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Soil Degradation in South Africa

INTRODUCTION

Did you know it can take up to 1,000 years to create one inch of soil? ("Key messages"). Nonetheless, soil can be washed away in just a moment. Soil is a finite resource, yet the issue of soil degradation is not popularly advocated for. According to the FAO, soil degradation is “a change in the soil health status resulting in a diminished capacity of the ecosystem to provide goods and services for its beneficiaries” ("Soil degradation"). These unhealthy soils are unable to perform normally and provide adequate crop yields. Soil degradation is an important yet unpopular issue in South Africa, and there are various ways to address this issue and help the people and ecosystems of South Africa.

ABOUT SOUTH AFRICA

As of 2021, South Africa has a population of around 60,143,000 people. South Africa is about 66.4% urban and 33.6% rural (Hall, et al.). South Africa is a very diverse country, with multiple ethnicities and blended cultures making up its society. The typical family life of a South African differs greatly due to this diversity. For example, families and their lives tend to vary based on region of residence in the country in addition to their social class. It is not uncommon to find extravagant housing of white people in close proximity to shacks of Black workers. There are a lot of disparities between the white minority and Black majority in South Africa in terms of opportunities in education and the economy, but the country continues to make progress to close the gap between these significant differences (Hall, et al.). South Africa's agricultural economy has two sides to it, one being the sector of commercial farming while the other being the sector of small-scale (mainly subsistence) farming.

The climate of South Africa is typically dry, and almost all of the country is in the temperate zone. The country is surrounded by the ocean on its south, east, and west. The African plateau covers a large part of the country, and the country has many mountains, valleys, and coastlines. More than half of South Africa is either arid or semi-arid, receiving less than 24 inches of rain annually, and many farmers often deal with water shortages ("South Africa"). The majority of the soils in South Africa are not extremely fertile, and the soils that are typically fertile (ex. those in the coastal KwaZulu Natal area) are easy to degrade ("South Africa").

ISSUE OF SOIL DEGRADATION AND ITS IMPACT

Soil degradation is present in certain regions of South Africa, but the issue of soil degradation is somewhat severe in South Africa due to its climate and the transformations brought with climate change. For example, South Africa currently has a semi-arid climate, but with climate change, there will be an increase in droughts and extreme weather. Climate change could also induce higher temperatures and less rainfall in South Africa. Additionally, changes in weather patterns like precipitation can also have an effect on desertification (when land turns into a desert) and soil erosion. This trend of soil degradation is somewhat worsening due to climate change and rapid population growth. The world population is currently growing, and by 2050, the United Nations projects the world's population will be 9.6 billion

(Karlen and Rice). If South African farmers are struggling with low crop yields or low agricultural productivity, it is an indicator that this issue of soil degradation needs to be addressed first. Soil is essential for sustainable food production, and this increasing demand for food production cannot be adequately met without healthy soils to grow and cultivate crops. Ultimately, soil degradation has a negative effect on the environment, as it causes decreased soil quality, increased difficulty with growing crops, and less agricultural productivity. Declines in crop productivity have been linked to hunger and poverty (Tully, et al.), and although it is a developed country, South Africa still struggles with both of these topics. Additionally, soil degradation causes soil to become depleted of nutrients, and the lack of nutrients in soil can affect how nutritious the crops are that grow from it. In order to continue to support the nation with healthy, productive crop yields, new sustainable agricultural practices should be introduced in South Africa as the population continues to develop and grow rapidly.

SOLUTIONS

One viable solution to this issue could be switching from plow/traditional tillage to conservation agriculture. Traditional tillage practices are disruptive, ruining agricultural soils. In fact, 24% of global land degradation is caused by traditional tillage (Hussain, et al.). Tilling land traditionally also decreases the amount of arable land available, which is essential for food production. In contrast, conservation agriculture prevents the disruption of soils. Conservation agriculture is a type of “farming system that can prevent losses of arable land while regenerating degraded lands. It promotes maintenance of a permanent soil cover, minimum soil disturbance, and diversification of plant species” (“What is Conservation”). Conservation agriculture has several positive effects, including increasing soil organic matter contents and decreasing the amount of greenhouse gasses released into the atmosphere. For example, traditional tillage practices potentially increase the amount of greenhouse gasses in the atmosphere by constantly moving the soil, inducing soil disintegration and less nutrients and organic carbon content in soil. However, one negative aspect of conservation agriculture would be its potential effect on women. When women are working in agriculture, they often have to look to their husbands or other males in their family before implementing a practice. Furthermore, some current environmentally friendly efforts in sustainable agriculture, like conservation agriculture, often require more labor intensive methods (which would be completed by women), so efforts to implement these methods are sometimes disliked because of the potential extra labor stress it would induce. Also, many countries in Sub-Saharan Africa struggle with a labor shortage, so the introduction of more labor intensive methods in agriculture are not that realistic or appealing. One important component of agricultural practices related to soils is carbon sequestration. Carbon sequestration is the process of transferring carbon dioxide from the atmosphere into soil or storing other forms of carbon as an effort against climate change (Hussain, et al.). Soil organic carbon (SOC) is carbon stored in soil as soil organic matter. With the use of conservation tillage practices, more SOC could be sequestered and stored in soil. The soils of South Africa already have low SOC levels, so switching to conservation tillage would help these low levels. Ultimately, conservation agriculture would be helpful with soil degradation as it promotes minimum disturbance of soils, allowing the soils of South Africa to maintain a sufficient level of nutrients and organic matter.

Another solution to this issue of soil degradation is the practice of intercropping and crop rotations. A popular practice in agriculture is monocropping, which is the practice of growing the same crop on the same piece of land repeatedly. After a while, the soil of this land is depleted of its nutrients, causing the soil to become less productive. Additionally, monocropping can lead to less organic matter in

soil and increased soil erosion. Monocropping could affect South Africa's agriculture as one of South Africa's most popular crops grown is maize. Maize is an example of one crop that is typically grown with monocropping. Although this practice may be helpful to a farmer in the present, over time, monocropping will eventually create more negative outcomes through the effects it has on soil. However, introducing the practice of crop rotation could counter these negative effects. Crop rotation would mean instead of repeatedly planting one type of crop on the same area of land, different crops could be planted throughout the year to allow the soil to be restored and maintain an adequate level of nutrients.

With both of these practices, it is important to consider the social norms of South Africa and how these practices would fit into those norms. For example, many people may be resistant to implement these new methods and want to continue using methods they are accustomed to. From personal experience (as someone who has family from South Africa and has visited the country several times), I have seen firsthand the difficulty of implementing new agricultural practices in South Africa, especially ones that come from foreigners or people outside of that community. Nonetheless, it is important that both of these solutions are supported by the dissemination of accurate information surrounding soil degradation. The processes of soil degradation and soil's depletion of nutrients are not very noticeable by sight, so it is important that South African farmers are able to recognize the signs of soil degradation before using these practices.

For instance, especially in rural areas, it would be helpful if someone in that community (ex. an agricultural extension agent or an experienced farmer) is responsible for disseminating information and informing others about these practices. This way, the people of each individual community could be more willing and accepting of these new ideas. Some farmers have used a mobile app in order to maintain contact with agricultural agents even in rural areas. This idea could be a potential way to ensure that farmers truly adopt the new practices even after the agricultural agent leaves. If an internet connection is not available in certain rural areas, farmers could also meet with an agricultural agent on a weekly or monthly basis to assess the efficiency of a new agricultural practice and gain additional insight or aid from the agent if needed. Finally, a suitable solution to the disconnect between farmers and government members/agricultural agents could be holding stakeholder meetings to determine what farmers actually want and need. Having increased communication with the government in order to more accurately target farmers' deficits could be more efficient long term.

An interesting component to consider when discussing monocropping is not only farmers but also consumers. Consumption of certain crops contributes greatly to the practice of monocropping, for if one crop produces high profits and is utilized often, farmers will continue to grow that crop rather than introducing other crops into their farm. One idea that could be considered is the promotion of other foods by the South African government in order to decrease demand for only a few crops. If monocropping is the most economically feasible option for farmers, they will continue to stick by that practice. However, by decreasing consumer demand for these crops, farmers might be more willing to switch to intercropping, helping farmers adapt to our changing climate.

Government funding could be used to support these efforts. For example, South Africa's government is currently working towards reforming land, increasing its use for the economy and agriculture, and developing rural areas. As of 2019, 2.9 billion rands (worth nearly \$168 million dollars in 2022) were allocated by the South African government to rural infrastructure development ("Agri-Parks

Programme). The South African government could also implement subsidies to promote intercropping rather than monocropping. Government subsidies often fuel the production of certain crops, leading to increased demand of processed foods, leading to increased consumer preference of those foods, which in turn leads to increased demand of these monocrops. When crops are fundamental to a nation's economy, sometimes the nation will subsidize those crops to ensure the demand is met. For example, in the United States, farmers who monocrop plants like corn, soybean, and wheat often receive subsidies (Evan). Government subsidies for farming aren't necessarily an issue in South Africa as they were stopped in the 1990's. However, this decreased government aid and intervention led to a transition to large scale farming, and large scale commercial farming often includes monocropping (Vink and Kirsten). Nonetheless, present day government intervention to promote use of environmentally friendly agricultural practices and to decrease consumer demand for certain crops could help farmers switch from monocropping to crop rotation.

These new agricultural practices may also have to be modified on a case-to-case basis, for as our climate continues to change and become more unpredictable, adaptation to individual cases is key. There also needs to be a compromise between scientists and farmers as we search for solutions to soil degradation. Scientists tend to look at soils and how to maximize their fertility and production, while farmers focus on having healthy soils to support their livelihoods (Tully, et al.). A combination of visual observation of crops and how much they produce (by farmers) and chemical analyses of soils (by scientists) would yield the best results when looking for solutions.

CONCLUSION

In conclusion, soil degradation is an issue that needs to be taken seriously, for its results can have long-term effects on soils and the potential level of global food production. The soils of South Africa will continue to be depleted if active efforts to preserve nutrients are not implemented. Again, soil is a finite resource, and it is vital that we care for it and value its role in sustaining our world.

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