# Durham 22 R2 1N

## 1 off- Research DA

#### 1. Space is essential to researching and managing Climate Change

### Chaturvedi 20

(Aditya Chaturvedi, 1/30/2020, “How satellite imagery is crucial for monitoring climate change, https://www.geospatialworld.net/blogs/satellites-for-monitoring-climate-change/)

**“If you can’t measure it, you can’t manage it”**, said María Fernanda Espinosa Garcés, President of the United Nations General Assembly at the COP 24 in Katowice Poland, summing up how crucial satellites are for measuring climate change. **Satellite measurements of Earth’s temperature, greenhouse gas emissions, sea levels, atmospheric gases**, dwindling ice and forest cover etc, **are essential for improving the understanding of Climate change and predicting future** of the Earth. Innovation such as miniaturization of sensors, high-speed data transfer, and upgraded storage capabilities have made satellites an integral part of the climate change mission. It is simply inconceivable to assess climate change sans insights provided by satellites. **Without precise data and other inputs provided by satellites, environmentalists and scientists won’t be able to understand, analyze and predict the impact of climate change, and policymakers won’t be able to formulate effective strategies**. Using an array of satellites, organizations like NASA, NOAA and ESA monitors ocean conditions, clouds, temperature, sea levels and heat content, to get information on how fast Earth’s temperature is changing. ESA map shows ocean salinity Satellite data provides authoritative information about more than half of the 50 crucial climate change variables. These insights include satellite radar altimetry, which measures distance between a satellite and the earth’s surface and gives us precise information about sea levels. Atmospheric chemical composition and greenhouses gases like Methane are also measured using satellites. Currently, there are around 162 satellites in-orbit that measure the various indicators related to climate change. New generation satellites have enhanced optical and temporal resolutions that have improved weather forecasting, climate modeling and the ability to obtain real-time details. Within the next five years, many new satellite missions will be launched, including Eumetsat’s second-generation polar-orbiting satellites, third-generation Meteosats and Chinese satellites.

#### 2. Space has provided countless benefits to Earth and society as a whole

### NASA 13

<https://www.nasa.gov/sites/default/files/files/Benefits-Stemming-from-Space-Exploration-2013-TAGGED.pdf>

**There are numerous** cases of **societal benefits linked to** new knowledge and technology from **space** exploration. Space exploration has contributed to many diverse aspects of everyday life, from **solar panels** to **implantable heart monitors**, \ **cancer therapy** to **light‐ weight materials**, and from **water‐purification systems** to **improved computing systems and** to **a global search‐and‐rescue system**4 . Achieving the ambitious future exploration goals as outlined above will further expand the economic relevance of space. **Space exploration will continue to be an essential driver for** opening up **new domains in science** and technology, **triggering other sectors to partner with the space sector for joint research** and development. **This will return immediate benefits back to Earth** in areas such as materials, power generation and energy

## 2 off - Get Off The Rock DA

#### Nuclear war, terrorism, disease, biological warfare, and asteroids make space colonization the only way for humans to survive

Engdahl, ‘07

**[Sylvia Engdahl, science teacher and space advocate, “Space and Human Survival: My Views on the Importance of Colonizing Space,” 10-07, www.sylviaengdahl.com/space/survival.htm]**

A more urgent cause for concern is the need not to “put all our eggs in one basket,” in case the worst happens and we blow up our own planet, or make it uninhabitable by means of nuclear disaster or perhaps biological warfare. We would all like to believe this won’t happen, yet some people are seriously afraid that it will—it’s hardly an irrational fear. Peace with Russia may have drawn attention from it, yet there are other potential troublemakers, even terrorists; the nuclear peril is not mere history. Furthermore, there is the small but all-too-real possibility that Earth might be struck by an asteroid. We all hope and believe our homes won’t burn down, and yet we buy fire insurance. Does not our species as a whole need an insurance policy? Even Carl Sagan, a long-time opponent of using manned spacecraft where robots can serve, came out in support of space colonization near the end of his life, for this reason; see his book Pale Blue Dot. And in an interview with Britain’s newspaper Daily Telegraph, eminent cosmologist Stephen Hawking said, “I don’t think that the human race will survive the next thousand years unless we spread into space. There are too many accidents that can befall life on a single planet.” Hawking is more worried about the possibility of our creating a virus that destroys us than about nuclear disaster. However, he said, “I’m an optimist. We will reach out to the stars.”

#### Space colonization is the only way for humans to survive

**Baum 10**

**[Seth D. Baum, Ph.D in Geography from Pennsylvania State University and M.S. in Electrical Engineering from Northeastern University and scholar at Columbia University's Center for Research on Environmental Decisions, “Cost–Benefit Analysis Of Space Exploration: Some Ethical Considerations”, Space Policy Volume 25, Issue 2, May, pg 75-80, http://www.sciencedirect.com/science/article/pii/S0265964609000198]**

Another non-market benefit of space exploration is reduction in the risk of the extinction of humanity and other Earth-originating life. Without space colonization, the survival of humanity and other Earth-originating life will become extremely difficult – perhaps impossible – over the very long term. This is because the Sun, like all stars, changes in its composition and radiative output over time. The Sun is gradually converting hydrogen into helium, thereby getting warmer. In some 500 million to one billion years, this warming is projected to render Earth uninhabitable to life as we know it [25] and [26]. Humanity, if it still exists on Earth then, could conceivably have developed technology to survive on Earth despite these radical conditions. Such technology may descend from present proposals to “geoengineer” the planet in response to anthropogenic climate change [27] and [28].2 However, later – around seven billion years later – the Sun will lose mass that spreads into Earth's orbit, causing Earth to slow, be pulled into the Sun, and evaporate. The only way life could survive on Earth would be if, by sheer coincidence (the odds are on the order of one in 105 to one in 106 [29]), the planet happened to be pulled out of the Solar System by a star system that was passing by. This process might enable life to survive on Earth much longer, although the chances of this are quite remote.  While space colonization would provide a hedge against these very long-term astronomical threats, it would also provide a hedge against the more immediate threats that face humanity and other species. Such threats include nuclear warfare, pandemics, anthropogenic climate change, and disruptive technology [30]. Because these threats would generally only affect life on Earth and not life elsewhere, self-sufficient space colonies would survive these catastrophes, enabling life to persist in the universe. For this reason, space colonization has been advocated as a means of ensuring long-term human survival [32] and [33]. Space exploration projects can help increase the probability of long-term human survival in other ways as well: technology developed for space exploration is central to proposals to avoid threats from large comet and asteroid impacts [34] and [35]. However, given the goal of increasing the probability of long-term human survival by a certain amount, there may be more cost-effective options than space colonization (with costs defined in terms of money, effort, or related measures). More cost-effective options may include isolated refuges on Earth to help humans survive a catastrophe [36] and materials to assist survivors, such as a how-to manual for civilization [37] or a seed bank [38]. Further analysis is necessary to determine the most cost-effective means of increasing the probability of long-term human survival.