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Climate Volatility

Using Holistic Grazing to cease Climate Change

During my entire life, I have always had everything, not one day passed when there was no food on my table, nor drinkable water. I knew there were people in the world dying of starvation, but I have never in my life felt hunger. I knew people in the world were begging for a drop of water, but I have never really been thirsty, I didn't know how troubled the world was until I began to spend time with my uncle. My uncle is a missionary and a doctor at the same time. He has the gift of wanting to help everyone around him, that is the reason why, when he turned 25, he went to Africa to help the communities most afflicted with hunger, lack of water and medical aid. When I began to talk to him a little bit more, he told me about the awful experiences he had had, about people starving, people dehydrating, people dying and for once, that world became real to me. He told me about how unfair it was for families that didn't even contribute to climate change to suffer the consequences of it.

The increase of carbon dioxide in the Earth's atmosphere leads to the increment of heat in the planet, resulting in higher temperatures. As stated by the National Oceanic and Atmospheric Administration (NOAA), the land and ocean temperatures rise 0.07°C (0.13°F) per decade since 1880 (Lindsey, R., et al, 2020), this may not seem like a big change, but currently, the lowest and highest temperatures of the Earth are more than 55°C (100°F) apart. This relatively small change of temperature has been responsible for what we know as climate change: the appearance of extreme meteorological conditions.

These conditions limit our access to every human being's basic needs, by 2080 Earth's temperature will increase by 4°C and the levels of CO₂ will double. As stated in Maslow's Hierarchy of needs, in order to live, we need four basic physiological elements: air, food, water and rest (Maslow, A., et al, 1987) , nevertheless, the growth of our population, also means the increase of carbon dioxide around the world. According to the United Nations, the levels of carbon emission grow correspondingly with the growth of human population, as is shown in the next chart: ₁

Fig 2. Growth of population along with CO₂ emissions

UN (2017). Population and CO2 Emissions 1750-2015. 30/June/2020, de Population Matters Sitio web: <https://populationmatters.org/the-facts/climate-change>

These changes will compromise two of our basic needs: access to water and food security (Turrall, H., et al, 2011). The increase of rainfall in already humid areas will lead to flooding and eventually to the destruction of drinking-water deposits by contaminating them (UN, 2017). On the other hand, the rise of drought in arid and semi-arid areas will lead to the loss of crops and any other water deposits, as has already been happening around the entire globe:

Fig 3. Consequences of Global Warming in water deposits all around the world

Morrison, J., Morikawa, M., Murphy, M. & Schulte, P.. (2009). Water and Climate Change. 30/June/2020, de Water Scarcity & climate change: Growing Risks for Businesses & Investors Sitio web: https://www.fcn.org.uk/sites/default/files/Water_scarcity_and_climate_change.pdf

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One of the main environmental challenges we have had to face due to climate change is desertification in the African continent. Desertification is defined as the degradation of the drylands up to the point that there is a loss of biological productivity (Millennium Ecosystem Assessment, 2005). That would mean that desertification doesn't necessarily just refer to the fact that an area becomes dry and that the rainfall rates decrease; it also means that vegetation, plants, trees that used to grow in that area, will dry and no longer decompose for other plants to grow in their place, the land that was once fertile, becomes sterile.

According to the University of Maryland, the Sahara has grown 10% since 1920 due to desertification (Imster, E., 2018), and it will continue to grow and spread throughout the African continent. That is the reason why, recently, the idea of reforesting the Sahara desert began, first, with the creation of the Great Green Wall: the initiative of building an 8000 km-long barrier filled with trees in order to stop desertification. Then, with the

proposal of the Sahara Forest Project: making deserts productive again through the use of technology to produce biofuels and electricity (Hodges, M., 2017).

Even if these seem like sustainable and helpful solutions to climate change, there is one aspect that they did not take into consideration: the benefits and importance of the Saharan Desert sand for other environments. NASA researcher Hongbin Yu, provided information about the first satellite-based estimate of phosphorus transport over the globe. It turns out that 182 million tons of Saharan desert dust travel each year all the way through the Atlantic Ocean and set in South America, especially in the Amazon (Garner, R., 2015). This highly-containing phosphorus dust, serves as a fertilizer for the vegetation of the Amazon Rainforest, therefore, the reforestation of the Saharan Desert by creating artificial conditions, might lead to the loss of the world's largest rainforest; the earth's lungs.

Darfur is a region located in Western Sudan, its area is approximately 493180 km² and has a population of 8.2 million people (UN, 2011). It is also the home of a great deal of nomad tribes such as: the Baggara tribe, from which spring other subtribes, for instance: the Rizeigat tribe. The Rizeigat tribe is one of the few tribes that are still considered nomads, it has a population of 364000 people that are constantly traveling in search of food and water, bringing their livestock along with them. This tribe is spread all over the regions of Darfur and Kordofan, areas that have also been affected by the expansion of the Sahara and have suffered the consequences of desertification.

Abd, M. & Salih, M. . (2015). The Role of Ecological Factors in Causing Land Surface Desertification, the Case of Sudan. 30/June/2020, de Research Gate Sitio web:
https://www.researchgate.net/publication/279726144_The_Role_of_Ecological_Factors_in_Causing_Land_Surface_Desertification_the_Case_of_Suda

Northern Darfur is an area that encompasses the tribe's route and is particularly affected by desertification, the drought of its soils already began to affect the crops that used to grow in its territory. According to FAO, in 2018, they harvested a total of 276000 hectares of millet, nevertheless, in 2019, they only harvested 196000 hectares; there has been a decrease of 39% hectares than the year before (FAO, 2020), making up for only 0.6612% of Northern Darfur's total area (COOPI, 2019). As for crop exports, numbers have also decreased: in 2008, there was an export of 265764 metric tons of sorghum cereal, however, that number radically lowered to an export of 320 sorghum crops in 2010 (Kenefick, E., et al, 2014).

Northern Darfur's climate is mostly arid; it can vary from 30°C up to 39°C during the entire year in day time and it can drop until 11°C with a maximum temperature of 25°C during the nighttime. Unlike Northern Darfur, that is governed mainly by a governor chosen through democracy; the Rizeigat tribe follows a tribal leadership, which is made up by a headman, a sub-headman and the members of the tribe acknowledged by their skills (Takana, Y., et al, 2012). Leadership is hereditary and by law, it excludes women, the headman of the tribe is called: "nazir" (Ntonzima, L. , et al, 2012).

There is no such thing as families as we know them in the Northern Rizeigat Tribe, for

them, families are segmentations made by patrilineal groups (that they are genetically related), each family is conformed between 500-1000 people and each woman can have between 2-15 children. As for marriages, since they follow the Islamic religion, it is required that the first marriage of any man or woman must be arranged, but only the father of the bride (or her elder brother) can negotiate with the groom. Men have the right to have a polygynous marriage, as a matter of fact 29% of men, in each segment, have polygynous marriages (Flint, J., 2010).

Fig 5. Dried and desertified areas of Sudan

Northern Rizeigat Tribe economy is based upon herding, specially camel herds (the most common livestock), they look after their livestock, in order to sell it afterwards. Some families have their own fields and crops (principally millet), but they only harvest for certain months and then, they move again (De Waal, A., 1989). They generally migrate from north to south and back, this is due to the fact that they follow the rain; the rainy season begins in August so they settle in the western area of Northern Darfur in Taiga Plateau because a group of plants called *jizzu* will have settled there until September and October, when the rainy season comes to an end (Lang, H., et al, 1996). After that, they just move south and settle in the southern part of Northern Darfur for the dry seasons, which begin in February. When they settle, they stay in tents: where unmarried men and adolescents are in separated tents and the tribe chief stays in a tent with his wife, tents are kept at least 10 m apart from each other.

Each tent has a specific function: residence, preparation of food, consumption, reproduction, production (herd-management) and budgeting (control of the financial resources). Every residence unit prepares their own meal and women and men must eat separately. As for education, in 1980 the tribe had something similar to a government-provided primary school, it had a policy in which every pupil could be withdrawn from school whenever it was needed, in order for them to respect their nomadic traditions, for that matter, children attended school for a few months only (Lang, H., et al, 1996).

A series of migrations during the medieval period gave origin to the Northern Rizeigat tribe. Due to the fact that they have arabic lineage, their language and culture derive from the Arab culture. This is portrayed in their dressing codes, which consist of a traditional robe and headdress for men and a full-length dress, as well as a hijab for women (TRADOC, 2006). They speak a modified version of the arabic language, customized to the country they inhabit, called: Sudanese Arabic. As it has been mentioned before, they follow the Islamic religion; because of this, women inside the

tribe are only subordinates in a society of men, this implies that they cannot shake hands with men, let alone engage in a conversation unless they have been formally introduced. Some other cultural aspects involve the fact that it is distasteful to admit that “you don't know” or that constructive criticism is taken as an insult (TRADOC, 2006).

Holistic grazing is a concept made up by ecologist Allan Savory, it refers to the fact that herbivorous animals can revitalize the sterile parts of the land through rotational grazing (Abdelatif, M., 2015). It is believed that if these animals can mimic wild herbivores by moving in flocks, nature will respond by increasing plant productivity. If this technique could be implemented in Darfur; that assembles part of the 10% extension of the Sahara desert (Reich, P., et al, 2001), then the degradation of the drylands could be controlled.

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According to the Food and Agriculture Organization (FAO), if 10 million hectares of the Sahara desert expansion are restored each year, there might be a chance of achieving land degradation neutrality by 2030 (FAO, 2017). Starting by a small city, such as Darfur, more specifically with the Rizeigat Tribe; it could help to determine whether this proposal could work on a larger scale. Using livestock to reverse the Sahara desert's desertification will guarantee the safety of the Amazon Rainforest, because it is not an utterly artificial solution; it is nature's response to a human-created stimulus. Grass and trees will not grow all over the desert, only in certain areas, because not every area of the desert hosted herbivore animals, therefore, the dust of the Sahara desert will not be altered.

There has been a reduction in the number of herbivore species in Northern Darfur, which have been attributed to the indirect effects of increasing human and domestic livestock populations and to hunting, in the case of carnivores, they were systematically exterminated in the 1940s and early 1950s (Wilson, R.T. , 2003). In the areas where herbivore animals have disappeared there is a chance for holistic grazing. It is true that one of the main reasons why there was a reduction in the animal population in the first place was because of the artificial insertion of livestock into the environment, but this was because the livestock that was introduced had a totally different behavior to the animal population that used to inhabit those areas, on the other hand, if we manage to mimic the behavior of those animals with livestock, we might be able to restore the vegetation that used to grow in that specific area.

In order to fulfill this project successfully, my proposal would be to negotiate with the Northern Rizeigat tribe, for them to use their very own livestock in order to revitalize the desertified areas of Northern Darfur, meanwhile, they maintain their nomadic features and their economic activities, respecting their lifestyle and culture. Still, they would have to abide by the following requirements:

- The tribe would have to follow the specific routes that have already been established by herbivores that used to inhabit those lands (Savory Institute, 2015), in the case of Northern Darfur, this are the passages that the Rizeigats have got to go through along with their livestock:

In the desert and semi-desert regions of Darfur, explorers reported the presence of animals such as addax, oryx, dama gazelle, and wild sheep. The addax is similar to an antelope and was last seen in west Sudan near the frontier to Chad in 1992, afterwards, the specie disappeared due to poaching (East, R., 1999). Because of its proximity to the routes that the tribe follows nowadays and because it belongs to the same order as sheeps, goats and camels: the Artiodactyla order (Animalia, 2018), the addax might be the easiest herbivore to mimic with livestock.

Moreover, in order for this technique to work, the areas that want to be healed need a recovery ratio (Savory Institute, 2015), therefore, there must be short grazing periods and long recovery periods, that is the reason why the route must be followed, during the period the tribe moves south, it will give the soil in the western area time to recover

- The Rural Industries Research and Development Corporation's Co-grazing project showed a 16% improvement when they combined cattle with camel herds. Additionally, in 2007, each camel was sold for \$432 US dollars (Abdalatif , Y., et al, 2010) and each sheep \$110 US dollars (Hassan, O., et al, 2009). This numeric data allows us to determine that by co-grazing both species there will be a higher productivity for a lower price.
- Animals must all be kept in herds, a wider range of spread animals will not have the same impact as a bunch of animals that move together and settle in smaller areas (Savory Institute, 2015). Stocking rates must also be taken into account,

assuming this tribe has a total population of 1000 people and according to the American Planning Association, the area required is 1 acre per 100 people (Moeller, J., 1965), therefore, the tribe's population needs an area of at least 10 acres, which is equivalent to 40468 m². If the right stocking rates indicate that there must be 4 camels in every 60 m² (Mohammed, A., et al, 2020) and 20 sheep per acre (4046 m²) (Umberger, S., 2009) and we 7

Fig 7. Map with a proposal for a route for the Rizeigat tribe
begin by grazing only 25% of the total territory, we would need a total of 55 sheep and 12 camels approximately for 10117 m²

Regarding how we will invite the Rizeigat tribe to help us, we will need someone that can communicate with them, not only in the sense of language, but someone that also understands their lifestyle and culture. Consequently, for us to make an arrangement with the tribe, we must look for an interpreter and someone that specializes in ethnography, someone that has studied the culture, economy, politics and the social aspects of this specific tribe. The Institute of Social and Cultural Anthropology is an institution that specializes in the study of the behavior and anthropological aspects of any culture or society in the world.

Some of their professors have made researches about nomadic tribes and African pastoral tribes (Parkin, R., 2019); they could help us understand the way in which these people live and their way of thinking. To this extent, we could formulate a specific strategy for convincing them through empathy and a great knowledge of their culture and society, this strategy would then be transmitted to them with the help of the interpreter. According to the Joshua Project initiative, the main language that the tribe speaks is Sudanese Arabic (Joshua Project, 2020). On these grounds, the National Register of Public Service Interpreters (NRPSI) is an organization that provides information and the contact of public service professional interpreters of any requested language (Croad, N., 2020), in that matter, we could look for a Sudanese Arabic speaker that could help us communicate the project to the tribe.

The Holistic Grazing Project must have a control measure in order to design an organized system that will lead to its success, consequently, the interpreter must also explain to the tribe the conditions that they should keep in line with. As calculated before, the suitable number of sheep and camels is 55 sheep and 12 camels for the specific area in which the tribe stays, that number cannot be exceeded because that might damage the soil even more and it cannot be lowered because we might not be able to reach the expected results. Therefore, the tribe needs to control the herds´

breedings, this can be managed through the regulation of reproduction, they need to keep the initial numbers of sheep and camels and limit any increase in their herds, the spare number of animals can be sold by them as part of their economical activities.

To ensure the safety of the livestock, for at least five years, there must be a system of verification that corroborates the state and number of livestock provided to the tribe. This might be somewhat uncomfortable at first, but these are only measures to keep during a short period of time; until the tribe adapts to the systems and the implications they have: the maximum and minimum number of livestock, the specific areas they need to cross and the controlled reproduction of their herds.

Concerning the economical support for this project, my idea is to partner up with the non-profitable institution that has been struggling against desertification since 2016: the Sahara Forest Project (SFP) and its CEO: Joakim Hauge. In order to get this project working, there need to be five basic elements: low humidity, access to salt-water, size and shape of land, wind direction, proximity to other industry and social and financial factors. In 2015, the EU invested €750,000 euros in the Renewable Energy and Energy Efficiency Demonstration (REEED) pilot projects in Jordan (SFP, 2019).

If the holistic grazing project can partner up with the SFP, we would need support to obtain certain resources such as water, hay, mixed grasses and monetary funds. In the interest of livestock, we would need an approximate of 55000 l of water and 222200 kg of mixed grass per year. These could be donated to us by the REEED in Jordan. As for money, in order to fulfill this project, we would require a loan of \$43,265 USD, this includes the acquisition of livestock and the health support they might need: \$9,700 USD for 55 sheep (Hassan, O., et al, 2009) and \$33,565 USD for 12 camels (Abdalatif , Y., et al, 2010), the money earned by the tribe through the practice of their economical activities will be kept by them.

For additional economical support, we can ask for earmarked contributions from the United Nations Environmental Programme (UNEP), these are funds given for very specific projects, for very specific areas, that is the reason why, this fund could work for an area as small as Darfur because the problem we want to solve is directly related to climate change. It would be ideal to request the Green Climate Fund (GCF), specially because it emphasizes on Least Developed Countries (LDC) and African States (GCF, 2020).

As for the verification system, it would be fundamental for the SFP, as well as the UNEP to evaluate the efficiency of their financing as a form of return on investment. Therefore, they ought to be the ones to perform the revision of livestock at every stop the Rizeigat tribe makes, that way, they can make sure that the tribe is following the already established terms and conditions and that their expenses (sheep and camels) are safe. In order to do this, they must abide to the route made by the Rizeigats and wait for them in the places where they camp, for example: Taiga Plateau, there they can carry out any analysis, whether medical or statistic.

Likewise, at the end of the testing period (five years), it would be essential to test whether there has been an improvement in the soil's fertility range, for this, a sample of soil must be taken and its components, nutrients and humidity must be registered (Marx, E., et al, 1999). This could be done by the Desertification and Desert Cultivation Studies Institute at Khartoum, where it has already been made using biophysical indicators in order to determine whether there is land degradation (Eljack, M., 2009).

It would be beneficial for the SFP to invest in our project because we have one objective in common: stop desertification in order to save humanity. Also, it would be important for them to acknowledge that by continuing with their project they might be damaging another part of the world: the Amazon and at this point, we cannot afford to lose another environment, specially not one called "The Earth's Lungs". Humanity is at some point blindfolded, we move around a dark room, not really understanding the things we're touching, just moving them around the place and by the time we find the light switch, we realize what a huge mess we have done.

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That is the reason why we must find a way of stopping desertification, without damaging our planet more than we already have, that is the only way in which we might be able to buy ourselves some time; by healing the Earth's damaged soil, we could cease the increasing of extreme meteorological conditions. We must have a plan by know, we cannot postpone it any longer, we cannot risk it because by the time carbon dioxide level emissions double again, it will already be too late.

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