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Agricultural soil pollution due to climate change

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Abstract
The agricultural sector is very important for human life because of its role for economic purposes and meeting food needs. The use of land for agricultural activities cannot be avoided because humans need food every day. The agricultural sector has a negative impact on soil conditions due to excessive use of fertilizers and water. The purpose of this study is to determine the impact of climate change (climate change) on soil pollution. The method used for this paper is a qualitative approach with a descriptive explanation. Climate change has an effect on temperature, rainfall, and sea level. The earth's temperature will increase, and there will be extreme rain and extreme weather, while the impact on sea water will increase sea level. This condition can cause flooding, flooding will erode the soil surface resulting in a decrease in soil quality. Pollution due to waste will cause soil pollution and have an impact on rising temperatures.
Keywords: agriculture; climate change; rain; soil pollution; temperature

1. Introduction

Nowadays, soil pollution is an environmental problem that is of concern to everyone. It is also one of the biggest factors causing environmental damage. Soil is an essential resource and material for prosperity and social development, and acts as a reservoir of nutrients for the survival of animals and plants. The main contributing factors include the increased use of non-renewable energy resources since the industrial revolution in the eighteenth century and the expanded agricultural activities associated with the growing human population. As of late, the disturbing effect of environmental change on expanding soil saltiness has drawn in broad exploration consideration. The increment in how much ozone depleting substances (GHG) in the environment and the ensuing expansion in air temperature and lessening in relative mugginess along with outrageous occasions of precipitation are marks of conceivable environmental change that significantly affects the pace of improvement of soil saltiness.

IPCC states that environmental change alludes to the normal variety of a spot's climatic conditions or to its genuinely critical fluctuation throughout a significant stretch of time (typically many years or more) (Parry, 2007). Moreover, it is likewise explained that environmental change can happen because of inner regular cycles or outside powers, or human exercises that constantly change the creation of the climate and land use.

Climate change is probably going to be one of the primary impediments to feasible farming and worldwide food security. Climate change is probably going to be one of the

primary deterrents to supportable agribusiness and worldwide food security (Mukhopadhyay *et al*., 2021). In the future, agricultural development will be faced with several serious problems, namely: 1) decreased productivity and production sloping which of course requires technological innovation to overcome them, 2) degradation of land and water resources resulting in soil sickness, decreased fertility levels, and pollution, 3) climate variability and changes that cause floods and droughts, and 4) conversion and fragmentation of agricultural land. Increased air temperature, extreme rainfall, drought, flooding, changes in soil fertility, and pest attacks coupled with an increase in areas exposed to galam (high salinity) will affect the agricultural sector which will ultimately affect agricultural productivity.

The size of the effect of environmental change on farming is highly dependent on the degree and pace of environmental change from one viewpoint and the nature and flexibility of agricultural resources and production systems on the other. For this reason, various studies and studies on environmental change and its effect on the agrarian area are needed, in terms of resources, infrastructure, as well as farming/agribusiness systems and national food security.

Environmental pressures on soil microbial communities from heavy metal contamination from human activities, such as electroplating, smelting, and mining, have been studied for a long time. Therefore, it is necessary to conduct a comprehensive and integrated assessment of the effects of environmental change, just as anticipatory strategies and adaptation technologies. The purpose of writing this paper is to understand and find out whether climate change has an impact on the soil, what kind of human activities have an effect on climate change, the effect of soil pollution, the impact of climate change on soil degradation, and adaptation mitigation strategies that can be carried out.

2. Methods

The technique method applied in the arrangement of this paper is qualitative. This method is an exploratory approach to understand the central phenomenon being studied (Raco, 2018). Sources of data obtained from various scientific articles obtained from Google Scholar. The reason for searching for articles on Google Scholar is that the number of articles displayed in this application's search engine is very large, making it easier for authors to choose articles that are relevant to the topics discussed in this paper. The scientific articles that have been selected are then analyzed and explained descriptively. Thematic analysis is one method for breaking down information determined to recognize designs or to find subjects through information that has been gathered by researchers (Creswell, 2009). This method is an exceptionally compelling strategy assuming a review to discuss in detail the qualitative data they have in order to find linkages between patterns in a phenomenon and explain the extent to which a phenomenon occurs through the eyes of the researcher (Fereday & Muir-Cochrane, 2006). Indeed, even this topical investigation is the premise or establishment for examining the interests of qualitative research. There are a few strategies that can be utilized in subjective exploration, and topical examination is vital to learn in light of the fact that it is considered as center abilities or fundamental information to direct investigation in subjective exploration. Even further, it can be said that the identification of themes that characterize thematic analysis is one of the generic skills for most qualitative analysis methods (Heriyanto, 2018). The reason for using this method is to measure the facts objectively and based on the case at hand (Somantri, 2005). This study emphasizes descriptive explanations that take the results of previous studies related to the objectives of this study. This method is very appropriate to use to explain the impact of the COVID-19 pandemic on family resilience.

3. Results and Discussion

Based on UU No. 31 Tahun 2009, climate change is an adjustment of environment that is caused, straightforwardly or by implication, by human exercises that cause changes in the creation of the worldwide air just as changes in normal climate change ability saw throughout equivalent time spans. The meaning of climate change is an adjustment of the

states of being of the world's climate, including temperature and appropriation of precipitation which generally affects different areas of human existence (Kementrian Lingkungan Hidup, 2018). Climate change as the normal change in at least one climate components in a specific region (Lembaga Penerbangan dan Antariksa Nasional, 2013). While the term world-scale climate change is climate change that concerns the entire world region

Climate change is a significant test for humankind as it comes down on the climate and influences the accessibility of water, land and other regular assets just as rural usefulness (Ikhuoso *et al.,* 2021). From the effect of environmental change on human exercises, its effect on agribusiness will be pulverizing for touching and agro pastoral creation frameworks in non-industrial nations. Climate change (especially temperature) changes many soil processes, has consequences for entire ecosystems (Bytnerowics *et al*., 2007). Higher temperatures, and changes in precipitation examples will speed up enduring. Climate change worsens the issue of fermentation by expanding the creation of HNO_3 and ammonium sulfate.

Climate change and its consequences for general wellbeing connected with openness to natural foreign substances and microbes examined in the past correspondence (Biswas *et al.,* 2018). Climate change furthermore its effect on general wellbeing connected with openness to natural pollutants and microbes were examined in the past correspondence. Extreme temperature changes can affect soil degradation (Utami, 2019).

3.1. Climate change

Climate change can be expressed as changes in the states of being of the world's climate including temperature and appropriation of precipitation which affect different areas of human existence (Utami, 2019). These changes occur in an increase in temperature, rainfall, an increase in temperature and sea level, and an increase in extreme climate and weather events (Surmaini *et al.,* 2015). Floods have brought about the deficiency of soil and supplements from the soil, bringing about low usefulness for the following not many years, except if and until restorative and proactive remediation procedures are not executed. Rising sea levels or heavy rainfall can result in a decrease in agricultural land in coastal areas (Arora, 2019). This also results in soil salinity in coastal areas which causes stress on plants such as decreased respiration, photosynthesis and transpiration, which in turn jeopardizes food availability and security in the area.

Climate change could could speed up the pace of advancement of soil salinity worldwide and especially in arid and semi-arid areas (Mukhopadhyay *et al.,* 2021). Climate change as a result of climate change has caused several impacts, such as: (a) air temperature throughout Indonesia increased sharply in the tropics; b) Less downpour in the south of Indonesia and less in the north (Julismin, 2013).

3.2. Impact of climate change on soil condition

Climate change has an impact on soil conditions. In the long term, climate change can cause soil erosion and land use also contributes to this erosion (Borrelli *et al.,* 2020). The use of land for agriculture is one of the sectors that greatly affects changes in soil conditions. This is because the mineral content of the soil will be used by plants to meet mineral needs so that they can grow and produce.

Agriculture has a negative impact on soil conditions if agricultural system mitigation is not carried out. The challenges in agricultural management that are faced today are increasing production, reducing greenhouse gas emissions, and efforts to adapt to climate change (Masturi *et al.,* 2021). Changes looked by the agricultural sector due to climate change are a decrease in water stocks and a decrease in harvest quality to crop failure (Hidayati & Suryanto, 2015).

Soil arrangement is constrained by many variables including climatic factors like temperature and precipitation. These climatic boundaries influence soil development straight by giving biomass and conditions to enduring. The primary environment boundaries that straightforwardly influence soil development are how much dynamic

temperature and the precipitation-vanishing proportion. They decide the worth of energy utilization for soil development and water balance in the dirt, components of natural mineral associations, change of natural and mineral substances, and the progression of soil arrangements. Stable moderate environment warming causes irreversible changes in the mineral framework of the dirt. Climate changes in outside variables of soil development (temperature and precipitation) will cause the change of inner elements (energy, hydrology, science). Climate change will build the energy of annihilating soil minerals which brings about the rearrangements of the mineral lattice because of the collection of minerals that are lenient to enduring. This will prompt a deficiency of soil function for richness upkeep and a more noteworthy reliance on mineral composts (Pareek, 2017). Excessive use of fertilizers will pollute the soil and cause soil degradation (Delang, 2017). The outcomes show that a 5 to 100 percent decrease in compound manures diminishes the ecological effect of corn creation as far as water fermentation by 4.38 to 87.58% (Abbas *et al.,* 2021).

Climate change is projected to altogether affect farming through immediate and aberrant impacts on crops, soil, animals and bugs. Notwithstanding the way that climate change is a languid cycle remembering fairly little changes for temperature and precipitation all through a broad time frame, this lethargic climate change influences different soil processes, particularly those connected with soil ripeness. The effect of climate change on soil is evaluated generally through changes in soil soddenness conditions and extensions in soil temperature and CO2 levels in light of climate change. Overall climate change is projected to effectsly influence soil cycles and properties that are critical for restoring soil extravagance and effectiveness. The primary impacts of climate change are believed to be through expanding CO_2 and expanding temperatures (Pareek, 2017). Climate change is exacerbating the problem of acidification by increasing the production of HNO_3 and ammonium sulfate (Bythnerowicz *et al.*, 2007).

Climate change causes changes at the beginning of the rainy season. In southern Indonesia, the short rainy season makes it hard to expand usefulness crop record assuming that there is no short existence without changing the water system organization. Increased rainfall in the rainy season causes frequent flooding, while lack of rain in the dry season increases the danger of dry season. On the other hand, rising water levels in northern Indonesia increase opportunities for agriculture, but soil conditions are not as good as in Java. It is undeniable that this practice is closely related to agriculture.

One of the efforts that can assist with lessening the effect of climate change is to plant trees because this can improve environmental conditions and enrich the soil through the input of organic matter which also increases soil organic carbon (Rana *et al.,* 2020). Human activities produce a lot of waste and can cause environmental damage. Pollution due to this waste turns out to have an impact on rising temperatures. Soil contamination is said to raise the temperature by 0,055 ^{0}C in the region of Indonesia (Azzahra & Faradiba, 2021). Climate change is communicated to cause the course of soil contaminations achieved by changes in precipitation which changes in precipitation which incorporate surface runoff, rainfall, evaporation, and degradation (Biswas *et al.,* 2018).

The increase in population, urban development and development, industrial growth, traffic density, deforestation, and so on are also the causes of climate change problems. This makes the temperature and humidity change which causes the upper atmosphere layer to be polluted by dust particles or fumes from motor vehicles and domestic combustion. These particles will increase in concentration in the dry season and decrease in the rainy season.

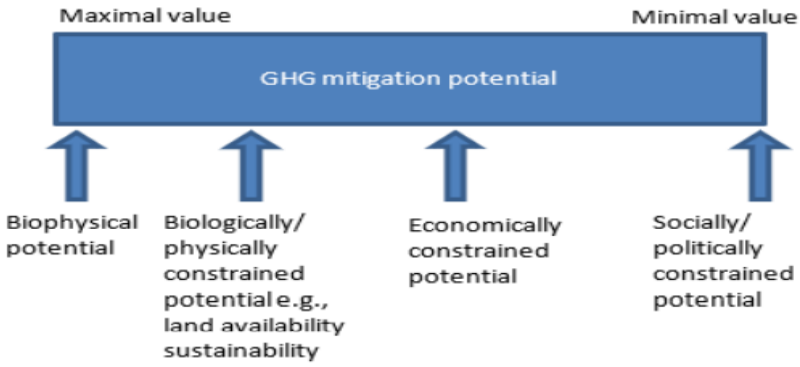

Figure 1. Impact of Various Limitation on Capacity Reduction GHG Mitigation

Many efforts were made to achieve agricultural goals, such as land management, which shows opportunities which is very significant for the reduction of pollution (up to 15% greenhouse gasses reduction) with combination with a carbon price that does not friendly. This delineates that the danger and reception boundaries can't be set up in this economic study. The danger that unnecessary will be connected with 30% for soil protection

3.3. Impact of climate change on soil degradation

Climate change affects the debasement of soil, water, and plant development and creation. Soil degradation can be triggered by different variables that decline the physical, compound, and organic cycles of the soil. The weakening of the actual properties of the soil is brought about by erosion, compaction, and fracture. The decrease in soil substance properties was because of supplement draining, fermentation, and salinization, while the decrease in soil natural properties was because of diminished soil natural matter and soil biodiversity.

a. *Erosion Acceleration and Surface Flow*
Soil disintegration is the vehicle of soil materials brought about by the development of water and wind. Disintegration can prompt a decrease in usefulness and soil conveying limit with regards to farming creation and the climate, in light of the fact that in the process the vehicle of dirt which is wealthy in supplements happens. Disintegration is a not kidding issue since it not just corrupts the physical and substance nature of the soil, yet in addition lessens water quality. Disintegration occasions can bring about loss of supplements required by plants to develop and grow ideally. The event of disintegration that is progressively incessant can lessen levels of natural matter and supplements in the soil.

b. *Soil Organic Carbon Dynamics*
In the erosion process, there is a translocation process of deposited soil organic carbon and then to water bodies. Others are deposited and distributed to other places, and some are transmitted into the air. Decrease of soil natural carbon can bring about a lessening in soil quality, diminish microbial action, affect pore water accessible for plants and furthermore on plant usefulness.

c. *Decreasing Soil Organism Biodiversity*
The interaction of various microorganisms, microflora, and soil fauna assumes a part in the physical, substance, and organic cycles of the dirt to help soil richness. Deterioration of natural matter, as well as giving supplements, expects a section in the deterioration cycle, further develops soil air flow, mixes supplements from the top layer to the base layer just as the opposite way around, loosens the soil, changes over plant stays into humus, and accepts a section in soil aggregation between soil

regular matter and mineral matter. Soil creatures require specific temperature conditions for their exercises and outrageous dry, wet limits and expanded soil temperature will influence the variety of soil organic entities (Yustika & Agus, 2014).

d. *Drought*

The longer dry season due to changes in rain patterns can disrupt the planting season. The phases of plant development that require water can be disrupted which results in disruption of plant metabolism and ultimately decreased plant productivity. Several analytical methods can provide information about the drought that can hit an area. BMKG has issued a map of the Water Availability Level for Plants in November 2021 (Figure 2). From Figure 2, it can be seen that most areas of Java Island are experiencing drought, as indicated by the level of water availability for plants that reach the deficit or shortage class.

Figure 2. Level of water availability for plants November 2021

3.4. Adaptation and mitigation strategies

Adaptation and mitigation techniques farming can adjust to environmental change by taking on horticulture the board rehearses that limit the unfriendly impacts of progress or a decline in precipitation and temperature or other outrageous climate condition. Numerous administration level transformation choices accessible to diminish the impacts of environmental change on crop creation, including without culturing, hold crop buildups, grow decrepit land, increment creation variety, changing outside amounts and times inputs (compost, water), and more extensive agronomic administration methodologies (eg changing establishing thickness, separating, establishing time; presenting new germplasm that is impervious to hotness or dry season pressure). Horticulture can add to environmental change moderation through rural administration rehearses that diminish ozone harming substance emanations (carbon dioxide, nitrous oxide, methane) and increment soil carbon ingestion. Carbon dioxide emanations can be decreased through diminished biomass consuming and more productive utilization of energy. Discharge methane can be diminished through better homestead the board rehearses that incorporate further developed domesticated animals squander the executives and water in the fields. Nitrous oxide emanations can be decreased through progress in the administration of N manure, including the fitting kind, portion and soil application and the executives techniques (keeping away from soil pressure).

Horticultural administration practices can build soil carbon stocks and advance soil useful solidness. Conservation cultivating advancement (least soil disturbance, cover reaps and yields turn including vegetables), soil security measures (for instance structure cultivating) and supplement restoration systems can restore soil organics material by giving protective ground cover and the environment accommodating for blazing plant improvement. In any case, at times, changes in agrarian creation structures may be required

for example constant oat advancement was superseded by ley developing or by the introduction of the agroforestry system. Worldwide soil carbon sources surpass biomass pool by a variable of four or five, without considering that new soil debasement has prompted the deficiency of somewhere in the range of 30% and 75% of the past soil natural carbon. Universally, consequently, expanding soil carbon offers extraordinary moderation potential. Carbon sequestration alludes to the capacity of carbon in a steady strong structure. He happens through immediate and circuitous obsession of air CO_2.

Direct soil carbon sequestration occurs by inorganic engineered reactions that convert CO_2 into soil inorganic carbon blends, for instance, calcium and magnesium carbonate. Plant carbon sequestration happens rapidly when plants photosynthesize in CO_2 air into plant biomass. Moreover, a portion of this plant biomass is in a roundabout way sequestered as soil natural carbon (SOC) during the disintegration interaction. That how much carbon sequestered at a site mirrors the drawn out balance between carbon sequestration and delivery instruments. Numerous agronomists, ranger service, and preservation works on, including best administration work on, prompting advantageous net additions in carbon obsession in soils.

4. Conclusions

The problem encountered in this study is that the threat to human life due to climate change is very worrying. The use of land for human economic activities such as agriculture has an effect on soil conditions. Waste generated from human activities will affect soil quality and adversely affect harvest quality. Climate change includes changes in temperature, rainfall, and sea level rise. Therefore, it is necessary to recommend soil and water conservation technology that is adaptive to climate change so that the agricultural sector can be sustainable. Soil conservation technique is the use of land in accordance with its capabilities and in accordance with the necessary conditions so that soil degradation does not occur. In areas that experience extreme rainfall, soil conservation techniques function to protect the soil from erosion and surface runoff that transport soil particles and nutrients from the topsoil, while in areas with less rainfall (dry season it is more length), the application of soil conservation technology can maintain soil moisture/ground water content. Policies also need to be considered considering regional-specific conditions, and need to include the agricultural sector as part of good land use governance and rural development, which is linked to bioenergy development.

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