The E&S Magazine

Volume 63
Issue 2 *The Innovation Issue*

2019

A Green Sahara: Is Afforestation the Solution to Climate Change that Mankind Has Been Looking For?

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An artist's rendering of a terraformed Sahara Desert

A Green Sahara: Is Afforestation the Solution to Climate Change that Mankind Has Been Looking For?

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Mankind is rapidly approaching a critical turning point in how we interact with the world around us. The advance of modern civilization has created unprecedented environmental challenges in the form of climate change across the world. National leaders are forced to consider alternatives to fossil fuels, like wind and solar power, as a means of energy. City planners must also rethink how infrastructure can be adapted to allow for more walkable and bicycle friendly communities. Worldwide, engineers spearhead the development of innovative carbon capture technologies to reduce the immense amount of greenhouse gases we have already released into our atmosphere. These are but a few examples of the various solutions being provided to combat the effects of climate change.

Despite this surge in environmental consciousness, many experts remain doubtful that the solutions currently in place will be enough to reverse the extensive damage that we have already wrought to the Earth's natural systems. Sea levels will inevitably rise several feet by mid-century, causing billions of dollars' worth of infrastructural damage in coastal cities like Miami, Dubai and New York. The severe weather patterns of recent years will continue to worsen as the Earth's surface continues to warm. In its article "Responding to Climate Change," NASA states that "even if we stopped emitting all greenhouse gases today, global warming and climate change will continue to affect future generations. In this way, humanity is 'committed' to some level of climate change." NASA's prediction holds a rather apocalyptic ring to it, so what can be done? Many engineers and environmental scientists have already started devising larger than life geoengineering projects that could mitigate a great deal of the catastrophic environmental situation we currently find ourselves hurtling towards. One such idea is strikingly reminiscent of something one might read in a utopian science-fiction novel: a tropical Saharan rainforest.

The idea of terraforming the world's largest desert into a lush rainforest has several obvious benefits, including bolstered economies, biodiversity and productivity of the once barren land, should it be rehabilitated. However, the desired effect that has most scientists turning their heads is the vast amount of carbon that a forest the size of the Sahara could remove from the atmosphere. Plants are the world's oldest natural means of carbon capture technology, converting solar energy and carbon dioxide from the atmosphere into solid carbon and excess oxygen gas via the process of photosynthesis. Assuming every 10,000 square meters could hold one thousand trees and every 9.8 trillion square meters of the Saharan Desert could be utilized in this way, we are

looking at a forest of approximately 980 billion trees. That is roughly two and a half times more trees than in the Amazon Rainforest in 2013. A forest of 980 billion trees would increase the world tree population by around 33%, an uptick that could capture between six and twelve gigatons of carbon per year for about a century.

The feasibility of such a colossal undertaking does bear questioning. A forest of this size would need around 4.9 trillion cubic meters of water per year for irrigation. Since the underground aquifers that support life in Northern Africa could not sustain pumping on this scale, the water would have to come from the ocean. This brings up another issue. Despite desalinization becoming increasingly cheaper as more investment and research goes into it, moving this much water through desalination plants and into the Sahara would still require roughly 19,600 terawatt/hours per year, which would cost $1.96 billion per year. Throw in infrastructure, installation and management costs, and the cost of the project as a whole likely jumps well into the trillions. The burden of financing cannot be dumped on the local municipalities, because the economies of Northern Africa could not support such a hefty project on their own. Although a cost of trillions of dollars is by no means a small price tag, it may be possible to finance the project through gas and oil taxes implemented in many of the countries that signed the Paris Climate Agreement in 2015. These types of taxes could generate income for this project (or others) while simultaneously disincentivizing unnecessary usage of automobiles and petroleum products.

The real problem with this plan does not necessarily lie with the trillions of dollars and many decades of global cooperation it would take to complete the project, but instead it lies with the possibly counterintuitive ecological repercussions that such a drastic alteration to the Earth's surface might have. Ironically, the sand that would be lost because of this project remains the key concern of environmental scientists. The same infertile, loose soil that keeps the Sahara a desolate wasteland is vital to the survival of marine ecosystems in the Atlantic. As wind travels across the Sahara Desert, it collects clouds of sand and dust particles that form gargantuan sandstorms that eventually make their way to the Atlantic Ocean. Once there, these large sand clouds, which contain nitrogen, phosphorus and iron, provide vital nutrients to large algae blooms, which serve as the foundation of most oceanic food webs.

Does this ecological factor disqualify the idea of terraforming the Sahara Desert? Many studies warn of the observable adverse effects that climate change has already unleashed on the natural systems that long served mankind for the past few millennia. Any legitimate strategy for getting the Earth's climate back on track may be complex and multifaceted, but perhaps not unachievable. For instance, even if large portions of the Sahara Desert could not be irrigated, many other younger deserts with better soil conditions present relatively easier land to reclaim over the next few decades. If replanted with trees, these lands could act as smaller, though still effective versions of the plan originally proposed. In addition, current human activities causing deserts to form at an alarmingly rapid rate must be further curtailed. Unfortunately, to do so requires a daunting level of policy and lifestyle changes across the world's nations.

Sooner or later, adaptation to the mess we have made for ourselves will become a necessity. Even here at Louisiana Tech, we have opportunities to take steps in preserving our world's fragile environment. For instance, the National Society of Black Engineers holds bi-weekly recycling drives where they collect all the recyclable materials that they can from around the community, load them onto trucks and bring them to the nearest recycling plant. The Greenscape Club offers another opportunity. Their activities recently included selling spring plants, planning and building raised bed gardens for local schools and assisted living communities, and preparing for the construction of a pollinator garden on South Campus.

Regardless of political views or lifestyle, we as engineers have an obligation to preserve and improve our beautiful planet, while still serving the needs of an advanced modern civilization. We must, above all else, continue to remain vigilant and produce solutions to address the changing climate in which we live. In time, through the concerted efforts of the world's engineers and scientists, we may yet devise a solution that will greatly reduce or eliminate the dire threat of extreme climate change while continuing to drive the progress of mankind's great technological achievements.

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