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for Advisor JuPong Lin
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# Deforestation, Trees, Rain: Desertification in Ancient History; Forgetting Hard Lessons Learned—And How We Can Recover.

I am pulling together evidence from multiple sources, of the severe and lasting environmental harm that is caused by deforestation. Trees take several human lifetimes to grow, so what is learned by one culture may be forgotten by the next culture who co-exist with a mature forest.

More than one source illustrates that major civilizations create deserts, in the way they take action in the environment.

In the history of human civilization, we have already learned many times over, how cutting down forests leads to desertification. At the current and accelerating rate of global deforestation, we are on track to desertify our entire planet, turning our blue green marble into an asteroid.

Soils and Civilization, the 1952 study by Edward S. Hyams[1], reveals that in nearly every place on earth where there's been a major civilization, there is now a desert. As one Australian reviewer of Hyam's study, E. N. Clayton put it[2]:

> A series of civilizations have destroyed themselves primarily by destroying their soils, pastures, and forests. Ancient Greece and Rome, prehistoric China, Peru of the Incas, early and present India, early and modern Europe, and North America are studied in relation to the soil and man's reactions to the environment.
>
> The soil is not an inert mass of particles of rock, but a complex community of elements—mineral, organic, vegetable and animal, bacteria, fungi and moulds in the form of solids, liquids and gases, acting and reacting continually on each other.

The reviewer continues:

> Hyams traces with a wealth of detail the destruction of the forests by man through the ages. The people of the Indus began their civilization about 2500 B.C. By 1500 B. C. their forests were gone to feed the vast brick kilns, forges, pottery kilns and kitchen fires. [They] destroyed the one sure stabilizer of their precariously balanced climate and soil. The Chinese repeated the mistake a thousand years later, the Americans three thousand five hundred years later and many other rising peoples at varying times.

The exception to this pattern, is Indigenous peoples' relationship to the land.:

> The native American people of the Andes Region, Central America and Mexico in particular, seem to have been singularly aware of the very precious, even sacred quality of fertile soil. …the Earth was the Mother Goddess of all things. …

> Similarly, the religion of the North American Indians was based upon Mother Earth. To them the idea that land could be bought, sold, or even given away, was immoral. The Indians lived in balance with the soil….

[1] Soil and Civilization, by Edward S. Hyams. 1952. https://archive.org/details/soilcivilization0000edwa_b4y4/mode/2up | accessed10-20-2022.
[2] Clayton, E. N. "Book review: Soil and Civilization." The Australian Quarterly, Vol. 24, No 3 (Sept. 1952), pp. 78-81. https://www.jstor.org/stable/41317694?seq=2#metadata_info_tab_contents | accessed 10-20-2022.

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## The Sahara Desert Was Once Renowned as the Most Fertile Region in the World.

North Africa was once renowned the most rich and fertile land on Earth. Now it is occupied by the Sahara Desert, the largest desert in the world.:

> Here were beautiful snow-capped mountains, thickly covered with enormous trees of spectacular girth. Romans knew nothing of a like grandeur anywhere in the world. The productivity of the soil was remarkable. Pliny, the natural historian, called this region, "the granary of the world." Every plant which grew elsewhere in the Empire grew here, but always with far greater yield and size than anywhere else. … And animals? The region of North Africa was like one gigantic game reserve.

The above quote is from an article written in June 1971, "How Rome Destroyed North Africa."[3] The Romans' plunder of North Africa lasted from the First Century to the Fifth Century AD. They cut down the trees in the mountains so big, they dwarfed the description of trees anywhere else in the world. Not a single one of those massive trees is left. They killed thousands of animals, mostly for entertainment in the amphitheaters, as many as 3500 a time. (an abundance of animals on the land is the single most important way to create fertility in the land)[4].

Before the Romans started killing them, the animals were so abundant, it was hard for people to work the land. The Romans were growing and exporting wheat throughout the Empire and beyond. North Africa was unrivaled in its abundance of agricultural land, and the quality of its food production. Though at first the Romans "practiced excellent agriculture — they understood the importance of having varied animals on farms, the use of legumes, proper crop rotations and the value of verdant pastures…, farming finally degenerated under the later Empire to a kind of monoculture system. Yields began to decline and much of the topsoil became exhausted. This, together with large-scale deforestation, left the soil exposed to the mercy of the weather. The desert, which existed along the southern borders of the fertile areas, began to creep northward. Lands which were once used for crops became poor pasturage for cattle. But soon even the cattle gave way to sheep and goat grazing.

“As Professor Ellsworth Huntington has written: ‘Sheep and goats eat not only grass, but seedling trees, and thus prevent the growth of new forests. Where they pasture in abundance the soil is badly trampled, and is no longer held in place by roots. Hence it is washed away by the winter rain, leaving the hillsides barren and ruining the fields in the lowlands’ (The Fall of Rome, ed. Chalmers, p. 58)."

The late Romans, in a last desperate attempt to bring water back to their agricultural land, built massive aqueducts to replenish the streams that were drying up, to no avail.

Today, this once vast fertile area of 2,500,000 acres is NOW FULL DESERT. It has not recovered for thousands of years.[5]

In West Africa the Sahara Desert is encroaching at a rate of five kilometers per year. Photo credit: NASA

Persistent Effects of the Sahara Desert to this Day:

To this day the Sahara is not only an impacted devastated environment, it is impacts other environments. On June 22, 2020, an “abnormally large dust cloud”[6] traveled from the Sahara 5000 miles across the Atlantic, suppressing tropical development in the Atlantic Basin.

Dust, when it rises high in the atmosphere, superheats, and actually prevents the tropical storms that form and normally bring needed rain up the Atlantic Coast. Think of putting drops of water on a hot stove; how water skittles around on the surface of the stove. The storm was nicknamed the “Godzilla dust cloud.” Experts considered it the biggest dust plume in decades. It lasted for days causing poor air quality in the Southeastern US, and as far north as the Ohio Valley.

These Saharan dust clouds are now a regular part of our weather cycles. “Known as the Saharan Air Layer (SAL), this dry dust plume commonly forms from late spring through early fall and moves into the tropical Atlantic Ocean every three to five days.” According to NOAA’s Hurricane

Research Division (HRD),” the SAL is typically located between 5,000 and 20,000 feet above the Earth's surface. It is transported westward by bursts of strong winds and tropical waves located in the central and western Atlantic Ocean at altitudes between 6,500 and 14,500 feet.

*Satellite imagery of the dust plume from the Sahara trekking across the Atlantic toward the Americas on June 22, 2020. (NOAA/GOES16)*[7]

“Saharan dust tracks as far west as the Caribbean Sea, Florida and the Gulf of Mexico each year.” [8]

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[3] Martin, Ernest L. “How Rome Destroyed North Africa.” The Plain Truth Magazine (Jun. 1971), pp. 37-41. https://www.hwalibrary.com/cgi-bin/get/hwa.cgi?action=getmagazine&InfoID=1382439579 file:///Users/macuser/Downloads/PT_06_1971.pdf | accessed 10-18-2022

[4] Inhabit (documentary). Directed by Costa Boutsikaris, 2015. Inhabit explores the many environmental issues facing us today and examines solutions that are being applied using the ecological design process called 'Permaculture'. Permaculture is a design lens that uses the principles found in ecosystems to help shift our impact from destructive to regenerative. www.inhabitfilm.com | accessed 10-20-2022.

[5] “Deforestation during the Roman period.” Wikipedia. https://en.wikipedia.org/wiki/Deforestation_during_the_Roman_period | accessed 10-18-2022.

[6] Navarro, Adriana. “'Abnormally large dust cloud' making 5,000-mile trek across Atlantic.” Accuweather. 19 Jun 2020. https://www.accuweather.com/en/weather-news/abnormally-large-dust-cloud-making-5000-mile-trek-across-atlantic/761708 | accessed 10-27-2022.

[7] Ibid.

[8] Dolce, Chris and and Jonathan Erdman. “Massive Saharan Dust Plume Spreads Into the U.S. After Completing a 5,000-Mile Journey From Africa.” The Weather Channel. 28 Jun 2020.

https://weather.com/storms/hurricane/news/2020-06-21-saharan-dust-sal-caribbean-gulf-of-mexico-us-forecast | accessed 10-27-2022.

## The Gobi Desert.

• The Gobi Desert has been severely expanded in our lifetimes by over-farming, overgrazing, and deforestation. It is the fastest growing desert on Earth.

According to Global Greenhouse Warming[9]:

> The Gobi Desert in central China has expanded by about 25,000 square miles since 1994 and its sands are now within 160 kilometers (100 miles) of the capital city, Beijing. The capital gets blasted by about half a million tons of sand every year, often reducing visibility to the point where even its soaring skyscrapers are barely visible, air traffic stops and people are forced to stay indoors." Sandy areas are now 27% of China's landmass, and are now expanding by more than 2,460 square kilometers every year.
>
> A recent U.S. Embassy report titled “Desert Mergers and Acquisitions” says satellite images show two deserts in north-central China expanding and merging to form a single, larger desert overlapping Inner Mongolia and Gansu provinces. To the west in Xinjiang Province, two even larger areas – the Taklimakan and Kumtag – are also heading for a merger. Highways there are regularly inundated by sand dunes.

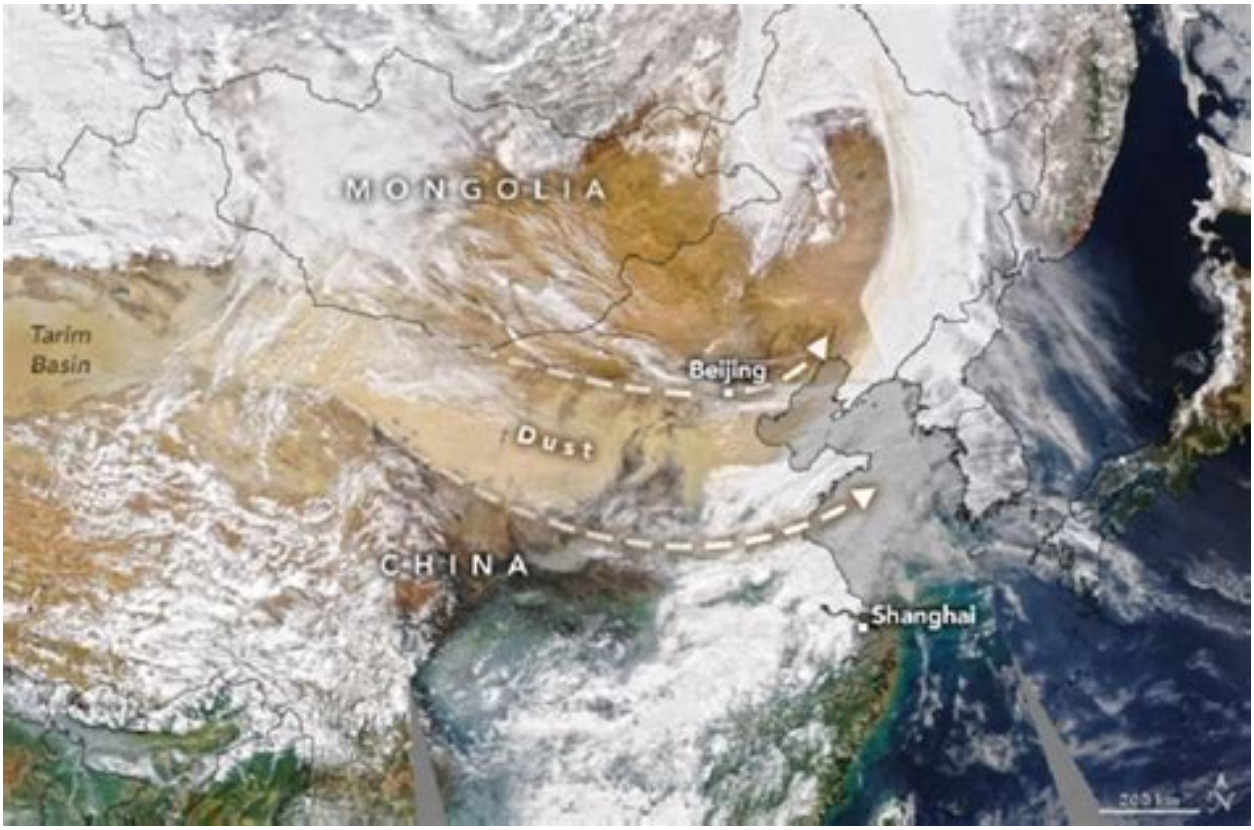
Expanding desertification in China engulfs thousands more acres of productive soil every year. The rate of desertification increased in the second half of the last century. More than a quarter of China is now degraded or becoming desert. The Gobi Desert alone consumes 3600 square kilometers of grassland each year. It is the fastest growing desert on Earth. It has grown by 1 million km² since 1950.[10] China acknowledges desertification as its most serious ecological problem.

Desertification threatens the subsistence of a third of its population, costing China US$6.9 billion per year. In the severely desertified regions the loss is as much as 23.16% of annual GDP. 400 million people endure water shortages, and degraded soil.[11] Droughts damage roughly 160,000 square kilometers of cropland annually, "double the area damaged in 1950."[12] Since 1940, China has lost 30% of its arable land. 4000 villages have disappeared.[13]

Deforestation has made things worse. According to Greenpeace, only 3.4% of China's original forests remain, of which 'only .1% is protected.'

The "Great Green Wall of China" massive afforestation effort has not yet reversed the trend of desertification.[14]

Dust and sand storms have intensified. The Gobi Desert is the second largest dust source (the Sahara is the largest). Dust from China reaches New Zealand, and even the French Alps. This "Yellow dust" costs Korea and Japan billions. There is a statistically significant link between Asian dust storms and daily mortality. Inhaling this dust has been linked to respiratory and cardiovascular diseases.




Largest and strongest Sandstorm in 10 years - NASA Moderate Resolution Imaging Spectroradiometer (MODIS) - 3/25/2021

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[9] "Gobi Desert." Global Greenhouse Warming. http://www.global-greenhouse-warming.com/gobi-desert.html | accessed 10-20-2022.
[10] Wellian, Jake. "From dirt to forests: China versus the Gobi Desert." Swaying Tree. 10 Nov. 2021. https://swayingtree.org/from-dirt-to-forests-china-versus-the-gobi-desert/ | accessed 10-20-2022.
[11] China From the Inside (4 Episode Documentary Series). PBS. 2006. In an extraordinary moment in history, the Chinses government allowed Western documentary film makers free access to all parts of China to create this four-part documentary series. Episode 3: "Shifting Nature," has rare footage of inhabitants of the Gobi Desert, and the hardships they endure. https://cosmolearning.org/documentaries/china-from-the-inside-489/ | accessed 10-20-2022.
[12] "China's desertification is causing trouble across Asia." The Conversation. 16 May, 2016. https://theconversation.com/chinas-desertification-is-causing-trouble-across-asia-59417 | accessed 10-20-2022.
[13] Balanzo, Juana. "The Expansion of The Gobi Desert!" Prezi. 7 Mar, 2014. https://prezi.com/ubbit_rob6-i/the-expansion-of-the-gobi-desert/ | accessed 10-20-2022.
[14] Shin, Judy. "What is the 'Great Green Wall' of China?" Earth.org. 23 Aug, 2021. https://earth.org/what-is-the-great-green-wall-in-china/ | accessed 10-20-2022.

## Timna Valley, Israel has not Recovered from Ancient Deforestation Damage.

3000 years ago, Israel's Timna Valley was irreparably harmed by deforestation. It has not recovered to this day. From the 11th to the 9th centuries BCE, copper mining in Israel's Timna Valley profoundly damaged its environment, due to the enormous quantity of wood fuel required to smelt copper. Timna Valley, known then as the Valley of Edom, was once the site of King Solomon's mines. King David conquered Edom, "placing garrisons throughout the land, so that the Edomites became his subjects."[15] Copper mining here peaked during the time of King David and his son, Solomon. Solomon "used huge quantities of copper for building the Temple in Jerusalem."[16] the local Edomites specialized in copper production. Copper was exported as far away as Egypt, Lebanon, and Greece.

A research study conducted by Ph.D. student Mark Cavanagh, Prof. Erez Ben-Yosef, and Dr. Dafna Langgut[17], of Tel Aviv University's Laboratory of Archaeobotany and Ancient Environments, determined (by examining charcoal samples under a microscope), that local wood was used initially, mainly local white broom and acacia thorn trees. The copper works "burned as many as 400 acacias and 1,800 brooms every year." Once these local trees were depleted, wood was imported from further distances. This proved unsustainable, and the copper works was abandoned by the 9th century BCE.

"Our findings indicate that the ancient copper industry at Timna was not managed in a sustainable manner, with overexploitation of local vegetation eventually leading to the disappearance of both the plants and the industry....." Dr. Langgut concluded, "Our study indicates that 3,000 years ago humans caused severe environmental damage in the Timna Valley, which affects the area to this day. The damage was caused through overexploitation, especially of the acacia and white broom, which, as key species in the ecosystem of the Southern Arava, had supported many other species, stored water, and stabilized the soil. Their disappearance generated a domino effect of environmental damage, irreparably harming the entire area. Three thousand years later, the local environment still hasn't recovered from the crisis. Some species, like the white broom, once prevalent in the Timna Valley, are now very rare, and others have disappeared forever.'

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[15] Tel Aviv University. "3,000 years ago, human activity destroyed vegetation and irreparably damaged the Timna Valley environment" Phys.org. 22 Sep. 2022. https://phys.org/news/2022-09-years-human-vegetation-irreparably-timna.amp | accessed 10-24-2022.

[16] Ibid.

[17] This research study conducted by Ph.D. student Mark Cavanagh, Prof. Erez Ben-Yosef, and Dr. Dafna Langgut[17], head of the Laboratory of Archaeobotany and Ancient Environments, from Tel Aviv University's Jacob M. Alkow Department of Archaeology and Ancient Near Eastern Cultures, was published in S*cientific Reports*: Mark Cavanagh et al, Fuel exploitation and environmental degradation at the Iron Age copper industry of the Timna Valley, southern Israel, *Scientific Reports* (2022). DOI: 10.1038/s41598-022-18940-z

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## An Ancient Maya Landscape Never Recovered from Deforestation.

"A [2018] study[18] shows that centuries of deforestation by the Maya people have drastically changed the ability of local rainforests to store carbon in the ground. And even now - long after the Maya cities were mysteriously abandoned and the forests grew back - the region's carbon reserves have not yet fully recovered."[19]

Before its collapse a thousand years ago, the Maya civilization in Mesoamerica had one of the densest populations in human history. As this ancient civilization spread across the Yucatan, "it left a pernicious mark on the environment that can still be observed today.":

> "'When you go to [the Yucatan region] today, much of it looks like dense, old-growth rainforest,' says lead author and geochemist Peter Douglas. 'But when you look at soil carbon storage, it seems the ecosystem was fundamentally changed and never returned to its original state'.
>
> Soil is a key ingredient in climate research because it is able to store an astounding amount of carbon - more than double the amount of Earth's atmosphere. When plants die, the carbon they have removed from the atmosphere is transferred into the ground. And if the plant carbon attaches to a mineral, it can stick around in the soil for thousands of years. …
>
> Using sediment cores from the bottom of three lakes in the Maya Lowlands, Douglas and his team identified specific molecules in the samples, called plant waxes, which attach to minerals and are stored in the soil for a long time. The age of these molecules and surrounding plant fossils was then determined through radiocarbon dating. The findings suggest a 70 to 90 percent decrease in the age of plant waxes, and these changes matched the land-use patterns of the ancient Maya. The results imply that after Maya deforestation, carbon was being stored in soils for much shorter periods of time."

In untouched biodiverse mature forests, 60% of the carbon is stored in the ground, in the forest duff layer—the miccorhizal fungi network. “Fungal networks underpin life on Earth,” says Mark Tercek, former CEO of the Nature Conservancy. “Thriving mycorrhizal fungi networks have been shown to store eight times as much carbon as ecosystems without such networks.”[20]
Every time a forest is deforested, the amount of carbon stored in the forest floor lessens. When a forest is logged, the sun bakes the forest floor–killing its shade-loving ecosystem; the miccorhizal fungi network.[21] Hundreds or thousands of years of stored carbon evaporates back into the atmosphere. It will take 50 to 100 years for the miccorhizal fungi ecosystem to heal, and even then, the forest floor will not be as carbon dense as it was before deforestation. [22]
Every time the forest is deforested it stores less carbon in the ground.

> Atmospheric scientists agree that about 12 percent of all human-made climate emissions now come from deforestation, mostly in tropical areas. The new research suggests that if deforestation continues at the current rate, it could

> jeopardize one of the largest carbon sinks in the world, potentially speeding up the rapid warming of our planet.
>
> This offers another reason - adding to a long list - to protect the remaining areas of old-growth tropical forests in the world,' Douglas says. 'It could also have implications for how we design things like carbon offsets, which often involve reforestation but don't fully account for the long-term storage of carbon.'
>
> In other words, planting trees is great, but if deforestation causes long-lasting harm to the soil's carbon reserves, it could all be for naught

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[18] Douglas, P.M.J., Pagani, M., Eglinton, T.I. et al. A long-term decrease in the persistence of soil carbon caused by ancient Maya land use. Nature Geosci 11, 645–649 (2018). https://doi.org/10.1038/s41561-018-0192-7

[19] Cassella, Carly. "Ancient Maya Landscape Never Recovered From Deforestation Thousands of Years Ago." Environment. 22 Aug 2018. https://www.sciencealert.com/the-ancient-landscape-of-the-maya-never-recovered-from-deforestation-thousands-of-years-ago-scientists-warn | accessed 10-24-2022.

[20] Harvey, Fiona. "World's vast networks of underground fungi to be mapped for first time." The Guardian. 30 Nov 2021. https://www.theguardian.com/science/2021/nov/30/worlds-vast-networks-of-underground-fungi-to-be-mapped-for-first-time | accessed 10-24-2022. Jane Goodall is advising the project from the Society for the Protection of Underground Networks (SPUN).

[21] Schueman, Lindsey Jean. "Mapping the fungi network that lives beneath the soil." One Earth. 8 Dec 2021. https://www.oneearth.org/mapping-the-fungi-network-that-lives-beneath-the-soil/ | accessed 10-24-2022.

[22] Veldkamp, E., Schmidt, M., Powers, J.S. et al. Deforestation and reforestation impacts on soils in the tropics. Nat Rev Earth Environ 1, 590–605 (2020). https://doi.org/10.1038/s43017-020-0091-5

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## Tyson Yunkaporta - Civilizations Make Cities Make Deserts.

I can think of no better way to wrap up this writing than to share Tyson Yunkaporta's thoughts about civilization, eloquently expressed in his book, "Sand Talk: How Indigenous Thinking Can Save the World.":

> To understand the crisis of civilization… we first need to define what civilization is from the standpoint of First Peoples' Law ("Nothing is created or destroyed; it just moves and changes, and this is First Law." Yunkaporta, Sand Talk 39).
>
> …Civilizations build cities. Wakanda in Marvel's Black Panther comics is an African Civilization, because it makes cities. In the real world, the ancient peoples of Zimbabwe who once made cities of stone lived within a civilization, until it inevitably collapsed. This was not an Indigenous culture just because its inhabitants had dark skin. Civilizations are cultures that create cities, communities that consume everything around them and then themselves. They can never be Indigenous until they abandoned their city-building culture, a lesson the Elders of Zimbabwe have handed down from bitter experience through deep time.

> A city is a community on the arrow of time, an upward-trending arrow demanding perpetual growth. Growth is the engine of the city—if the increase stops, the city falls. Because of this, the local resources are used up quickly, and the lands around the city die. The biota is stripped, then the topsoil goes, then the water. It is no accident that the ruins of the world's oldest civilizations are mostly in deserts now. It wasn't desert before that. A city tells itself it is a closed system that must decay in order for time to run straight, while simultaneously demanding eternal growth. This means it must outsource its decay for as long as possible.
>
> For this reason, a city is dependent on the importation of resources from interconnected systems beyond its borders. The city places itself at the center of these systems and strips them to feed its growth, disrupting cycles of time and land and weather and water and ecological exchange between the systems. The exchange is now going only one way. Matter and energy are still neither created or destroyed in this reaction; they are directed into static heaps rather than cycled back through and between systems.

## Closing Thoughts:

I wrote this paper because I wanted to gather together in one place everything I have learned about how ancient deforestation caused desertification. I needed to lay it out, weave the stories together, and make connections. Then I needed time to reflect, and sleep on things. Returning to this writing now, I know I can't leave this writing in this dark place.

Greenpeace has a Facebook group. Their rule for posting is that you can't post a story about ecological devastation without sharing a way to take action. I agree. I truly don't think this is the end for humanity or the planet. An amazing planetary awakening is emerging right now, a realization of the unspeakably profound love for mother earth, embedded in each one of us (yes, I believe, even in the worst actors – somewhere inside). This bible quote came to me, "It is easier for a camel to pass through the eye of a needle, than for a rich man to enter heaven." I read a bit about this. There was a gate in Jerusalem so narrow that for a camel to pass through it, all of the camel's burdens had to be removed, before the camel could pass through the gate. Similarly, I believe there is a way forward to a future more wholesome and caring. It requires that we embrace what is most essential. What is essential is love: love and respect for all life, for all our relations, for ourselves, for each other, and for our more than human kin. In this simplicity of embracing deep gratitude for all life, we will be able to pass through the eye of the needle that is this moment.

There are a few places to look, already, where people have begun to understand that nature, and especially mature forests are the life support system of the planet.

In my next writing, I will write about the bright spots, people who have dedicated themselves to planet repair. To end this writing in light and not in darkness, I will share a few.:

## Trees for the Future:

Trees for the Future (www.trees.org), works in five sub-Saharan countries, helping destitute people transform lands devastated in the ill-conceived "green revolution" of the 1960s (slash and burn and plant a monocrop), by transforming them into permaculture forest gardens. They work with each family for four years, helping them to plant 1000 trees per hectare of land per year. In the first year, they plant a green fence of fast growing trees suited for the climate:

thorny acacias, leucaena trees, pigeon pea trees (which produce a nut high in protein), and miracle fruit trees (which produce a fruit high in vitamin C). The thorny acacias are coppiced and woven together. This provides firewood, the main fuel in this part of the world (without this, people walk to the edge of the desert to cut trees for fuel, which has caused the Sahara desert to expand). The coppiced green fence also protects the land. It keeps out goats, floods, and sandstorms, the three things that can wipe out crops. After the green fence is established in the first year, a succession of fruit and nut trees is planted inside the green fence. Finally crops are planted beneath the trees. In four years, when the forest garden is established, a family will have a stable livelihood; fresh fruit, vegetables and crops to eat and bring to market year-round (with monocrops, a crop can only be produced during the rainy season, and people are forced to go miles away for work during the dry season). The forest gardens have created a trend of people returning to their land, no longer traveling far way for work. The program is growing, as families see the forest gardens thrive on their neighbors' land, and ask to join the program.

Seynabou Diatta in the third year of her Forest Garden. Photo credit: Trees.org

In 33 years, Trees.org has planted 278 million trees; restored 71,000 acres of land; assisted 320,000 people to have a stable livelihood.

Trees.org Impact Report: [https://trees-for-the-future.s3.amazonaws.com/2022-Impact-Report.pdf](https://trees-for-the-future.s3.amazonaws.com/2022-Impact-Report.pdf)

## The Woman Who Raised 300 Trees as her Children:

Saalumarada Thimmakka couldn't have children, so she and her husband raised trees instead. There was no water where they lived. Saalumarada planted and cared for three hundred trees as her

children. She is now 105. The rains have returned to her homeland. ( https://inhabitat.com/meet-the-105-year-old-woman-from-india-planted-300-trees-because-she-couldnt-have-children/)

Saalumarada Thimmakka with her trees. Photo credit: Saalumarada Thimmakka International Foundation

## Neal Spackman, and Regenerative Resources Company:

https://regenerativeresources.co/

Neal Spackman and his team transform degraded land into highly productive landscapes with seawater. Spackman cut his teeth working to reverse desertification in Saudi Arabia, by planting trees at the edge of the desert. He has worked to heal land in some of the harshest environments on earth. Here are some of their projects: in Saudi Arabia; Eritrea, Govan Wetlands- Glasgow, Scotland; and Egypt. Projects: https://regeneratiiveresources.co/about/

## Global Earth Repair Foundation:

The Global Earth Repair Foundation is committed to spreading the knowledge of ecosystem restoration to heal the climate and the planet.:

“Global Earth Repair is about building a grass-roots, locally-managed restoration mass movement to regreen our planet and recarbonize our soil. On May 3-5 2019 in Port Townsend Washington, we brought together over 600 people for three days of education, networking, and collective action – including 160 presenters and panelists that ranged from ecology experts to indigenous elders, permaculture gurus to environmental grief facilitators. Our focus is earth repair, ecosystem restoration and bioremediation.”

https://globalearthrepairfoundation.org/global-earth-repair-is-working-with-organizations-and-incredible-people-around-the-world-to-restore-the-biosphere-by-assisting-nature-to-regenerate-the-planet/