Between 1991 and 2017, that number dropped to 8%, as interest in nuclear power began to wane in the United States because of the high capital costs and the increasing availability and affordability of natural gas. (See Figure 1.) Chinese and Russian vendors made up the difference and currently constitute a staggering two-thirds of all global reactor constructions. From 1991 to 2017, Russian vendors constructed 19 reactors for domestic and international markets. China still lags behind Russia in terms of reactor deployments to other nations, but Chinese vendors have connected 33 new nuclear power plants to its grid in the past 28 years and the nation is estimated to overtake the United States in deployed reactors in 20 years. China’s dramatic expansion in nuclear capacity and construction activity coupled with its ambitious Belt and Road Initiative shows that it is well positioned to supply other nations with reactors. Russia is constructing or has signed contracts with 11 countries to build nuclear power plants. China has built four reactors in Pakistan, and has announced an agreement to build a reactor in Argentina and an additional three in Pakistan. Currently, Russia and China are engaged in nuclear cooperation agreements with about 24 countries in Africa, the Middle East, South America, and Eastern Europe. Emerging markets’ reliance on Russia and China for low-barrier, quick pathways to nuclear power can create several nuclear proliferation, safety, and strategic risks. Whereas the United States promotes a strong culture of nuclear security—for example, assembling a group of 40 nuclear experts from countries looking to adopt or expand nuclear capacity at the annual meeting of the Institute of Nuclear Materials Management in 2015—Russia and China have shown that they do not see value in these types of safety and security engagements. Their influence can therefore shift the attention of emerging markets away from the last area in which the United States still maintains some leadership. This will ultimately lead to future nuclear security and safety challenges in countries that may be among the most vulnerable in the event of an accident or security incident. Nations that expand their nuclear capacity by working with US vendors are required to sign international nuclear safety agreements and adhere to additional safeguards as part of nuclear export controls outlined in the US Atomic Energy Act. But Russia seems willing to lower regulatory barriers to entry by not requiring host nations to sign some international nuclear safety agreements. Emerging markets relying on Russia and China incur their own national security risks as well. Many countries do not prioritize the threat of nuclear terrorism as part of their national security agenda, believing that nuclear terrorism is unlikely to happen within their borders. They also may implement inadequate security measures due to limited resources and weak regulatory structures. Emerging markets are vulnerable to regulatory capture: for example, if Russia drafts the nuclear regulations for a host nation that provide little domestic, independent oversight of safeguards and nuclear safety, it will have continual leverage over the host nation.

#### It almost guarantees “theft, sabotage, and unauthorized ceding of radioactive material to illegal recipients.”

Bhattacharya 22 – Assistant Professor of Political Science and the Co-Convener of the Centre for Human Rights, Gender and Social Inclusion at Jagran Lakecity University, India. Ipshita Bhattacharya, “The Weight of China’s Nuclear Projects May Lead to Global Spondylosis,” China’s Nuclear Belt and Road Workshop, A Tale of Two Asias: Living in and Beyond the Nuclear Age, University of Colorado Center for Asian Studies, 04-22-2022, https://www.colorado.edu/cas/research-academics/cas-initiatives/tale-two-asias-living-and-beyond-nuclear-age#the\_weight\_of\_china\_s\_nuclear\_projects\_may\_lead\_to\_global\_spondylosis-183

Conclusion

The Chinese nuclear investments and cooperation in the BRI states and its strategic expansion could potentially mutate into nuclear security threats across the globe. The viability of host countries to handle the nuclear material in the absence of proper protective systems is highly questionable with respect to theft, sabotage and unauthorized ceding of the radioactive material to the illegal recipients. Through its great power status China is pulling down the gravity of the Nuclear energy to a level of a retail market commodity, making it available to the countries that primarily require proper, stable governments, appropriate domestic regulations for nuclear deals and proper technology and infrastructures to protect the atom. Principally China as a big promoter of nuclear energy and as a responsible nation must work upon the compliance issues with host nations. As a key party working towards solutions for climate change in the region, China needs to balance business and international compliance to IAEA by the host countries as the primary requirement for eligibility. The domestic issues like political instability and corruption in host countries are also sensitive concerns, as these issues have direct impact on nuclear energy projects. These are not any highway or infrastructural projects but nuclear projects which demand political stability, transparency, and compliance to international rule of order. The principal issue here is that when the host countries with weaker and limited institutional capacity take on nuclear deals it becomes extremely important for China to provide them with all the compliances and sharing of responsibility and required guidance.

#### Controlling material is both necessary and sufficient to prevent transnational terrorist groups from constructing a crude nuclear bomb.

Bunn 21 – Professor, Practice of Energy, National Security, and Foreign Policy at Harvard Kennedy School. Ph.D. in Technology, Management, and Policy from MIT. Matthew Bunn, “Twenty years after 9/11, terrorists could still go nuclear,” Bulletin of the Atomic Scientists, 09-16-2021, https://thebulletin.org/2021/09/twenty-years-after-9-11-terrorists-could-still-go-nuclear/

Capability. Government studies make clear that if a sophisticated, well-funded terrorist group got hold of the needed plutonium or highly enriched uranium (HEU), they might well be able to put together a crude nuclear bomb. Unfortunately, it does not take a Manhattan Project to build a bomb, when you have weapons-usable fissile material. Indeed, the group needed to make a crude bomb might not have a footprint much bigger than the 9/11 attackers had. Despite the enormous destruction that has been rained on al Qaeda and the Islamic State over the last 20 years, a cell of terrorists could be working on a nuclear project even now, somewhere far from US attention and drone strikes.

The intense counterterrorism campaigns of the last two decades have surely reduced terrorists’ ability to plan and carry out such a complex effort. But we simply do not know what capability might remain. The Taliban’s rapid return to power in Afghanistan could add to that capability, making that country a terrorist haven again—but there are many other largely ungoverned or terrorist-controlled places where such a project could be undertaken.

And the capability side of the equation can change at remarkable speed. In January 2014, the US intelligence community did not mention the Islamic State in its annual assessment of threats to US security. By summer, the group had seized much of Iraq and Syria and declared a global caliphate.

Opportunity. Fortunately, around the world, security for plutonium and HEU is far better than it once was, making it far harder for terrorists to get their hands on the needed ingredients for a bomb. More than half of all the countries that once had such material on their soil have gotten rid of it. While stolen HEU or plutonium was once showing up in parked cars and airplane luggage racks in Europe, there hasn’t been a major seizure of potential nuclear bomb material for a decade now.

Nevertheless, with the Obama-era nuclear security summits now far in the rearview mirror, the momentum of nuclear security improvement has slowed. There is still a need to ensure that nuclear weapons, materials, and facilities are protected against the full range of plausible threats—especially from insiders, who appear to pose the biggest nuclear security problem. The rise of domestic violent extremists in the United States and other advanced democracies makes the insider threat even more challenging. There is still a need for realistic tests and assessments of nuclear security systems’ real capabilities against intelligent adversaries looking for ways to beat them. And there’s still a need to strengthen nuclear security culture—to make sure the staff and guards at nuclear facilities are giving security the priority it needs, day-in and day-out.

If terrorists ever did manage to turn the heart of a modern city into a smoldering radioactive ruin, they would change history. The economic, political, and social consequences would reverberate far and wide. Fears that it could happen again—possibly stoked by terrorist claims that they had more bombs already hidden in cities and would detonate them unless their demands were met—could lead people to flee major cities. The reactions after 9/11—a more aggressive US foreign policy, racist animosity, expanded government powers, cutbacks in civil liberties—would be expanded manyfold, particularly once people realized that the material for such a bomb could be hidden in any suitcase.

President Biden has warned of these dangers. Now is the time for him to act. Despite the many other priorities on his desk, it is time for him to launch a new, expanded nuclear security initiative, working to ensure that nuclear stockpiles worldwide are secure and accounted for to the highest standards, that major obstacles are placed in the path of nuclear smugglers, that states are deterred from helping terrorists with nuclear, biological, or chemical weapons, and that terrorist nuclear plots are found and stopped. The risk of a nuclear 9/11 will persist as long as high-capability terrorists and the materials needed to make a nuclear bomb both exist in the world.

#### Extinction. A single terrorist crude bomb kills millions and sparks military lashout, global great power wars, and collapse of international institutions.

Roth 17 – Senior Director of Nuclear Materials Security, Nuclear Threat Initiative. M.P.P., UMaryland. Nikolas Roth, Former Director of Stimson Center’s Nuclear Security Program and senior research associate at the Project on Managing the Atom at the Harvard Kennedy School, and Matthew Bunn, Professor of Energy, National Security, and Foreign Policy at Harvard Kennedy School and Ph.D. in Technology, Management, and Policy from MIT, “The effects of a single terrorist nuclear bomb,” Bulletin of the Atomic Scientists, 9-28-2017, <https://thebulletin.org/2017/09/the-effects-of-a-single-terrorist-nuclear-bomb/>

The escalating threats between North Korea and the United States make it easy to forget the “nuclear nightmare,” as former US Secretary of Defense William J. Perry put it, that could result even from the use of just a single terrorist nuclear bomb in the heart of a major city.

At the risk of repeating the vast literature on the tragedies of Hiroshima and Nagasaki—and the substantial literature surrounding nuclear tests and simulations since then—we attempt to spell out here the likely consequences of the explosion of a single terrorist nuclear bomb on a major city, and its subsequent ripple effects on the rest of the planet. Depending on where and when it was detonated, the blast, fire, initial radiation, and long-term radioactive fallout from such a bomb could leave the heart of a major city a smoldering radioactive ruin, killing tens or hundreds of thousands of people and wounding hundreds of thousands more. Vast areas would have to be evacuated and might be uninhabitable for years. Economic, political, and social aftershocks would ripple throughout the world. A single terrorist nuclear bomb would change history. The country attacked—and the world—would never be the same. The idea of terrorists accomplishing such a thing is, unfortunately, not out of the question; it is far easier to make a crude, unsafe, unreliable nuclear explosive that might fit in the back of a truck than it is to make a safe, reliable weapon ofv known yield that can be delivered by missile or combat aircraft. Numerous government studies have concluded that it is plausible that a sophisticated terrorist group could make a crude bomb if they got the needed nuclear material. And in the last quarter century, there have been some 20 seizures of stolen, weapons-usable nuclear material, and at least two terrorist groups have made significant efforts to acquire nuclear bombs. Terrorist use of an actual nuclear bomb is a low-probability event—but the immensity of the consequences means that even a small chance is enough to justify an intensive effort to reduce the risk. Fortunately, since the early 1990s, countries around the world have significantly reduced the danger—but it remains very real, and there is more to do to ensure this nightmare never becomes reality. Brighter than a thousand suns. Imagine a crude terrorist nuclear bomb—containing a chunk of highly enriched uranium just under the size of a regulation bowling ball, or a much smaller chunk of plutonium—suddenly detonating inside a delivery van parked in the heart of a major city. Such a terrorist bomb would release as much as 10 kilotons of explosive energy, or the equivalent of 10,000 tons of conventional explosives, a volume of explosives large enough to fill all the cars of a mile-long train. In a millionth of a second, all of that energy would be released inside that small ball of nuclear material, creating temperatures and pressures as high as those at the center of the sun. That furious energy would explode outward, releasing its energy in three main ways: a powerful blast wave; intense heat; and deadly radiation. The ball would expand almost instantly into a fireball the width of four football fields, incinerating essentially everything and everyone within. The heated fireball would rise, sucking in air from below and expanding above, creating the mushroom cloud that has become the symbol of the terror of the nuclear age. The ionized plasma in the fireball would create a localized electromagnetic pulse more powerful than lightning, shorting out communications and electronics nearby—though most would be destroyed by the bomb’s other effects in any case. (Estimates of heat, blast, and radiation effects in this article are drawn primarily from Alex Wellerstein’s “Nukemap,” which itself comes from declassified US government data, such as the 660-page government textbook The Effects of Nuclear Weapons.) At the instant of its detonation, the bomb would also release an intense burst of gamma and neutron radiation which would be lethal for nearly everyone directly exposed within about two-thirds of a mile from the center of the blast. (Those who happened to be shielded by being inside, or having buildings between them and the bomb, would be partly protected—in some cases, reducing their doses by ten times or more.) The nuclear flash from the heat of the fireball would radiate in both visible light and the infrared; it would be “brighter than a thousand suns,” in the words of the title of a book describing the development of nuclear weapons—adapting a phrase from the Hindu epic the Bhagavad-Gita. Anyone who looked directly at the blast would be blinded. The heat from the fireball would ignite fires and horribly burn everyone exposed outside at distances of nearly a mile away. (In the Nagasaki Atomic Bomb Museum, visitors gaze in horror at the bones of a human hand embedded in glass melted by the bomb.) No one has burned a city on that scale in the decades since World War II, so it is difficult to predict the full extent of the fire damage that would occur from the explosion of a nuclear bomb in one of today’s cities. Modern glass, steel, and concrete buildings would presumably be less flammable than the wood-and-rice-paper housing of Hiroshima or Nagasaki in the 1940s—but many questions remain, including exactly how thousands of broken gas lines might contribute to fire damage (as they did in Dresden during World War II). On 9/11, the buildings of the World Trade Center proved to be much more vulnerable to fire damage than had been expected. Ultimately, even a crude terrorist nuclear bomb would carry the possibility that the countless fires touched off by the explosion would coalesce into a devastating firestorm, as occurred at Hiroshima. In a firestorm, the rising column of hot air from the massive fire sucks in the air from all around, creating hurricane-force winds; everything flammable and everything alive within the firestorm would be consumed. The fires and the dust from the blast would make it extremely difficult for either rescuers or survivors to see. The explosion would create a powerful blast wave rushing out in every direction. For more than a quarter-mile all around the blast, the pulse of pressure would be over 20 pounds per square inch above atmospheric pressure (known as “overpressure”), destroying or severely damaging even sturdy buildings. The combination of blast, heat, and radiation would kill virtually everyone in this zone. The blast would be accompanied by winds of many hundreds of miles per hour. The damage from the explosion would extend far beyond this inner zone of almost total death. Out to more than half a mile, the blast would be strong enough to collapse most residential buildings and create a serious danger that office buildings would topple over, killing those inside and those in the path of the rubble. (On the other hand, the office towers of a modern city would tend to block the blast wave in some areas, providing partial protection from the blast, as well as from the heat and radiation.) In that zone, almost anything made of wood would be destroyed: Roofs would cave in, windows would shatter, gas lines would rupture. Telephone poles, street lamps, and utility lines would be severely damaged. Many roads would be blocked by mountains of wreckage. In this zone, many people would be killed or injured in building collapses, or trapped under the rubble; many more would be burned, blinded, or injured by flying debris. In many cases, their charred skin would become ragged and fall off in sheets. The effects of the detonation would act in deadly synergy. The smashed materials of buildings broken by the blast would be far easier for the fires to ignite than intact structures. The effects of radiation would make it far more difficult for burned and injured people to recover. The combination of burns, radiation, and physical injuries would cause far more death and suffering than any one of them would alone. The silent killer. The bomb’s immediate effects would be followed by a slow, lingering killer: radioactive fallout. A bomb detonated at ground level would dig a huge crater, hurling tons of earth and debris thousands of feet into the sky. Sucked into the rising fireball, these particles would mix with the radioactive remainders of the bomb, and over the next few hours or days, the debris would rain down for miles downwind. Depending on weather and wind patterns, the fallout could actually be deadlier and make a far larger area unusable than the blast itself. Acute radiation sickness from the initial radiation pulse and the fallout would likely affect tens of thousands of people. Depending on the dose, they might suffer from vomiting, watery diarrhea, fever, sores, loss of hair, and bone marrow depletion. Some would survive; some would die within days; some would take months to die. Cancer rates among the survivors would rise. Women would be more vulnerable than men—children and infants especially so. Much of the radiation from a nuclear blast is short-lived; radiation levels even a few days after the blast would be far below those in the first hours. For those not killed or terribly wounded by the initial explosion, the best advice would be to take shelter in a basement for at least several days. But many would be too terrified to stay. Thousands of panic-stricken people might receive deadly doses of radiation as they fled from their homes. Some of the radiation will be longer-lived; areas most severely affected would have to be abandoned for many years after the attack. The combination of radioactive fallout and the devastation of nearly all life-sustaining infrastructure over a vast area would mean that hundreds of thousands of people would have to evacuate. Ambulances to nowhere. The explosion would also destroy much of the city’s ability to respond. Hospitals would be leveled, doctors and nurses killed and wounded, ambulances destroyed. (In Hiroshima, 42 of 45 hospitals were destroyed or severely damaged, and 270 of 300 doctors were killed.) Resources that survived outside the zone of destruction would be utterly overwhelmed. Hospitals have no ability to cope with tens or hundreds of thousands of terribly burned and injured people all at once; the United States, for example, has 1,760 burn beds in hospitals nationwide, of which a third are available on any given day. And the problem would not be limited to hospitals; firefighters, for example, would have little ability to cope with thousands of fires raging out of control at once. Fire stations and equipment would be destroyed in the affected area, and firemen killed, along with police and other emergency responders. Some of the first responders may become casualties themselves, from radioactive fallout, fire, and collapsing buildings. Over much of the affected area, communications would be destroyed, by both the physical effects and the electromagnetic pulse from the explosion. Better preparation for such a disaster could save thousands of lives—but ultimately, there is no way any city can genuinely be prepared for a catastrophe on such a historic scale, occurring in a flash, with zero warning. Rescue and recovery attempts would be impeded by the destruction of most of the needed personnel and equipment, and by fire, debris, radiation, fear, lack of communications, and the immense scale of the disaster. The US military and the national guard could provide critically important capabilities—but federal plans assume that “no significant federal response” would be available for 24-to-72 hours. Many of those burned and injured would wait in vain for help, food, or water, perhaps for days. The scale of death and suffering. How many would die in such an event, and how many would be terribly wounded, would depend on where and when the bomb was detonated, what the weather conditions were at the time, how successful the response was in helping the wounded survivors, and more. Many estimates of casualties are based on census data, which reflect where people sleep at night; if the attack occurred in the middle of a workday, the numbers of people crowded into the office towers at the heart of many modern cities would be far higher. The daytime population of Manhattan, for example, is roughly twice its nighttime population; in Midtown on a typical workday, there are an estimated 980,000 people per square mile. A 10-kiloton weapon detonated there might well kill half a million people—not counting those who might die of radiation sickness from the fallout. (These effects were analyzed in great detail in the Rand Corporation’s Considering the Effects of a Catastrophic Terrorist Attack and the British Medical Journal’s “Nuclear terrorism.”) On a typical day, the wind would blow the fallout north, seriously contaminating virtually all of Manhattan above Gramercy Park; people living as far away as Stamford, Connecticut would likely have to evacuate. Seriously injured survivors would greatly outnumber the dead, their suffering magnified by the complete inadequacy of available help. The psychological and social effects—overwhelming sadness, depression, post-traumatic stress disorder, myriad forms of anxiety—would be profound and long-lasting. The scenario we have been describing is a groundburst. An airburst—such as might occur, for example, if terrorists put their bomb in a small aircraft they had purchased or rented—would extend the blast and fire effects over a wider area, killing and injuring even larger numbers of people immediately. But an airburst would not have the same lingering effects from fallout as a groundburst, because the rock and dirt would not be sucked up into the fireball and contaminated. The 10-kiloton blast we have been discussing is likely toward the high end of what terrorists could plausibly achieve with a crude, improvised bomb, but even a 1-kiloton blast would be a catastrophic event, having a deadly radius between one-third and one-half that of a 10-kiloton blast. These hundreds of thousands of people would not be mere statistics, but countless individual stories of loss—parents, children, entire families; all religions; rich and poor alike—killed or horribly mutilated. Human suffering and tragedy on this scale does not have to be imagined; it can be remembered through the stories of the survivors of the US atomic bombings of Hiroshima and Nagasaki, the only times in history when nuclear weapons have been used intentionally against human beings. The pain and suffering caused by those bombings are almost beyond human comprehension; the eloquent testimony of the Hibakusha—the survivors who passed through the atomic fire—should stand as an eternal reminder of the need to prevent nuclear weapons from ever being used in anger again. Global economic disaster. The economic impact of such an attack would be enormous. The effects would reverberate for so far and so long that they are difficult to estimate in all their complexity. Hundreds of thousands of people would be too injured or sick to work for weeks or months. Hundreds of thousands more would evacuate to locations far from their jobs. Many places of employment would have to be abandoned because of the radioactive fallout. Insurance companies would reel under the losses; but at the same time, many insurance policies exclude the effects of nuclear attacks—an item insurers considered beyond their ability to cover—so the owners of thousands of buildings would not have the insurance payments needed to cover the cost of fixing them, thousands of companies would go bankrupt, and banks would be left holding an immense number of mortgages that would never be repaid. Consumer and investor confidence would likely be dramatically affected, as worried people slowed their spending. Enormous new homeland security and military investments would be very likely. If the bomb had come in a shipping container, the targeted country—and possibly others—might stop all containers from entering until it could devise a system for ensuring they could never again be used for such a purpose, throwing a wrench into the gears of global trade for an extended period. (And this might well occur even if a shipping container had not been the means of delivery.) Even the far smaller 9/11 attacks are estimated to have caused economic aftershocks costing almost $1 trillion even excluding the multi-trillion-dollar costs of the wars that ensued. The cost of a terrorist nuclear attack in a major city would likely be many times higher. The most severe effects would be local, but the effects of trade disruptions, reduced economic activity, and more would reverberate around the world. Consequently, while some countries may feel that nuclear terrorism is only a concern for the countries most likely to be targeted—such as the United States—in reality it is a threat to everyone, everywhere. In 2005, then-UN Secretary-General Kofi Annan warned that these global effects would push “tens of millions of people into dire poverty,” creating “a second death toll throughout the developing world.” One recent estimate suggested that a nuclear attack in an urban area would cause a global recession, cutting global Gross Domestic Product by some two percent, and pushing an additional 30 million people in the developing world into extreme poverty. Desperate dilemmas. In short, an act of nuclear terrorism could rip the heart out of a major city, and cause ripple effects throughout the world. The government of the country attacked would face desperate decisions: How to help the city attacked? How to prevent further attacks? How to respond or retaliate? Terrorists—either those who committed the attack or others—would probably claim they had more bombs already hidden in other cities (whether they did or not), and threaten to detonate them unless their demands were met. The fear that this might be true could lead people to flee major cities in a large-scale, uncontrolled evacuation. There is very little ability to support the population of major cities in the surrounding countryside. The potential for widespread havoc and economic chaos is very real. If the detonation took place in the capital of the nation attacked, much of the government might be destroyed. A bomb in Washington, D.C., for example, might kill the President, the Vice President, and many of the members of Congress and the Supreme Court. (Having some plausible national leader survive is a key reason why one cabinet member is always elsewhere on the night of the State of the Union address.) Elaborate, classified plans for “continuity of government” have already been drawn up in a number of countries, but the potential for chaos and confusion—if almost all of a country’s top leaders were killed—would still be enormous. Who, for example, could address the public on what the government would do, and what the public should do, to respond? Could anyone honestly assure the public there would be no further attacks? If they did, who would believe them? In the United States, given the practical impossibility of passing major legislation with Congress in ruins and most of its members dead or seriously injured, some have argued for passing legislation in advance giving the government emergency powers to act—and creating procedures, for example, for legitimately replacing most of the House of Representatives. But to date, no such legislative preparations have been made. In what would inevitably be a desperate effort to prevent further attacks, traditional standards of civil liberties might be jettisoned, at least for a time—particularly when people realized that the fuel for the bomb that had done such damage would easily have fit in a suitcase. Old rules limiting search and surveillance could be among the first to go. The government might well impose martial law as it sought to control the situation, hunt for the perpetrators, and find any additional weapons or nuclear materials they might have. Even the far smaller attacks of 9/11 saw the US government authorizing torture of prisoners and mass electronic surveillance. And what standards of international order and law would still hold sway? The country attacked might well lash out militarily at whatever countries it thought might bear a portion of responsibility. (A terrifying description of the kinds of discussions that might occur appeared in Brian Jenkins’ book, Will Terrorists Go Nuclear?) With the nuclear threshold already crossed in this scenario—at least by terrorists—it is conceivable that some of the resulting conflicts might escalate to nuclear use. International politics could become more brutish and violent, with powerful states taking unilateral action, by force if necessary, in an effort to ensure their security. After 9/11, the United States led the invasions of two sovereign nations, in wars that have since cost hundreds of thousands of lives and trillions of dollars, while plunging a region into chaos. Would the reaction after a far more devastating nuclear attack be any less? In particular, the idea that each state can decide for itself how much security to provide for nuclear weapons and their essential ingredients would likely be seen as totally unacceptable following such an attack. Powerful states would likely demand that others surrender their nuclear material or accept foreign troops (or other imposed security measures) to guard it. That could well be the first step toward a more profound transformation of the international system. After such a catastrophe, major powers may feel compelled to more freely engage in preventive war, seizing territories they worry might otherwise be terrorist safe havens, and taking other steps they see as brutal but necessary to preserve their security. For this reason, foreign policy analyst Stephen Krasner has argued that “conventional rules of sovereignty would be abandoned overnight.” Confidence in both the national security institutions of the country attacked and international institutions such as the International Atomic Energy Agency and the United Nations, which had so manifestly failed to prevent the devastation, might erode. The effect on nuclear weapons policies is hard to predict: One can imagine new nuclear terror driving a new push for nuclear disarmament, but one could also imagine states feeling more certain than ever before that they needed nuclear weapons.

### Contention 2 – Climate Change

#### Current energy sources are hopelessly inadequate. Non-nuclear renewables would require five times more resources than exist on Earth AND traditional nuclear power is 100 times less effective than nuclear energy

Snyder ’23 [Van; March 16; spent 53 years as a mathematician and engineer at the Caltech Jet Propulsion Laboratory, MS in Applied Mathematics and System Engineering, spent seventeen years as an adjunct associate professor; “Five Myths About Nuclear Power,” https://substack.com/home/post/p-108860660?utm\_campaign=post&utm\_medium=web]

IFR-type reactors extract 99.99% of the energy immanent in mined uranium but today's reactors extract only 0.6%. The price of uranium would contribute the same amount to the delivered electricity price from IFR-type reactors if it were to increase 167 fold. Uranium could be economically extracted from lower quality ores, or from seawater, where there is estimated to be at least a thousand times more than could be extracted from land. Another low-quality ore is coal-fired power plant waste, which contains nineteen times more energy in the form of uranium and thorium than was extracted by burning the coal. Thorium, four times more common than uranium, can be converted to fissile fuel by neutron transmutation in a fast-spectrum reactor. Nuclear fission is an effectively inexhaustible source of energy. It is possible to breed about 5% more fuel from uranium than is consumed, but only about 1% more from thorium. If the goal is to deploy a fleet of new breeder reactors fueled only by recycled fuel, thorium should not be used before sufficient reactors are in service. The first two goals of the IFR project were safety and waste mitigation. The third was fuel economy. The system problem Most energy discussions focus only on components — wind turbines and solar panels. Electricity production and distribution is a system problem, not simply a component problem. In Burden of Proof: A comprehensive review of the feasibility of 100% renewable-electricity systems, Renewable and Sustainable Energy Reviews 76, Elsevier (2017), pp 1122-1133, Ben Heard et al described an analysis of 24 studies that claimed to explain how to construct and operate regional, national, or continental-scale electricity systems. None of the studies described systems that were physically feasible. Heard et al concluded there was no point to study economic viability. A more serious system problem is that the Earth does not have sufficient materials to build the “technology units” that the International Energy Agency (IEA) demands be built to provide all energy from renewable sources. To stay out of the weeds, here is just one problem: Five times more copper is needed than is known to exist on the Earth in forms that can be recovered.

#### Dramatic expansions of modernized nuclear power are the only feasible path to abate climate change.

Stein ’22 [Adam, Jonah Messinger, Dr. Seaver Wang, Juzel Lloyd, Jameson McBride, and Rani Franovich; July 6; Director of the Nuclear Energy Innovation program at the Breakthrough Institute, published by the Electric Power Research Institute, presented to the Nuclear Regulatory Commission, and contributed to many high-profile projects, including the first-ever license application for an advanced nuclear reactor in the U.S., Ph.D. and M.S. in Engineering and Public Policy from Carnegie Mellon University where his research focused on changing the paradigm for emergency preparedness and response for nuclear facilities; a non-resident Senior Energy Analyst at the Breakthrough Institute, Ph.D. student at the Cavendish Laboratory of Physics at the University of Cambridge, was a Visiting Scientist and ThinkSwiss Scholar at ETH Zürich, Master’s in Energy and Bachelor’s in Physics from the University of Illinois at Urbana-Champaign; Breakthrough Institute Co-Director of the Climate and Energy team, PhD in Earth and Ocean Sciences from Duke University as well as a BA in Earth Sciences from the University of Pennsylvania; climate and energy analyst at Breakthrough, Bachelor of Science in Mechanical Engineering at Howard University; graduate student in Technology and Policy at MIT, and a researcher at the MIT Energy Initiative. He studies the political economy of decarbonization, with a focus on US energy and technology policy published in the New York Times, the Los Angeles Times, Greentech Media, and the Columbia Political Review; Master of Science in Industrial and Systems Engineering from Virginia Tech; Breakthrough Institute, “Advancing Nuclear Energy,” https://thebreakthrough.org/articles/advancing-nuclear-energy-report]

The Biden Administration has sought to restore America’s leadership in the global fight against climate change by investing in clean energy. The results illuminate the potential contribution of advanced nuclear power to meeting the Biden Administration’s climate goals. Upon taking office, President Biden rejoined the Paris Agreement, which seeks to limit the average global temperature rise by 2100 to 1.5 to 2 degrees Celsius above pre-industrial levels. Research published by the Intergovernmental Panel on Climate Change suggests that an unprecedented increase in global nuclear generation may be required, with global nuclear generation increasing to up to 500 percent of current levels across modeled scenarios, to reach ambitious climate targets like 1.5 C at low cost. President Biden has also announced a policy goal of reaching 100% clean electricity in the United States by 2035. Nuclear already accounts for 48 percent of clean electricity generation in the United States at present, and provides a valuable firm source of power to complement the increasing share of variable renewables on the grid. Meeting the administration’s ambitious climate and energy targets will require continued existing nuclear power plant operation, as well as advanced nuclear reactor deployment. The modeling results, produced with Vibrant Clean Energy, suggest that commercializing advanced nuclear technology could result in rapid growth of clean nuclear generation that would help to meet the administration’s climate goals. The contribution of advanced nuclear to the United States electricity sector in 2050 across the scenarios is summarized in Table 7-1. In the optimistic Low-Cost High-Learning scenario, the least-cost pathway to meeting a 2050 net-zero power sector target in the United States would have nuclear power provide approximately 50 percent of the entire US electricity demand, up from 19 percent today. The majority of this nuclear generation would come from advanced reactors, with the deployment of 469 GWe of advanced nuclear power by 2050. Nuclear energy is able to provide this high share of generation with only 21 percent of the capacity in the electricity system, due to the high capacity factors of nuclear plants relative to other clean sources. Additionally, this growth comes in spite of a steady decline in generation from existing traditional nuclear plants, which declines by 80 percent by 2050 in the Low-Cost High-Learning scenario. The results illustrate the potential importance of advanced nuclear power relative to solar and wind. In the Low-Cost High-Learning scenario, nuclear generation exceeds solar generation by 75 percent and exceeds wind generation by 50 percent in 2050. This suggests that the market size for advanced reactors could substantially exceed the projected large markets for solar and wind power in the course of achieving a future low-cost net-zero power sector. However, finance and policy support would be necessary to achieve the low costs and high learning rates implied by this optimistic scenario. In these modeling results, 20 to 50 GWe of advanced nuclear capacity is deployed by 2035. The contribution of advanced nuclear to the United States electricity sector in 2035 is summarized in Table 7-2. Across the scenarios, advanced nuclear power contributes 3 to 8% of US generation by 2035, with all nuclear generation providing 15 to 19% of US generation that year. In 2035, the percentage of total generation from the sum of conventional and advanced nuclear power plants across all scenarios is comparable to generation from wind or solar. Table 7 2 Table 7-2: Nuclear shares of total US generation and capacity in 2035 (least-cost optimized for 2050 net-zero power sector target). By 2035, the United States achieves around a 60% total reduction of direct power sector CO2 emissions relative to 2020 fossil CO2 emissions across all four of the scenarios. This corresponds to 2035 power sector CO2 emissions of around 700 million metric tons of CO2 (Mt CO2), compared with 2020 emissions of 1,750 Mt CO2. In the model scenarios, power sector emissions fall by 90% relative to 2020 levels by 2045 (175 Mt CO2 in 2045), before the power grid achieves essentially full decarbonization in 2050 (Figure 7-1). Note that the current US grid has already achieved some decarbonization relative to 2010 power sector fossil emissions of 2,400 Mt CO2. The scenarios used in this report were constructed around a 2050 net-zero power sector target rather than the Biden Administration’s 2035 goal for a zero-emission power sector, which means that these results may understate the potential contribution of advanced nuclear technology in reaching a binding 2035 net-zero target. Reaching a 2035 net-zero target would require substantially more policy and financial support. Across the scenarios, around 70% of the United States generation comes from clean sources in 2035.

#### Warming triggers existential planetary ecocide and geopolitical fractures.

Yang ’23 [Ying and Zhi Chen; January 5; M.D Ph.D from Zhejiang University; Ph.D and professor at the School of Medicine at Zhejiang University; 8th Annual International Conference on Social Science and Contemporary Humanity Development, “Severe Situation of Human Impact on Climate Change, Impact on Infectious Diseases and Solutions,” https://doi.org/10.1051/shsconf/202315205001]

Abstract. The activities of the human activities, especially since the industrial revolution caused the greenhouse effect and the severe climate change situation, leading to a variety of suffering such as natural disasters, the collapse of the food system and extinction, also infectious diseases and mental diseases and so on. These grim situation makes most countries reach a consensus of net zero discharge and limiting the temperature rise to 1.5° C. To cope with and adapt to climate change threat in the future, we should carry out cross-regional and multidisciplinary cooperation as much as possible, develop high-tech products for early warning of climate health risks, carry out a number of climate health monitoring projects, strengthen the monitoring and early warning capacity of climate change risks, and work together to maintain and promote a good climate for the earth and human health. 1 Introduction The global human disaster caused by COVID-19 is not over yet, and climate change is increasingly becoming a global focus. Climate change not only exacerbates COVID-19, but also causes or aggravates other diseases or discomfort. Climate change and general health are issues that need to be addressed together with the strength of all mankind. After decades of discussion, climate change has become an urgent issue. Most countries in the world jointly participated in the Kyoto Protocol and the Paris Agreement, aiming at the core targets of carbon peak and carbon emission. This article also gives some examples of measures to solve the climate problem. We must respect nature, and the climate issue should be an issue that requires a high degree of solidarity among mankind. We should take this as an opportunity to build a cultural environment of solving problems through negotiation and mutual trust among countries on a global scale. Although it is difficult to unite and cooperate in this era of individualism, nationalism and the supremacy of interests, I believe that mankind can unite and find a solution after experiencing the pain of climate change and holding the clear understanding that if it is not solved, it will probably lead to the extinction of ~~mankind~~ [humankind]. 2 Grim situation and consensus on human activities changing climate A team consist of 93 scientists has published a exceptionally comprehensive record of paleoclimatic data across the past 12,000 years. It contains 1,319 data records collected from 679 sites around the world and from samples such as marine sediments, lake sediments, peat, coral, cave sediments and glacial ice cores. From this data, the researchers mapped changes in surface air temperatures over the 12,000 years since the last iceage. The figure is compared to the century average temperature between 1800 and 1900 to track changes likely to be brought about by the Industrial Revolution. As expected, temperatures at the start of the period were much cooler than the 19th century baseline. But over the next few thousand years, temperatures rose steadily, eventually surpassing the baseline. Temperatures peaked 6,500 years ago, and since then, the planet has been slowly but surely cooling, seemingly driven by slow cycles in Earth's orbit, which reduced the amount of sunlight in the northern hemisphere's summer and ultimately led to the 'Little Ice Age' of recent centuries. In a relatively short period since the middle of the 19th century, human activity has increased the average temperature by as much as 1̊ C, a huge peak that is higher than the peak of 6500 years ago (Fig.1) [1]. <<<Figure 1 Omitted>>> A recent report by Xu Chi, a professor at the School of Life Sciences at Nanjing University, showed that, on a global scale, humans have been distributed in more stable climate conditions for the past 6,000 years. The research was conducted using interdisciplinary studies such as ecology, archaeology and climatology. If the global population is to remain in this climatic niche, according to the current trends in climate change, by 2070, some 3 billion people would be living in extreme temperatures similar to those currently found in the heart of the Sahara. Max Callaghan and other researchers used Bert model machine learning to identify and classify 100,000 climate impact research papers, in an attempt to determine how many people in the world are already experiencing the effects of the climate crisis. They drawed important conclusions: For climate change research, it is more focused on richer countries in Europe and North America, with about twice as many studies as low-income countries such as Africa and the Pacific Islands. The combined results show that the vast majority of the world, with more than 80% of the land area and 85% of the population, is currently experiencing the impacts of the climate crisis (Fig.2) [2]. <<<Figure 2 Omitted>>> The people of the Republic of Kiribati, an island nation in the central Pacific Ocean, have been forced to move their homes due to rising sea levels. They are at constant risk of flooding and waves. The rich and the rich countries emit more carbon, while the poor don't even own a house or a car. The poor who are most dependent on nature and want to live in harmony bear more of the impacts of climate change. The modern mode of development and industrialization were brought by the people of rich countries. Their technological strength, sustainable development concept, capital and management strength can also bring about visible results in a short period of time. There is no doubt that developed countries need to take the lead in solving the climate problem. 3 IPCC report The effects of human activities on the climate system has been the core content of every assessment report by the United Nations' Intergovernmental Panel on Climate Change (IPCC).The latest sixth IPCC assessment report adopted climate models participating in the Coupled Model Intercomparison Project Phase 6 (CMIP6), so that the impacts of different anthropogenic forcing factors on the climate system can be further recognized and quantified, and the understanding of the effects of human activities on climate change can be deepened. The indicators in different layers of the climate system, including the atmosphere, oceans, cryosphere and the surface of the change of the climate change , can detect the influence of human activity.The sixth time evaluation report suggests extreme cold and extreme warm events change in global and most of the mainland are likely to be the main reason of the greenhouse gases caused by human activities. The intensification of global heavy rainfall in recent decades may also be due to the influence of human activities. The decline in spring snow cover in the Northern Hemisphere since 1950 has also been linked to human activity, which is also likely to be a major driver of the recent universal glacier retreat that has occurred nearly worldwide. Human activity is most likely the main driver of global sea-level rise and ocean heat content increase since the 1970s.On 28 February 2022, the IPCC released its report "Climate Change 2022: Impacts, Adaptation and Vulnerability". The report argues that warming has pushed the majority of the planet's ecosystems to "hard limits of human adaptation" -- the point at which human societies will be unable to adapt to any more change. Antonio Guterres, Secretary-General of the United Nations, said: Today's IPCC report is an 'atlas of human suffering' ", and the climate problem is worse than ever [3]. The latest IPCC report, which is more than 2,000 pages and was compiled by 270 scientists after reviewing numerous independent studies, provides a comprehensive overview of the entire body of scientific research on climate change, with a focus on its effects on ecosystems, wildlife and human societies. According to the IPCC report, some of the consequences we are already seeing at current levels of warming include: 1) The disease is spreading to more areas 2) Species are dying out everywhere 3) Local animal and plant populations die or migrate, irreversibly changing local ecosystems 4) Plants and mammals died in large numbers due to droughts and heat waves 5) Major food systems begin to collapse 6) Past carbon sinks, such as the Amazon rainforest and Arctic permafrost, turn into sources of greenhouse gas emissions 7) As a result of climate change, half of the world's living things are at present moving habitats, destroying ecosystems everywhere. Half the world's population faces water shortages for at least part of the year. The risks to the food system are high: about 8 percent of the world's farmland could become unusable if warming reaches 1.5 degrees.