

Saving Our Soil; The Soil Degradation Crisis

Project Group 26

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It's odd to think about how the very thing that we live on, walk on, build on, yet virtually ignore is so essential to our livelihood as humans. Soil is key to all life on Earth, an essential medium that allows life to flourish and grow. It seems ironic that we are destroying the very thing that keeps us alive. Article titled "Relationship Between Physical-geographical Factors and Soil Degradation on Agricultural Land." by Bednar et al. states that at least 33% of Earth's surface has been affected by soil degradation (2). The Intergovernmental Panel on Climate Change (IPCC), which is the body of the UN responsible for assessing the science behind climate change, in their report titled "Climate Change and Change in Land" published in 2023, defines solid (or land) degradation as a negative trend in land condition, caused by direct or indirect human-induced processes including anthropogenic climate change, expressed as long-term reduction or loss of at least one of the following: biological productivity, ecological integrity, or value to humans (53). Not only is soil being eroded from the Earth's surface, but the soil that is still here battles the consequences of human action as well. Agricultural activity often depletes soil of important organic matter, lowering the nutrient contents. The European Union reported that Europe has 2.5 million locations that have potentially contaminated soil, and 342,000 locations that need immediate revisions to improve soil health (Bednar 3). The key to it all: human actions causing climate change. Various results of human action have caused overall changes to the climate that are proving to have lasting effects on our Earth.

There are numerous impacts on soil caused by human activities that cause soil degradation. Soil desertification is one of the most concerning of these implications. The IPCC defines desertification as land degradation to drylands, mostly resulting from climate change and human activities (53). They also estimate that around 3 billion people live in areas that qualify as drylands, and that the amount of dryland that is becoming desertified is increasing over the past decades (50). Increasing global temperatures leading to draughts deplete soils of water and important nutrients along with drying up the topsoil and making it highly susceptible to erosion. In addition to that, extreme weather caused by climate change has increased the levels of erosion the Earth is experiencing according to "Climate change: Land degradation and desertification" published by the World Health Organization in 2020. physical

Soil degradation is happening on a global scale in all climate zones, but there are certain areas that are more susceptible to it than others. Previously mentioned drylands are prone to land degradation due to higher temperatures, low moisture levels, and more extreme weather and erosion; these regions are typical in Northern Africa, central Asia, and throughout the middle of North America. The Midwest in the United States of America is currently experiencing alarming levels of soil erosion. Article titled "Soil in Midwestern US is Eroding 10 to 1,000 Times Faster than it Forms" out of the University of Massachusetts-Amherst states that varying sites throughout the Midwest are experiencing up to 1,000 times the level of erosion they faced in pre-agriculture farming years (1).

The complexity surrounding land degradation is that there is no easy box to fit it into with cause and effects specifically listed out. The combination of both global and local human factors and the multitude of climate change impacts create an issue that is not only complex but difficult to solve as there are so many moving parts. The IPCC created a web of these factors that play into soil degradation, see this in **Figure 1** below.

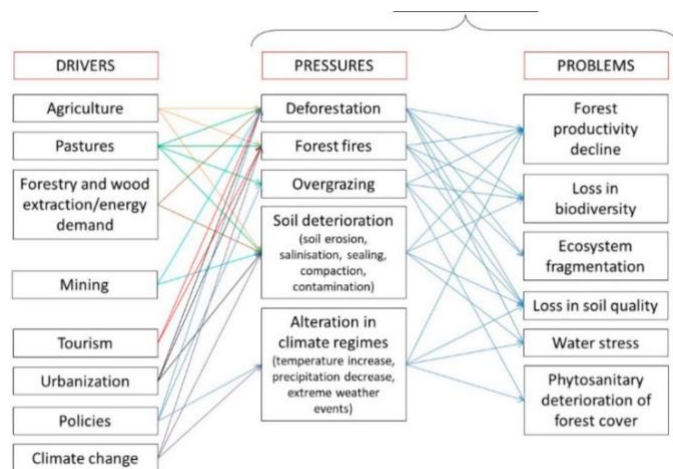


Figure 1. A common framework that illustrates the intrinsic complexity of local systems exposed to Soil, Land and Ecosystem Degradation and Desertification risk. (IPCC 2023).

This complex issue stems to create even more issues on global and local scales. When soil is degraded and nutrients are lost, often factored with agricultural practices such as pesticides which often decrease nutritional value as well, overall nutrient content from food products significantly declines. Topsoil is typically rich in organic matter

(carbon) which gives it its nutritional properties. When topsoil is eroded, all of that value is lost, thus the food we are growing in that topsoil is being depleted of those nutrients. This means that the very food we are growing is lower in nutrient content than it should be because of human actions. Food waste, a massive issue on a global scale, only adds to soil degradation. Food that goes to landfills prevents nutrients from being recycled back into the soils, effectively continuing the depletion (University of Massachusetts-Amherst- 1).

In addition to nutrient deficiencies, as previously mentioned 3.3 million people live on land that qualifies as dryland. These areas are highly susceptible to desertification, which causes further environmental stress and eventually leads to changes in land usage. Titled “Restoring Soil Quality to Mitigate Soil Degradation” by Lat et. al., published in 2015, authors state that changing the usage of land typically results in pollution of water that negatively impacts its quality. Almost all major rivers in developing countries have water contamination, severe water pollution, and eutrophication problems (7). All of these factors have negative impacts on not only the environment, but humans.

Hopefully it is evident that this topic impacts all aspects of life on Earth, both living and non. For humans, impacts range from not getting enough nutrients from our food, to health issues regarding soil and water contamination, and those are just the tip of the iceberg. For the planet that provides us with life, the very thing that allows it to do so is disappearing. Soil is being eroded on a global scale at an alarming rate, depleting top soils, causing land to be altered, contaminated, water sources are being polluted, carbon emissions are increasing, and carbon sinks are evaporating. Scientists already care, and are actively working against the institutions that enable this to happen. Some people are just involved because they care about the planet, some because they are being actively affected by the issue. Whether you like to hug trees or spend your day in a high rise cubicle, land degradation is inevitable and it’s here. Through more sustainable land management and monitoring of global warming, we can try and remedy what we have done to our home. That being said, this starts with getting the word out, increasing awareness, and starting to reform our flawed system.

To work towards that goal, we’ll be launching a website and blog focused on raising awareness of soil degradation. Through this medium, we’ll be making posts introducing readers

to the concept of soil degradation; its causes, effects, the science behind it, and how readers can make a difference in their own communities. Our goal will be to inform and to motivate our audience. By communicating through a digital medium, that audience will be skewed towards younger demographics, social media users, and, within those groups, environmentalists, who will be predisposed to click on our page. Younger generations should be an effective target audience for us, as they're generally already more engaged with environmental causes; the social burden of "saving the planet" is often put on their shoulders, as they'll be "inheriting" the earth that older generations leave behind. They're also likely to be students, like us, which can both be useful in creating a sense of camaraderie, as their peers, and means they'll have the opportunity to spread awareness in a school setting and potentially set up soil science projects or groups within their school communities, with access to like-minded people and mentors in the sciences. Our site will ideally go live before the end of the semester, so that we can monitor engagement and tailor our messages as we work to be the most effective communicator possible. Another advantage of the digital medium is that tracking engagement, and therefore the success of our communication project, is possible through built-in features in the site, via both silent visits to the website, and interactions—likes, shares, and replies—with our posts.

Sources

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