

Jacob Savela
Sebeka Public School
Sebeka, MN, United States
Senegal, Sustainable Agriculture

Senegal: Building A Healthy Soil Biome

Senegal--a country in western Africa has a population of over 18 million people. With this large of a population, they are dealing with numerous problems dealing with food insecurities (“Explore All Countries-Senegal”). There are many things that come into play that are causing this food insecurity. The greatest of them being that the land is incapable of supporting the vast population that the country has. They also have a very short growing season that contributes greatly to this problem. The winds that blow sand off the dead dirt for most of the year, also make it difficult to prepare for a healthy growing season.

The Republic of Senegal is led by a presidential republic. Its Chief of State is President Macky Sall and the Head of Government is Minister Amadou Ba (“Explore All Countries- Senegal”). These two people work together with other organizations to make it “one of the most stable democracies in Africa.” (“Explore All Countries- Senegal”). To do this they work together with many international organizations to help benefit their people. This includes the UN, Peace Corps, along with numerous others that are helping them with their food insecurities. They also work together to help provide a better healthcare system.

Senegal is composed of predominantly savanna, or flat lands with savanna vegetation. It also has a very marshy, swampy area in the southwest area of the country (“Senegal Geography”). Because much of Senegal is flat, it allows for winds to travel fast and easily across it. From November to June, the northeastern winds form their winter, which is dry and cooler. The summer, from July to October, is hot and humid with a southwest wind (“Senegal Geography”). These winds erode much of the lands by removing the topsoil, which is one of the most important layers in the soil. Their growing season, from July to October, is very short due to the limited amount of rainfall that occurs. This makes it so they can only grow short season crops.

Senegal has many large cities but their population is also very widespread over the entire country, with approximately 70% of Senegal’s population living in rural areas (Explore All Countries- Senegal). In these rural areas they have many different houses. The most common include huts, which house 32.6% of the population, booths, housing 30.1% of the population, low houses, which house 16% of the population, story houses, and apartments, which house 6.9% and 6.4% respectively (Zhukovskii). On average these houses house 9 people (Population Facts). A result of most of the population being rural is that, “Only 32 percent of rural households have access to regular health care” (Bryan). While this doesn’t directly correlate to the food insecurities Senegal is facing, food is an important part of health. Without healthy greens and nutrients, the people are often very sick. Health care often also correlates to a higher level of living, which if we follow this data means many Senegalese may have a lower quality of life.

The Senegalese get most of their food from an open-air market. This provides the staples of their food, including rice, maize, and millet (Lachelier). These items make their diet high in starches, which sustain the body for short periods of time. They often cook these starches with meat into a dish full of carbs and protein.

Senegal has a climate that is very arid that makes only 13% of the land arable (“Explore All Countries- Senegal”). Even with this barrier, 46.8% of the land is being used for agricultural purposes (“Explore All Countries- Senegal”). Of this land that is being used for farming, “Ninety five percent of Senegal’s farms are smallholding, with farm size ranging from 1.5 to 5 hectares.” (“Senegal” *Land Links*) This is equal to 3.7-12.3 acres, or about 3 and ½ to 12 and 1/3 NFL football fields. These farms grow many different crops, with groundnuts being the most common export (“Explore All Countries- Senegal”). Groundnuts are an excellent source of ground cover, but they take large amounts of essential water.

Temperature greatly affects the ability for plants to grow and the amount of rainfall that falls. The average temperature continues to rise in Senegal. In 1921 the mean temperature was 28.03 degrees Celsius, while in 2021 the mean temperature was 29.63 degrees Celsius (“Country Senegal”). The water has been rising on the coasts because of the ongoing climate crisis and has taken over arable land. This has also affected the soil in Senegal by making the water saltier, which in turn makes the soil have more salt content in it (Lassana). This is being combated by desalinizing the soil, which is often done with plants. This is another reason why Senegal’s interior lands need to be made arable.

Senegal has a climate which is best described as an arid climate. This means that it is hot and dry, with minimal vegetation. This prevents crops that take a lot of water, along with large amounts of crops from being grown in that area. According to the Climate Change Knowledge Portal, Senegal’s “arid zones receive a rainfall under 300 millimeters per year, [while] the forested south receives an average of 1200 mm/year” (Spengler). With this in mind they need to focus on building soil that can hold the most water in, because they need to be able to grow as many plants as possible. One of the plants that would be best able to thrive in an area is native plants, which originated or have lived in that area for a long time.

Sandy soil is very common in Senegal, which contains many desert-like areas. Sandy soil is often missing organic material, which promotes a healthy soil biome. Without this organic material, the soil is not able to provide enough nutrients which keep a plant alive without intervention. There are many ways to help improve sandy soil, but the most common is to gradually add more and more organic matter over time. One source of organic matter is mulch, which also holds water in the soil (Berg Stack). This is important, especially in a desert area, as water is vital for life and sustenance.

Mulch can come in many different forms, but it all has the same basic function: holding-back weeds and holding water. Different types of organic mulches, or natural mulches, include “compost, aged manure or bark chips [which] decompose[s] to supply OM [organic matter] and nutrients in the long term” (Berg Stack). Since sandy soil is often missing organic matter, which holds a lot of nutrients, mulch would be a great source of organic matter.

Compost, a form of mulch, is very expensive to buy. It is possible to make though. Senegal has a lot of waste from growing many different crops in their fields but from the main ones that include maize, rice, millet, and sugar cane (“Explore All Countries- Senegal). This waste is in the form of the plant stems and cobs from the maize. This waste would typically be burned to create biochar, but would work great for creating compost, as it would provide the carbon required. The compost would still need the “green” components, which is just as it sounds: items that are green or living. At least here in America we have a lot of waste from our vegetables that go to landfills, but would work great for creating compost. Creating your own compost greatly decreases cost, and prevents waste from going to landfills.

One way of gardening that incorporates large amounts of mulch is no-till gardening. No-till gardening is a method of gardening in which you lay a thick layer of mulch on the soil to hold water, suppress weeds, and improve the soil health. When weeds aren’t growing, less work is required to maintain a field, and less water is required. This is a positive way to both use up extra agricultural waste, along with saving the precious water that is available. This also would lower the cost of fresh produce as it is cheaper to produce, available in a larger quantity, and lowers the quantity of water required to grow one plant (Fick). This would be a great way to hold moisture in the soil and use up extra agricultural waste. These all have disadvantages as well. These include that it is time consuming to create compost, requiring from “two weeks to two years (“Turn your Spoils”).” Along with the space required to create compost, although Senegal has many empty desert areas that could be filled with composting sites. An added advantage to having commercial composting sites is that they are able to compost meats as well, which lowers waste even more.

If produce was cheaper to make, they could also make more money off it. This could possibly raise the minimum wage of “182.95 CFA Francs per for agricultural workers.” (“Senegal Minimum Wage”) This is only about 1,683 USD minimum wage per year (“Senegal Minimum Wage”). With 77.5% of the people being employed in the agriculture sector, this means most people make barely enough to survive (“Explore All Countries- Senegal”). When we are talking about food insecurity, we also need to ensure that people are able to afford fresh produce, enough food, and adequate healthcare. If we make more money, in turn raising the minimum wage, the workers will be able to better afford food, living spaces, and healthcare.

A major problem in desert-like areas is when they get a lot of rain, the rain just runs off the soil taking nutrients with it. Planting native crops would help this water to be absorbed better. When it rains, and you have native crops planted, the water has a place to go down into the soil through the roots. These roots will absorb some of the water and bring the rest down to a water table. If you mix native plants with mulch, it results in a field that absorbs water, holds water, and promotes a healthy soil underneath.

Native plants also prevent wind erosion. If you have an empty plain, the wind will come along, and drag the soil along with it. When you have a natural barrier, such as native plants, the wind gets stopped by them and does not remove the topsoil. Since the topsoil is one of the most important parts of the soil, we want to preserve this as best as we possibly can. This is commonly used in the US by the National Park Service as they say, “The root system of these plants helps to stabilize the soil and prevent open areas

from wearing away” (“Reducing Erosion Native Plants”). This reason is why we want to plant native plants.

This can be costly, though, because many plants have to be bought from producers such as nurseries. They also have to be transported to areas that need them, which releases carbon dioxide into the atmosphere and compacts the soil. This cost would be able to be covered by many different organizations that work in Africa including the Peace Corp, which is currently working on planting native plants, or the World Food Prize. With this in mind, we still can focus on planting native plants. Just on a smaller scale in local areas. Growing plants that cover large areas and that are available where they are needed.

One solution that they are currently implementing in Senegal is that they are planting native trees to help stabilize the soil. One common tree that is used is moringa which as the Peace Corp says, “Moringa is a very green, leafy tree that is fast growing, fixes nitrogen in the soil (nitrogen is an important nutrient for fertile soil) and produces edible leaves that are full of essential vitamins” (Fellows). This is very important for Senegal, as it prevents erosion in and around fields, fixes nitrogen which greatly improves yields, and provides greens that are edible (Fellows). These components together help support Senegal and its soil. Moringa trees also work together with healthcare, as healthy food helps promote a healthy life.

When soil is uncovered, it allows the sun to beat down it, therefore breaking down the soil even more. Mother nature likes to have its soil covered, which is why when it’s uncovered from tillage it grows weeds. One option that could be implemented in Senegal is the use of cover crops. Cover crops are a crop that is planted in an empty plot of land to “Increase soil health and structure, reduce soil compaction, prevent erosion, suppress weeds, maintain soil moisture, and add winter interest” (Vaughan Sesler). This covers a lot of issues that Senegal is currently having with its soil.

Planting cover crops could be funded by the UN or the government of Senegal. They could do this by sending seeds to the individual farmers. When the rainy season comes up, the farmers could spread the seeds over their fields that are not being used for that year’s crop. This would be relatively cheap for the supporting government agency. It would also provide an excellent source of food for animals and humans, while also helping the soil.

Cover crops improve soil health and structure because their root systems break down over time. This will add organic matter back into the soil that is missing and also reduce soil compaction because it aerates the soil, thus breaking up compact pieces. The root systems also play a part in preventing erosion by holding the soil in place. The plant also prevents wind erosion by acting as a wind block. They suppress weeds by covering the open land space, maintain soil moisture by preventing the sun from shining straight on the soil, and add winter interest by making a space look greener and better.

Cover crops also have negative effects as well. They require space to be taken away from possible farmers that need it, require more water than if the land was empty, and take up seeds that are vital for

people to live. Although the first one, essential space being taken up, will never change with the future in cover crops, the second one can change. If you combine a cover crop with the usage of mulch, it drastically lowers the amount of water required for those plants, although it is more costly. This happens because it covers the empty soil and holds moisture in the mulch. Although cover crops also take up much needed seeds, the farmers can get some of them back in the year by harvesting flower heads before they till the plants into the ground.

All of these methods are evaluable by measuring the soil nutrients that are present in the soil at the beginning and in between. Soil is sampled from many different areas in a field, sent to a laboratory, and evaluated for different nutrients, pH, along with organic matter content. These are all important as cover crops and mulch build organic matter content and nutrients, while planting native plants can help restore the land to a typical pH and supply organic matter content (“Measuring Soil Nutrients”). This can be a costly test, as the soil samples have to be harvested from multiple locations and sent into a laboratory. The supporting agencies would be eager to see where they have been improving soil, so they could offer financial support as needed to be able to complete this test.

Working in a desert area places a lot of restrictive barriers on what can be done due to the lack of available water. This is why they have to focus on farming techniques that use less water, in turn saving more fresh water for the people. This also allows them to grow more plants, feeding more people. Ideas could include things such as covering the landscape in mulch, planting native plants, and/or planting cover crops. These all work to help build back dirt that is dead to a soil that is happy and living, although they all have negatives.

These solutions may take a large amount of convincing and consideration by the Senegalese, as it is a new step towards building a food secure country. The Senegalese may be skeptical at first, as the government would be asking them to contribute land, resources, and time to make these adaptations work. If this process was started first by volunteers from external agencies and shows a positive response, they might be a lot more willing to start building these practices into their life. This would cost a considerable amount of time from volunteers, but with the importance of improving food security, many volunteers could be acquired from across the globe with numerous different backgrounds. All building a richer community of people to help a struggling country improve their resources.

Senegal. A country that is currently very reliant on other countries for food, needs our help. If we step in to help them improve their food systems, we can make them more self-reliant. An added bonus to improving the soil is that it also reduces the CO₂ present in the atmosphere. This is why we need to work together on Earth to provide essential resources to one another while keeping our planet in the best shape.

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