

# Stratospheric Aerosol Injection: Implications for Ecosystems and Climate Mitigation Efforts

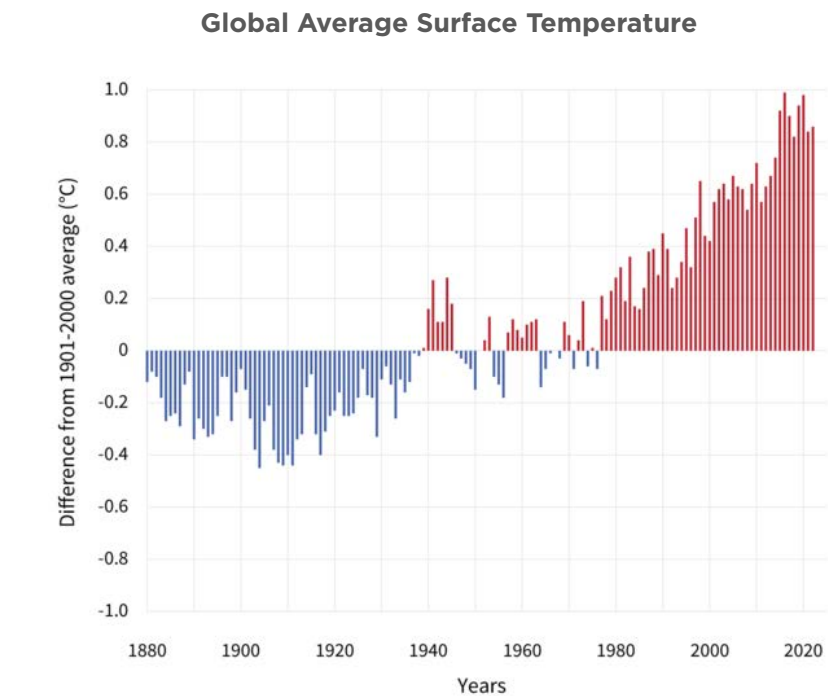
By Hannah Buehler

The treeline newsletter focuses on storytelling and information sharing at the nexus of woody plant communities and climate change. We hear frequently about the tough decisions that, for example, small woodland owners in Western Oregon and Washington are grappling with, such as whether to continue to plant species like Western red cedar or Douglas fir, or whether they should look to more heat and drought tolerant species. These decisions are still made with decades-long conjectures about future climate change and the interplay with other local physical, biological and environmental factors.

New strategies to reverse climate change, like Stratospheric Aerosol Injection (SAI), throw another wrench in decision making processes. How likely are these interventions to occur in the next five, ten or twenty years? What might we expect about their local impacts on temperatures, UV radiation, pests and pathogens, and more? What do these impacts mean for plant selection now? This article describes SAI and gathers input from experts regarding potential implications for decision making regarding assisted migration and plant materials selection now and in the coming years.

As climate change continues to affect communities of plants, animals and people, even the most aggressive climate mitigation policies and strategies largely offer only delayed or partial respite from the impending impacts. New strategies for climate stabilization are being explored, and among them is Stratospheric Aerosol Injection.

Stratospheric Aerosol Injection aims to replicate the cooling phenomena that occurs following volcanic eruptions.<sup>1</sup>



Source: [Climate.gov](https://climate.gov)

Volcanic eruptions push out enormous amounts of sulfur dioxide and other particulate matter, blocking sunlight from reaching the earth's surface, resulting in measurable reductions in global temperatures for upwards of a year following the initial eruption event. SAI aims to mimic this effect by intentionally injecting reflective particles, mainly sulfur dioxide, into the stratosphere using high altitude airplanes, balloons or artillery.<sup>2</sup> These particles, much like they do after a

volcanic eruption, would then act to deflect a fraction of the sun's heat and energy back out of the earth's atmosphere and into space before the full force of the sun's heat and energy can reach the earth's surface and carry out a warming effect.

The allure of Stratospheric Aerosol Injection lies in its relatively straightforward implementation and cost-effectiveness, and its ability to potentially significantly contribute

1 Keys, P., Barnes, E., Diffenbaugh, N., Hurrell, J., & Bell, C. (2022). *Potential for Perceived Failure of Stratospheric Aerosol Injection Deployment*. <https://doi.org/10.31223/x5805s>  
2 *Stratospheric Aerosol Injection: A SRM geoengineering climate solution*. Geoengineering.global. (2023, March 3). <https://geoengineering.global/stratospheric-aerosol-injection/>

to global cooling.<sup>3</sup> The science is relatively clear that SAI would produce a substantial and rapid cooling effect. However, in addition to complicated ethical and governance questions that would arise, the question now becomes: What else would SAI do?

Stratospheric Aerosol Injection practices would also result in unforeseen and likely uncontrollable impacts.<sup>4</sup> On a global scale, there is potential for SAI to

temporarily make the sky appear hazy or milky, could alter the quality of sunlight plants rely on for photosynthesis, or harm the ozone layer. The most likely and significant issues however arise on the regional level. While the global temperature would quite likely be lowered as intended, recent research shows that SAI's impact on regional climates and weather patterns could be much more difficult to predict, ranging from increased precipitation and

flooding in some areas to droughts in others. These unpredictable changes to the quality of sunlight reaching plants as well as changes to precipitation patterns would have significant impacts on plant productivity. Stratospheric Aerosol Injection is also risky in that if the deployment of these aerosols stops, temperatures are predicted to dramatically rebound to the levels that would have reached had aerosol deployment not occurred at all.

- 
- 3 McKibben, B. (2022, November 22). Dimming the sun to cool the planet is a desperate idea, yet we're inching toward it. *The New Yorker*. Retrieved August 16, 2023, from <https://www.newyorker.com/news/annals-of-a-warming-planet/dimming-the-sun-to-cool-the-planet-is-a-desperate-idea-yet-were-inching-toward-it>
- 4 Tang, A., & Kemp, L. (2021). A fate worse than warming? stratospheric aerosol injection and global catastrophic risk. *Frontiers in Climate*, 3. <https://doi.org/10.3389/fclim.2021.720312>

Despite these major challenges and unknowns, SAI continues to be promoted as a viable climate mitigation strategy, largely by the fossil fuel industry as a way to slow movements to eradicate fossil fuel extraction.

We wanted to hear from resilience planners, climate scientists, foresters and ecologists in our community to illuminate how the deployment of SAI technologies could potentially impact plant and forest communities in the Pacific Northwest, as well as ongoing assisted migration initiatives, in order to shed light on the potential, the pitfalls, and the imperative for informed and conscientious action around SAI.

---

**“Although this MAY cause a global reduction in warming, it may not play out that way in any local place.**

Plus, what happens if it works too well? We might find ourselves with reduced agricultural production and continued droughts etc. Who knows what would happen. We only have one planet, messing with the stratosphere is a bad idea. We just don't know what its full implications are.”

- David Shaw, College of Forestry at Oregon State University

---

**“A gentleman asked me at a recent conference if he was “stupid to keep planting cedar,” while he watches cedars on his Molalla Canyon property die.**

My response at the moment was, “no, you might as well keep planting some because no one knows what direction the climate will be taking.” This is even more true if we start intentionally fiddling with the mechanisms that drive Earth's climate. In light of Rex Tillerson's surreptitious climate scheme, the only way to plan for outcomes now is to spread your bets. No particularly good reason to bet against cedar just yet if it only costs a few bucks to plant some... The world is remarkably resilient and productive, and given half a chance, Earth's systems will continue to function for our benefit. The question is, will we give it this chance?”

- George Kral, Co-Founder of Scholls Valley Native Nursery



Top view of a volcanic eruption.  
Photo Credit: Pexels

---

**“We’ve created a bit of a dilemma for ourselves. Our environmental challenges are fundamentally a product of our Western worldview, and are, therefore, fundamentally philosophical in nature.**

In sum, we have a bad or broken relationship with the world because of mistaken assumptions we make about ourselves, the world, and the relationship between ourselves and the world. This suggests that we are not going to tinker and technologize (alone) our way out of our current mess. At the same time, some of these techniques might work, might buy us time — but they will not right our relationship with the world, they may only enforce it, and the belief that we can simply engineer our way out is part of the problematic belief structure in the first place. Engineering fixes are ultimately futile unless we also work to right our relationship with the world. If that’s what something like this can buy us time to do, then maybe they will be worth a try, but only if the work to do in that period of grace is nothing short of worldview remediation.

I’m reminded of this passage from conservationist Aldo Leopold: *“Our tools are better than we are, and grow better faster than we do. They suffice to crack the atom, to command the tides, but they do not suffice for the oldest task in human history, to live on a piece of land without spoiling it.”*

- Michael Nelson, Director of the Center for the Future of Forests and Society, Oregon State University

---

**“The ability to do something doesn’t mean one should do it until the effects are fully understood.**

The range of unintended consequences for these global engineered climate actions are concerning. Also the ability to model or predict these consequences seems out of reach with current tech. Another concern is rate of change and sustainability. Stable ecosystems when presented with rapid changes have shown they are unable to remain stable and in nature there are winners and losers in the race to adapt. Combine this with the ability of those in power to determine how to change the environment—to control who benefits and frankly to define what is a benefit seems rife for abuse against those with the least influence.”

- Bob Whitener, [The Whitener Group](#)

---

**“Three issues come to mind. First is the misdiagnosis of the context for decision-making.**

Aerosol injection is a solution that assumes that earth systems are complicated: Too hot? Turn down the heat. Simple! Yet Earth systems are not complicated — where one act causes a predictable result. Earth systems are complex, in constant flux with emergent interactions between species, humans, earth and sun. Whatever near-term benefit might be intended, the global impact of aerosol injection would be deeply uncertain and risky and will only reveal itself over time.

The second issue is around un-tipping a tipping point. Many earth systems have tipping points. Aerosol injection will not necessarily un-tip and could multiply the impacts of highly destructive feedback loops of earth systems. Lastly, SAI allows for the mother of all scapegoats. If someone injects aerosols into the atmosphere, they will forever be blamed for every extreme weather event that follows.”

- Steve Moddemeyer, Principal at Collinswoerman