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Impact Of Agricultural Development On Soil Degradation

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ABSTRACT

When soil loses some or all of its ability to support plant life, we say that it has degraded. Soil degradation refers to the rate at which land becomes less productive as a result of natural processes that are mostly impacted by human activities. Even though soil is vital for plants' nutritional base, hydroponics has shown that it is not required for agriculture. If soil nutrients couldn't be dissolved in water, plants wouldn't need them to grow. Sangli District is one of the developed districts in Maharashtra State, and its soils include a wide variety of granitic types. This means that agriculture in the region has flourished in recent years. Because of the abundance of black soil in this research region, crop yields are very high. Some tahsils in the Sangli district, such as Jat, Atpadi, Khanapur, and Kavathemhankal, have been left behind as land degradation has worsened over the last two decades.

KEYWORDS: Soil degradation, Development, Agriculture, Soil

INTRODUCTION

Detrimental changes in nutritional status, soil organic matter, structural characteristics, and concentrations of electrolytes and toxic compounds all contribute to soil degradation, which in turn reduces soil production. Degradation of soil occurs when its productive potential declines, either immediately or over time. It is also the pace at which soil quality deteriorates, causing land to become less productive owing to processes mostly influenced by human activity. This means that soil productivity is decreasing, vegetation cover is deteriorating, water resources are becoming less abundant and of worse quality, soils are being degraded, and air pollution is increasing. Degradation is a transitional stage in evolution that decreases the potential of available resources. Every year, climate change and deforestation cause around 7.40 million hectares of once-fertile land to become unusable. Since the beginning of agricultural practices, soil deterioration has been an issue. With India's population expanding at 1.8% every year, more and more of the country's fringes have had to be cultivated in order to keep up with rising food demands. These already poor quality and somewhat unproductive soils are more susceptible to deterioration. This document presents a concise overview of soil degradation in India, including its types, causes, key risks, and treatment strategies.

The many types of wastelands in India, as well as their nature and size, were mapped out by the National Remote Sensing Centre (NRSC). The National Commission on Agriculture

estimated that 148 M hectares were impacted by land degradation first, followed by 175 M ha according to the Ministry of Agriculture's Soil and Water Conservation Division. The NBSS & LUP originally predicted an area of 187 M ha as degraded lands in 1994, however this number was later reduced to 147 M ha. According to the National Wasteland Development Board, 123 million hectares are classified as wastelands. Estimates are all over the place since they were not made using a uniform set of criteria and procedures. Recently, the Indian Council of Agricultural Research (ICAR) and the National Academy of Agricultural Research reconciled the soil degradation data in cooperation data created by the institution and compiled it into a 1:250000 scale map of India's soil resources.

LITERATURE REVIEW

Hemant Kumar (2013) In the tropics particularly, soil erosion poses a threat to the long-term viability of agricultural production. A dynamic process, soil productivity declines when erosion rates outpace the formation of new topsoil, resulting in poor agricultural output and revenue. Achieving long-term sustainability in any production system requires striking a balance between soil-forming and soil-depleting activities. In the semiarid Lower Chambal Valley, soil erosion is a major cause of land degradation. Landsat satellite pictures from 1977, 1990, and 2000 were used in this research to determine the progression of degraded land in the area. Arable land seems to be being invaded at a pace that is comparable to the expansion of degraded land, according to available data. Field survey data shows that the proportion of degraded land to total planted area is inversely linked to crop yields. Villages with smaller proportions of degraded land have higher agricultural production, as assessed by gross value of output per area. A simple linear regression model can account for the significant fluctuation in crop yields caused by a substantial proportion of degraded land (more than 50 percent of total planted area). This research presents evidence of the seriousness of land degradation and its tight connection to regional agricultural output.

Tesfaye Samuel Saguye (2017) In many places of the globe, land degradation is becoming worse and worse. Successfully reversing land degradation requires a deeper familiarity of its origins, dynamics, and measurable outcomes. Different scientific approaches have been used to evaluate land degradation across the world. While scientists and policymakers have learned a lot about the origins, processes, indicators, and impacts of land degradation, they have used local community knowledge very rarely. Although land degradation occurs on a physical level, it has deep roots in the social, economic, political, and cultural contexts in which land users function. Sustainable land management methods may be designed and promoted with the use of data gleaned through an analysis of the causes and consequences of land degradation from the viewpoint of local community knowledge, perception, and adaptation techniques. The area of southern Ethiopia where this research was done is known as Geze Gofa. The study's primary goal was to examine the possibility of land degradation through the lens of indigenous wisdom. The homes in the study's sample were chosen using a multi-stage sampling technique. A total of 156 homes served as the study's sample. Data was gathered primarily via semi-structured interviews, in-depth interviews with key informants, focus groups, and field observations. Both a qualitative (thematic) and quantitative (descriptive statistics and logistic regression) method were used to analyze the data for this research. Communities in

the study area identified the following indicators of land degradation: sheet, rill, and gully erosions; soil accumulation around clumps of vegetation; soil deposits on gentle slopes; exposed roots; muddy water; sedimentation in streams and rivers; sandy layers; a shift in plant species; a decrease in organic matter; an increase in runoff; a decrease in soil water; a shallower rooting depth; and a decrease in soil water. Land degradation in the study area was attributed to a number of human-caused factors, including but not limited to: continuous cropping, overgrazing, deforestation, steep slope cultivation, extreme weather events (flood and drought), and improper fertilizer use, as perceived by the local community. The study area's land degradation is rooted in the region's severe land scarcity, extreme poverty, and dense population. The study found that due to land degradation, crop yields dropped, responses to inputs became less effective, productivity on irrigated land decreased, irrigation water was lost, food supplies became less stable, and the need for labor increased. Institutional, demographic, and weakly biophysical variables impacted whether or not farmers would see the consequences of land degradation as moderate or severe on agricultural land production.

Nisha (2018) Land is where agriculture, a significant phenomenon, takes place. The addition of different fertilizers, herbicides, and insecticides to land was prioritized in order to boost food production. The green revolution is partly to blame for the state's worsening environmental crisis. In order to do so, the researcher collected data on the causes of soil degradation and water pollution; the effects of these problems on the environment and people; the relationship between agricultural development and the depletion of land, soil, and water resources; and the causes of soil degradation and water contamination. The purpose of this study is to analyze the effects of Haryana's current cropping pattern on the state's agricultural output, soil fertility, water resources, and residents' health and well-being. Primary sources have been used for the analysis. Data was collected from respondents through a survey, making them the primary source. The results show that most people in the three studied areas do not understand the risks posed by chemical fertilizers and pesticides. Agriculture faces issues of land, water, and soil degradation because farmers utilize excessive amounts of pesticides to boost output at the expense of soil and water health. A second green revolution, one that is both sustainable and inclusive, is required to keep up productivity and environmental standards.

Colin G. Scanes (2018) Each kind of animal has an impact on the natural world. Water, air, and soil are all significantly impacted by the cattle and poultry industry. Particularly with large-scale livestock operations, manure and other forms of animal waste are a major cause for alarm. As of this writing, animals and poultry in the United States create 120 million metric tons of dry manure. Some studies estimate that 27% of all human water use goes toward livestock production (this includes water needed to cultivate feed grains). Livestock and poultry may have a negative impact on water quality if not properly managed. Phosphate and nitrate, infections (viruses, bacteria, and protozoa), antibiotics, and androgenic chemicals are only some of the contaminants that make their way into water supplies from livestock and poultry establishments. Waterway and estuary nitrate and phosphate pollution causes algal blooms, eutrophication, and hypoxic zones. Pigs and chickens are raised with the use of antibiotics, while cattle are boosted with growth hormones. Methane emissions from

ruminants account for a significant portion of agriculture's 11% share in global greenhouse gas emissions. Carbon dioxide, ammonia, total reduced sulfur including hydrogen sulfide, and water vapor coupled with smells are all gases that might be an issue when released by animals and poultry. The latter may be irritating to farm neighbors and may even have health consequences. Furthermore, infections may spread from animal facilities to people via the air. Soil erosion, salinization (from freshwater removal), soil loss (from deforestation or overgrazing), "compaction and crusting (of soils) can be caused by cattle trampling," and waterlogging with water-impaired movement are all caused or exacerbated by livestock. Overgrazing of rangeland (679 million ha worldwide) and deforestation (579 million ha worldwide) are the two main causes of soil degradation that are directly or indirectly connected to livestock.

Maria Christina Jolejole-Foreman (2012) The value of Ethiopia's agricultural output is estimated in relation to the impact of land degradation. Although it is generally accepted that degraded land has a negative impact on agricultural productivity, few studies have clearly quantified the value of produce lost due to land degradation. Ethiopia has one of the highest rates of soil erosion in Africa, making it especially susceptible to the consequences of land degradation. This research uses a spatially coded plot-level farmer survey (n=6,301) and a high-resolution environmental map to evaluate farms' features, output, and an indicator of land degradation that encompasses soil, water, and ecological quality. Unlike most prior work, this study specifically accounts for the possibility of endogeneity in land degradation by considering bequest and cooking energy as instrumental variables in agricultural production decisions. By taking into consideration the geographical context of the land degradation process, we are able to get more accurate estimations. We find that land degradation lowers agricultural value by 7% after accounting for endogeneity and farmer adaptability. This number is far lower than what is estimated without taking endogeneity into consideration. Finally, a vulnerability map was created using the estimated values from the regression. This report helps policymakers in Ethiopia prioritize soil conservation initiatives by identifying the areas or sectors most at risk of losing agricultural value due to land degradation.

IMPORTANCE OF SOIL:-

Hydroponics has shown that soil is not necessary for agriculture, despite the fact that it provides the major nutritional foundation for plants. The nutrients in the soil wouldn't be necessary for plant development if they couldn't be dissolved in water. Plant species and their cultivation are inextricably linked to soil composition and moisture levels. In addition to being an essential part of these businesses, mining, building, and landscape design all rely heavily on soil material. Even most building projects rely on it heavily. Surface mining is essential for the construction of roads, buildings, and dams since it requires the moving of large quantities of dirt. Earth sheltering is a method of architecture that involves the use of dirt as an outside thermal mass against building walls. Bricks and other construction materials are also derived from the earth.

Many soil resources are essential to environmental health, food security, and textile manufacturing. Plants rely heavily on the nutrients and water that may be found in soil. Soil acts as a purifier, cleaning and percolating water, and plays a crucial function in absorbing

precipitation for later release, so reducing the likelihood of floods and drought. Numerous species call this place their primary habitat. Varied Soil invertebrates (such as earthworms, woodlice, millipedes, centipedes, and even springtails, nematodes, and Protests) play an important role in maintaining biodiversity. Most of the bacteria, archaea, fungus, and algae found in the upper atmosphere are really plant components. All of these creatures have underground stages of their life cycles. Soil is of fundamental significance to any restoration or conservation strategy because it serves as a conduit for both above- and below-ground bio-diversities. About 57% of the soil's biotic content is carbon, and this is only one of several vital biological components. Even on arid crusts, cyan bacteria, lichens, and mosses collect and store a large quantity of carbon via photosynthesis. It's also tried with sloppy approaches to farming and grazing. Some of the greenhouse gases that cause global warming may be neutralized if efforts to increase agricultural yields and decrease water demands for soil restoration were successful.

SOIL TEXTURE: -

Sand, sandy loam, sandy clay loam, sandy clay, clay and clay loam, loam silty, silty, clay, loam, etc. make up the bulk of the Sangli District, which is one of the developed districts in Maharashtra State. Information is provided in the table that follows.

Table 1 Sangli District Soil Texture

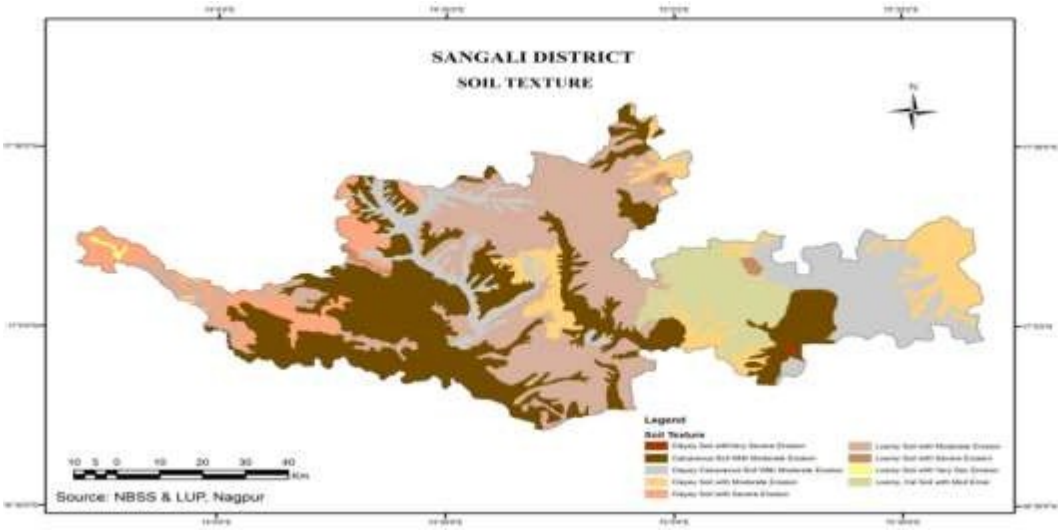
Sr. No.	DESCRIPTION	SAND	SILT	CLAY
1	Sandy	35-100	00-15	--
2	Sandy Loam	43-88	00-50	00-20
3	Sandy Clay Loam	45-80	00-28	20-35
4	Sandy Clay	44-55	00-20	35-45
5	Clay	00-45	00-40	40-100
6	Clay Loam	20-45	15-83	27-40
7	Loam	23-52	28-50	07—27
8	Silty Loam	00-50	50-88	00—27
9	Silty Clay Loam	00-20	40-73	27-40
10	Silty Clay	00-20	40-60	40-60

PARENT MATERIAL: -

Environment, Terrain, and Lifeforms Time The term "parent material" is used to describe the mineral stuff from which soil develops. All plant nutrients outside nitrogen-hydrogen and carbon originate in rock, whether igneous, sedimentary, or metamorphic, and rock is the primary source of all soil mineral elements.

Weathering of parent material: -

Physical weathering (disintegration) occurs when the parent material is exposed to the elements; minerals formed at great depths with the earth's under the highest temperature and pressures are less resistant to weathering than those formed at the surface under low temperature and pressure conditions.



Map 1

IMPACT OF AGRICULTURE DEVELOPMENT ON SOIL DEGRADATION

The term "degradation of land" is used to describe any process, whether natural or anthropogenic, that reduces the usefulness of the land. Acidification, pollution, desertification, erosion, and salinization are all forms of soil deterioration. In the case of alkaline soil, a moderate amount of acidification is advantageous, but an excessive amount reduces agricultural yields and makes the soil more susceptible to contamination and erosion. Because their original materials were acidic and deficient in the abdications (calcium, magnesium, potassium, and sodium), many soils had an acidic pH at first. These elements are leached from the soil profile by the processes of harvesting forests or agricultural crops, or simply by rainfall, leading to acidity. Acid precipitation hastens the process of soil acidification brought on by the application of acid-forming nitrogenous fertilizers.

Soil acidification is helpful for alkaline soils, but also has unintended consequences, including the degradation of land due to decreased agricultural yields and increased susceptibility to contamination and erosion. These components are leached from the soil profile, and the resulting acidity, by precipitation or the cutting down of trees or harvesting of crops. Soil contamination at low levels often falls within a soil's ability to absorb and assimilate waste material. The soil is harmed by industrial pollution and other forms of urbanization. Exceeding treatment capacity may degrade soil biotic and restrict soil function, which is why we see derelict soils when they reach a certain level. The biotic processes in soil may be used to remediate garbage. When soil particles have formed, they are more able to take in trash. Even garbage treatment processes rely on the ability of soil to treat waste. Soil remediation employs geological, physical, chemical, and biological principles to reduce degradation and attenuation, and may even include isolating and eliminating soil pollutants. Leaching, air sparging, and

chemical additives are all methods that may be used for this goal. Soil values at resorts are increased via phytoremediation, and even bioremediation and natural deterioration.

Soil eroding for the most part due to water, wind, ice, and movement due to gravity. Erosion may take place in a variety of forms at once. Soil erosion occurs naturally and is exacerbated by human activity, particularly bad land use practices in many areas. Weathering is another cause of soil erosion, in which degraded soil is moved away from its site of origin and characterized as sediment. Overgrazing, tree cutting, and shoddy building practices all result in exposed soil, which is especially vulnerable to flooding and erosion during storms. Reduced erosion is possible with better management strategies. Soil conservation methods include changes to land use (such as replacing erosion-prone crops with soil-binding plants) and to the timing and nature of agricultural activities (such as building terraces). Even when constructing terraces, it is desirable to employ erosion-suppressing cover materials, such as crop and plant covers, and to minimize disruption during construction and avoidance of work during seasons when erosion is most likely to occur.

Soil salination occurs when free salts accumulate in the soil, diminishing its fertility and destroying the plants that grow there. Consequences of soil salination include corrosion damage, reduced plant development, erosion owing to lack of plant cover, and even changed soil structures, as well as lower water quality due to sedimentation near water supplies. occurs as a result of both natural and anthropogenic factors. The buildup of salt is enhanced in dry environments. The presence of salt in the soil's parent material seems to be the cause. The water table may be raised by irrigation, particularly if canals leak or if fields are over-irrigated. Soil salinity management, which includes water table control and flushing with greater amounts of applied water in conjunction with tile drainage or other forms of subsurface drainage, is necessary because the capillary fringe of salty groundwater causes the land surface to become salty very quickly. Table 2: Location and coverage of impacted land in India due to salt intrusion.

Table 2 Salt Affected Soil in India (Area *1000 Hect.)

Sr. No.	State	Water Logged		Salt-affected area			Total
		Canal Command	Total	Canal Command	Outside Canal Command	Coastal	
1	Andhra Pradesh	266	399	139	391	283	813
2	Bihar	363	363	224	176	NA	400
3	Gujarat	173	484	540	327	302	1214
4	Haryana	230	275	455	NA	NA	455
5	Karnataka	36	36	51	267	86	404
6	Kerala	12	12	NA	NA	26	26
7	Madhya Pradesh	57	57	220	22	NA	242
8	**Maharashtra & Goa**	**6**	**111**	**446**	**NA**	**88**	**534**
9	Orissa	196	196	NA	NA	400	400
10	Punjab	199	199	393	127	NA	519
11	Rajasthan	180	348	138	984	NA	1122
12	Tamil Nadu	18	128	257	NA	84	340
13	Uttar Pradesh	455	1980	606	689	Nil	1295
14	West Bengal	NA	NA	NA	NA	800	800

AGRICULTURAL ACTIVITIES LEADING TO SOIL DEGRADATION IN SANGLI DISTRICT: -

Excessive use of Water:-

While the western section of the Sangli District is well developed and well irrigated and has excellent soil fertility, the northern and eastern parts of the district—specifically the walwa, Miraj, Palus, and Shirala—are particularly vulnerable to drought. Some crops are concentrated in Tahsil; sugarcane is the principal crop in these tahsils; impacts of soil degradation in that tahsil; developed tahsil; greatest usage of water for agricultural purposes. Waste of precious agricultural water.

High and Imbalanced Fertilization: -

In comparison to walwa, miraj, palus, shirala, kadegaon, and tasgaon, these tahsils are very advanced. For this reason, the farmers in Tahsil use a lot of fertilizer, which has a negative effect on the land and contributes to soil deterioration.

Excessive Tillage and Use of Heavy Machinery: -

There are 10 tahsil in the Sangli district, and the western part of the district has the highest tractor and machinery use. However, in other parts of the district, both modern and traditional farming methods can be found, each of which has an effect on the district's soil fertility and crop yields.

Crop Residue Burning and Inadequate Organic Matter Inputs: -

This practice makes advantage of agricultural waste burning and an absence of organic stuff. All of the soils in the district have been deteriorated owing to poor productivity, low soil fertility, and the usage of agricultural waste burn-in in the tahsil Jat, Kavathemhankal, Khanapur, and Atpadi.

Poor Crop Rotations: -

Some Tahsil, including Walwa, Tasgaon, Miraj, Palus, kadegaon, and Shirala, do not practice regular crop rotation, resulting in negative effects on the soil's NPK and pH levels when wheat and rice are planted year after year. Soil deterioration has had a significant overall effect in the study area, resulting in the lowest output of any district.

CONCLUSION

Western Maharashtra is home to the developed district of Sangli. The Sangli District has very fertile soil, advanced irrigation infrastructure, and widespread growth. When compared to the other tahsils in the district, Walwa, Miraj, and Palus stand out as particularly developed areas. The agricultural growth of the area has therefore developed during the last several years. Black soil is prevalent in this study area, leading to increased agricultural output. However, land degradation has increased in the Sangli district over the past two decades, leaving some tahsils—including Jat, Atpadi, Khanapur, and Kavathemhankal—behind. These areas are particularly vulnerable to drought, which has a negative effect on agricultural growth.

According to the results of the soil analysis conducted in the Sangli district, the study area may be roughly split into two categories: irrigated and non-irrigated.

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