Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 6, No.4, June : 2024

IMPACT OF THE INDUSTRIALIZATION, AGRICULTURAL AND URBANIZATION OF SOIL TEXTURE OF THE SURROUNDING BILASPUR DISTRICT

Mrs. Usha Jaiswal PhD Research Scholar, Department of Chemistry, Govt. Bilasa P.G. Girls College, Bilaspur, C.G: : ranuushajaiswal@gmail.com
Dr. Ambuj Pandey Assistant Professor Department of Chemistry, Govt. Bilasa P.G. Girls College, Bilaspur, C.G.

Abstract: This case study examines the influence of industrialization, agricultural practices, and urban development on soil texture and the surrounding areas in Bilaspur. In recent decades, the region has undergone substantial changes in land use patterns, leading to modifications in soil qualities that have ramifications for both the environment and the socio-economic aspects. Industrialization introduces contaminants and heavy metals into the soil, hence modifying its physical and chemical properties. Intensive agricultural methods, such as the use of chemical fertilizers and pesticides, have caused a decline in soil quality and disturbed the natural composition of soil. Urbanization causes soil compaction, which reduces infiltration rates and increases runoff, so affecting soil texture. The study utilizes a blend of on-site data collection, scientific examination in a controlled environment, and analysis of data obtained from remote sensing to evaluate these alterations. Soil samples were gathered from industrial, agricultural, and urban settings. The study emphasizes the necessity of using sustainable land management strategies in order to prevent negative impacts and enhance soil health. Suggested measures including incorporating green infrastructure into urban development, embracing organic farming techniques, and consistently monitoring soil quality. In summary, this research highlights the crucial importance of maintaining a balance between development and environmental stewardship in order to guarantee the long-term viability of soil resources in Bilaspur.

Keywords- Industrialization, Agricultural and industrial effects, Challenges, soil parameters, soil characteristics, bioremediation, Agricultural and industrial consequences.

Introduction

The term "environment" refers to the immediate surroundings in which organisms reside. The environment consists of the elements of air, water, and soil. Soil quality refers to the ability of soil to perform its functions successfully both currently and in the future. Karlen defines soil quality as the ability of soil to operate within the limits of natural or controlled ecosystems, sustain the productivity of plants and animals, preserve or improve the quality of water and air, and support human health and habitation. The direct measurement of soil quality is not possible; instead, it must be deduced from various soil quality properties (physical, chemical, and biological) that impact the soil's ability to function optimally. Therefore, the task of finding indicators of soil quality and determining evaluation methods is made more difficult by the numerous physical, chemical, and biological components that interact with and regulate soil activities. It is also subject to fluctuations based on factors such as time, climate, rainfall, as well as plant and human influences. Soil quality refers to the extent to which soil performs the desired functions. An optimal soil is both fertile and possesses a robust soil structure, while also exhibiting a high level of biological activity. The natural environment has been substantially affected by the growth of human society, which has occurred through industrialization, urbanization, and agricultural activities. Soil is a crucial element of the environment that plays a vital role in supporting ecosystems, agricultural output, and human health due to its texture and quality. This introduction examines the diverse effects of industrialization, urbanization, and agricultural practices on soil texture and the surrounding surroundings of Bilaspur, a location that serves as a prime example of these intricate interconnections.

- **Industrialization**

Industrialization has played a crucial role in driving economic growth and development, resulting in substantial changes in land utilization and environmental circumstances. In Bilaspur, like in several other areas, industrial operations lead to soil pollution by discharging contaminants such as heavy metals, chemicals, and industrial waste. Contaminants have the ability to alter the texture of soil by impacting soil aggregation, porosity, and the distribution of soil particles such as sand, silt, and clay. Industrial waste deposition can cause soil compaction and decreased permeability, which can have negative impacts on plant development and water infiltration.

- **Agricultural Practices**

Agriculture continues to be crucial in Bilaspur yet, contemporary agricultural methods have the potential to adversely affect soil texture and overall health. Intensive agricultural practices, such as excessive utilization of chemical fertilizers and pesticides, can result in soil acidification, loss of nutrients, and the eradication of soil microorganisms. In addition, the practice of mono-cropping and excessive irrigation can lead to soil erosion, salinization, and compaction. The alterations in soil characteristics might diminish agricultural output and jeopardize the long-term viability of farming systems.

- **Urbanization**

The swift urbanization in Bilaspur has resulted in significant alterations to land cover, as natural landscapes have been converted into urban environments. This process frequently eliminates the uppermost layer of soil, modifies the original flow of water, and enhances the amount of water that flows over the surface. Urban areas commonly contain impermeable surfaces like roads and buildings, which decrease the ability of water to seep into the soil. This can result in erosion and the deterioration of soil quality. Urban sprawl also intrudes upon agricultural areas and natural habitats, disturbing the ecological equilibrium and resulting in additional soil degradation.

- **Combined Effects**

The synergistic effects of industrialization, urbanization, and agricultural methods give rise to intricate interconnections that profoundly modify soil texture and its immediate surroundings. These activities are responsible for soil deterioration, which negatively impacts its physical, chemical, and biological characteristics. Gaining a comprehensive understanding of these effects is essential for formulating approaches to alleviate soil deterioration and advocate for sustainable land management methods in Bilaspur.

- **Importance of the Study**

This study is crucial for multiple reasons. Firstly, it offers a thorough comprehension of how different human activities impact soil texture, which is crucial for preserving soil health and agricultural output. Furthermore, it emphasizes the necessity of implementing comprehensive land management strategies that take into account the combined impacts of industrial, urban, and agricultural operations. Ultimately, it emphasizes the significance of implementing sustainable methods to safeguard and rejuvenate soil health, hence guaranteeing the enduring sustainability of ecosystems and human sustenance in Bilaspur and comparable areas.

Challenges of the Impact of Industrialization, Agricultural Practices, and Urbanization on Soil Texture

The effects of industrialization, agricultural methods, and urbanization on soil texture provide multiple difficulties that can impair environmental sustainability, agricultural production, and human health. Gaining a comprehensive understanding of these problems is essential in order to design successful ways to reduce negative impacts and encourage sustainable land management.

1. Soil Contamination

- **Industrialization:** Industrial activities frequently result in soil contamination with heavy metals, chemicals, and other pollutants. These pollutants have the potential to disturb the inherent arrangement of soil, modifying its consistency by impacting the distribution of particle sizes and the cohesion of soil particles. Soils that are contaminated can have decreased fertility and can be hazardous to the health of plants and animals.

- **Agricultural Practices:** Excessive utilization of chemical fertilizers, insecticides, and herbicides in agriculture can result in the buildup of noxious compounds in the soil. These compounds have the ability to alter the chemical makeup of the soil, resulting in soil acidification, imbalances in nutrient levels, and the disturbance of vital microbial communities that are necessary for preserving soil structure and fertility.
- **Urbanization:** Urban areas frequently serve as origins of diverse contaminants, such as hydrocarbons, heavy metals, and building waste. These pollutants have the potential to deteriorate the quality of soil, decrease its porosity and permeability, and impair its capacity to sustain plant development.

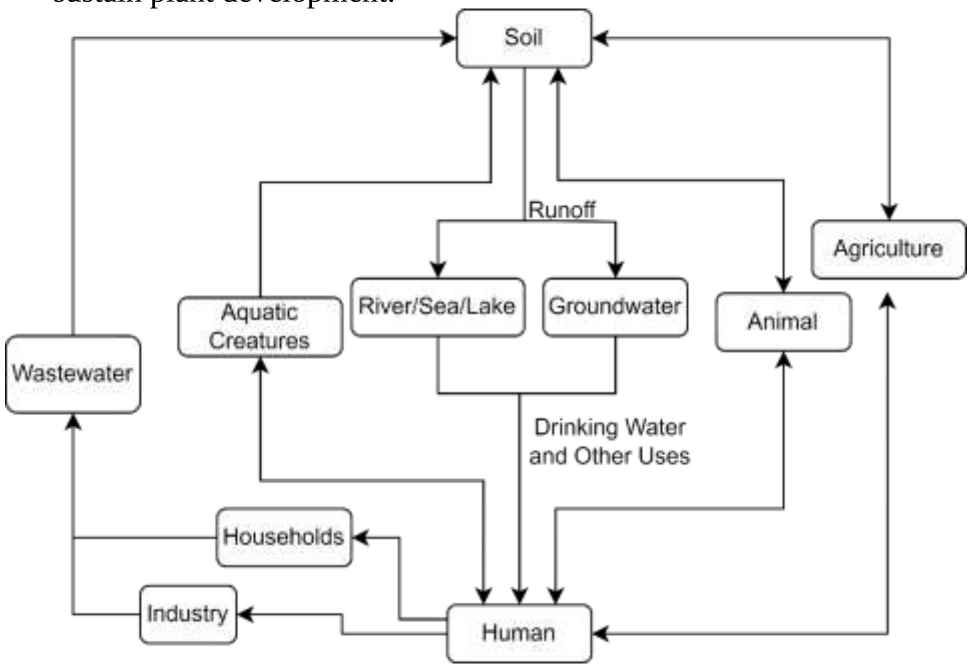

Figure-1: Silent effects of humans and soil intertwined

2. Soil Erosion

- **Industrialization:** Soil erosion can be caused by mining, construction, and other industrial activities by the removal of vegetative cover and disturbance of the soil surface. Erosion diminishes the thickness of the topsoil stratum, which is vital for preserving soil fertility and structure.
- **Agricultural Practices:** Specific agricultural practices, such as monocropping, overgrazing, and deforestation to make more space for cultivation, might worsen soil erosion. Insufficient plant growth and inadequate land practices can result in the erosion of topsoil, which is the most productive and structurally resilient layer.
- **Urbanization:** Urban development frequently entails substantial land clearance and grading, resulting in heightened surface runoff and soil erosion. Impervious surfaces such as roads and buildings hinder the infiltration of water, leading to an increase in the volume and velocity of runoff. This, in turn, accelerates erosion processes.

3. Soil Compaction

- **Industrialization:** Industrial operations using heavy machinery can cause soil compaction, resulting in a decrease in both porosity and permeability. Soils that are compacted impede the ability of roots to penetrate, water to infiltrate, and gases to exchange, which are all crucial for promoting healthy plant growth.
- **Agricultural Practices:** Soil compaction can occur as a result of frequent utilization of heavy machinery and extensive tillage practices in agriculture. Soils that are compacted have a

decreased ability to store water and allow air to circulate, which can have a detrimental effect on crop production and the activity of microorganisms in the soil.

- **Urbanization:** Constructing buildings, roads, and other infrastructure in metropolitan areas results in soil compaction. Soils that have been compacted have less ability to support plant growth and are more susceptible to erosion and runoff.

4. Loss of Soil Organic Matter

- **Industrialization:** Industrial processes can exacerbate the depletion of soil organic matter through the acceleration of soil erosion and deterioration. Organic matter has a vital role in preserving the integrity of soil structure, enhancing its fertility, and improving its ability to retain moisture.
- **Agricultural Practices:** Intensive agricultural methods that eliminate leftover plant material, excessively rely on synthetic fertilizers, and disregard natural additives can exhaust the organic content of the soil. Decreased levels of organic matter in soil lead to a decrease in the stability of soil structure, the availability of nutrients, and the capacity to hold water.
- **Urbanization:** Urban development frequently entails the extraction of topsoil and plants, resulting in a decline in soil organic matter. The absence of organic inputs in urban soils worsens the degradation of soil quality and structure.

5. Alteration of Soil Texture

- **Industrialization:** The deposition of industrial waste and by-products can modify the native soil texture by introducing external substances, which can impact the composition of sand, silt, and clay particles. This can result in alterations in soil's physical characteristics, such as its ability to retain water and facilitate drainage.
- **Agricultural Practices:** Over-irrigation and the application of specific soil amendments can cause alterations in soil texture. For instance, the utilization of low-quality water for irrigation can lead to soil salinization, resulting in adverse impacts on the physical structure and fertility of the soil.
- **Urbanization:** Urban soil compaction and sealing can alter the inherent soil texture, rendering it less conducive to vegetation growth. Substituting natural soil layers with construction materials also modifies the soil profile and physical characteristics.

Study Area

Bilaspur, located in the Indian state of Chhattisgarh, is a city of great historical and economic importance. The location is situated within the longitude range of 21°47' to 23°08' north and the latitude range of 81°41' to 83°15' east. Bilaspur is located around 111 kilometres to the north of Raipur, the capital of the state. The city is situated adjacent to the Arpa River. Bilaspur has a population of around 331,030, according to the 2011 census, making it the second-largest city in Chhattisgarh. Bilaspur has a tropical climate characterized by sweltering summers, a monsoon period, and temperate winters. Bilaspur has experienced substantial development since gaining independence, particularly via the formation of industrial sectors and educational institutions. Bilaspur serves as a prominent centre for industry, particularly for the South Eastern Coalfields Limited (SECL), which is the largest coal producer in India. The economic significance of the area is further emphasized by the existence of multiple thermal power plants. The adjacent area is highly productive for agriculture, yielding rice, wheat, and a variety of legumes, which significantly contribute to the local economy. Bilaspur is renowned for its commerce in Kosa silk and various handcrafted textiles.

Materials & Methods

Soil sampling A soil sample was obtained from a sampling site in Bilaspur district during January 2022. The sample was taken from the surface soil, namely from a depth of 0-20cm. Soil samples were gathered from additional industrial, agricultural, and urban regions within the Bilaspur district.

Sampling Locations:

Industrial Areas:

- Sirgitti
- Tifra
- NTPC Sipat

Agricultural Areas:

- Mangla
- Sakri
- Koni

Urban Areas:

- Nehru Chowk
- Jarhabhata
- Sarkanda

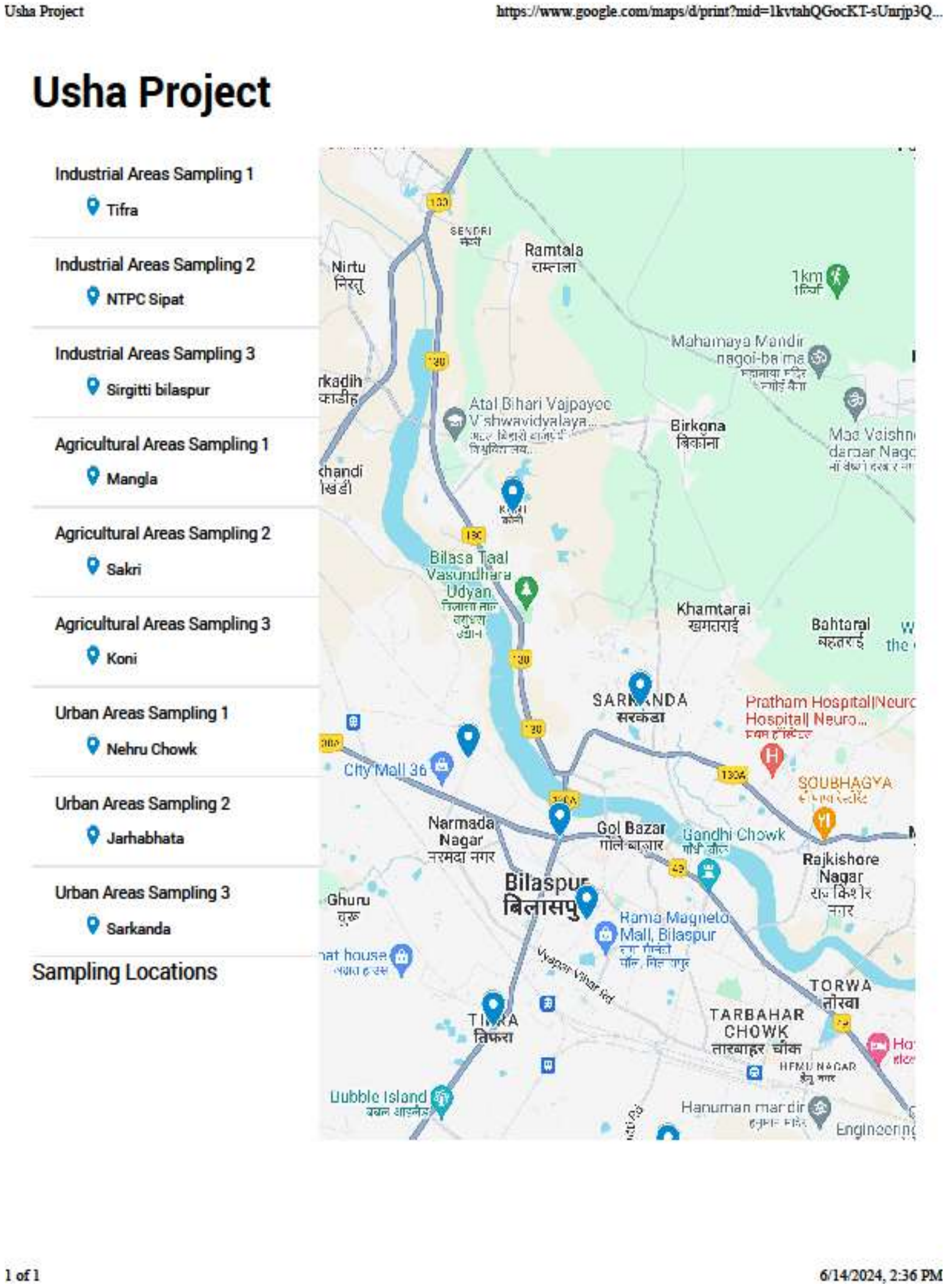

Figure-2:Sampling station of study area in Bilaspur district

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 6, No.4, June : 2024

Laboratory Analysis: The soil samples were analyzed for various soil properties using a standardized analysis procedure. The measured parameters include pH, organic carbon (OC), macronutrients such as nitrogen (N), phosphorus (P), potassium (K), and heavy metals such as lead (Pb), cadmium (Cd), arsenic (As), mercury (Hg), and so on.

Empirical: The sites under consideration are subject to soil contamination from the aforementioned sources in industrial, agricultural, and urban regions. The measured values of numerous soil characteristics, obtained from soil samples collected at various sites, after being exposed to soil pollution, are as follows: The items are displayed in Table 1. The tables below provide a summary of the soil parameters obtained from the sample stations in the district. The measured parameters include pH, organic carbon (OC), nitrogen (N), phosphorus (P), potassium (K), lead (Pb), cadmium (Cd), arsenic (As), mercury (Hg), and so on.

Table 1: Soil Parameters Experimental Results - Industrial Areas

Parameter	**Sirgitti(S1)**	**Tifra(S2)**	**NTPC Sipat(S3)**
pH	7.4	7.6	7.5
Organic Carbon (%)	0.8	0.9	0.85
Nitrogen (mg/kg)	250	260	255
Phosphorus (mg/kg)	15	18	16
Potassium (mg/kg)	200	210	205
Lead (Pb) (mg/kg)	30	28	29
Cadmium (Cd) (mg/kg)	1.2	1.1	1.15
Arsenic (As) (mg/kg)	2.5	2.8	2.65
Mercury (Hg) (mg/kg)	0.05	0.04	0.045

Table 2: Values of Agricultural Areas

Parameter	**Mangla(S4)**	**Sakri(S5)**	**Koni(S6)**
pH	6.8	6.7	6.9
Organic Carbon (%)	1.2	1.3	1.25
Nitrogen (mg/kg)	300	310	305
Phosphorus (mg/kg)	25	28	26
Potassium (mg/kg)	220	230	225
Lead (Pb) (mg/kg)	10	9	9.5
Cadmium (Cd) (mg/kg)	0.5	0.4	0.45
Arsenic (As) (mg/kg)	1.0	1.1	1.05
Mercury (Hg) (mg/kg)	0.02	0.01	0.015

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 6, No.4, June : 2024

Table 3: Values of Urban Areas

Parameter	Nehru Chowk(S7)	Jarhabhata(S8)	Sarkanda(S9)
pH	7.2	7.1	7.3
Organic Carbon (%)	0.9	0.95	0.92
Nitrogen (mg/kg)	270	275	272
Phosphorus (mg/kg)	20	22	21
Potassium (mg/kg)	210	215	212
Lead (Pb) (mg/kg)	20	22	21
Cadmium (Cd) (mg/kg)	0.8	0.85	0.825
Arsenic (As) (mg/kg)	1.5	1.6	1.55
Mercury (Hg) (mg/kg)	0.03	0.035	0.032

Result and Discussion:

The objective of the case study is to assess and monitor the importance of environmental pollution caused by plastics, papers, cold drinks, and other chemicals, as well as their significant risks to the ecosystem. Multiple studies have focused on the dissemination of the subject. Moreover, these compounds have deleterious effects on organisms and leave behind enduring impacts even after completing treatment. The investigation findings indicated that some samples displayed values that exceeded their usual discharge standards. This results in harmful effects on organisms. The pH, EC, OC, Cd, and As parameters display concentrations that beyond the acceptable standard levels for soil. The pH results indicate a state of being neither acidic nor alkaline, leaning slightly towards alkalinity, which is a common feature of industrial areas. The levels of organic carbon exhibit a decline in agricultural regions, indicating a reduction in organic material. Elevated levels of hazardous metals (lead, cadmium, arsenic, mercury) suggest pollution caused by industrial activities. Regular surveillance and control of industrial waste water is necessary. Heavy metals and pollutants alter the chemical properties of the soil, hence impacting the soil texture by changing the composition of clay minerals.

Cadmium Sources: Cadmium contamination in soil is mostly caused by industrial activities, including mining, smelting, and the application of phosphate fertilizers.

Health and Environmental Risks: Cadmium exhibits a significant level of toxicity towards plants, animals, and humans. It has the ability to impede plant growth, diminish crop production, and infiltrate the food chain, so presenting significant health hazards such as renal impairment, skeletal abnormalities, and malignancy.

The soil pH in agricultural areas often ranges from slightly acidic to neutral, creating a favourable environment for the growth of most crops. The presence of a greater amount of organic carbon indicates the addition of organic materials such as manure and leftover plant matter from crops. The nutrient levels of nitrogen (N), phosphorus (P), and potassium (K) are sufficient, which promotes the growth of crops in a healthy manner. The levels of heavy metal present are within the permissible range, suggesting that there is only minor contamination. Construction activities can lead to soil compaction and changes in its structure. Anticipate an increase in the amount of organic carbon present as a result of the addition of agricultural leftovers and manure. The nutrient levels (nitrogen, phosphorus, potassium) can vary according on the methods used for fertilization. The soil texture will

have an effect on the ability of the soil to retain water and drain it, which in turn will have an impact on the production of crops. Enhanced levels of organic matter derived by agricultural wastes and fertilizers can provide a temporary improvement in soil texture, but may eventually result in soil degradation. Unsustainable extensive farming can result in soil degradation, erosion, and diminished soil fertility. Erosion has the ability to eliminate smaller particles such as silt and clay, resulting in a rougher soil texture.
The soil pH in urban areas is often neutral to slightly alkaline. The organic carbon content is at a moderate level and is affected by the practices used in urban landscaping. The nutrient levels in urban vegetation are adequate, albeit they are lower compared to agricultural soils. Heavy metal concentrations are elevated in urban areas compared to agricultural regions, although they are lower than in industrial areas, suggesting the influence of urban pollution. Construction activities can lead to soil compaction and changes in its structure. Further more Potential pollution resulting from the discharge of urban runoff and garbage. Landscaping strategies have an impact on the variation in soil qualities. The soil texture becomes heterogeneous as a result of construction activities, which cause a mixed composition of the soil. Heavy metal emissions are a significant source of soil pollution in several sectors, characterized by their persistence and toxicity. Consuming heavy metals can lead to severe adverse health effects in people. They have the potential to induce harm to organs, promote cancer formation, generate oxidative stress, impair the neurological system, lead to respiratory failure, and hinder growth and development. These metals are not easily broken down and are very poisonous, causing significant disruption to the ecological equilibrium. Dyes and plastics are pervasive developing pollutants that widely disperse in soil and many settings. We are now in the early stages of comprehending the potential hazards associated with these contaminants. There is a need for a more comprehensive understanding of the occurrence, novel methodologies, and the detrimental impact of these particles on the ecosystem.

Soil Improvement Techniques:** Implementing crop rotation, cover cropping, and reduced tillage practices can gradually enhance soil structure and texture. Enhance the structure and fertility of the soil by incorporating organic matter. Employ the technique of crop rotation and utilize cover crops to sustain soil fertility. Implement a well-proportioned fertilizing strategy according to the findings of the soil test. Integrate organic amendments such as compost and manure to improve soil health. Continue utilizing organic additions to sustain soil vitality. Improve fertilizing methods by utilizing soil test data to increase productivity. Employ erosion control techniques to mitigate soil degradation. Utilize permeable materials in urban infrastructure to mitigate soil compaction.

For Industrial Areas:

Apply soil remediation methods to mitigate heavy metal pollution. To enhance the organic matter content, incorporate compost or biochar. Regularly monitor the quality of the soil to prevent any further deterioration.

For Agricultural Areas:

Continue utilizing organic additions to sustain soil vitality. Improve fertilizing methods by utilizing soil test data to increase productivity. Employ erosion control techniques to mitigate soil degradation. Regarding urban regions, implement green spaces and urban gardens to enhance soil fertility. Enforce regulations for effective waste management to mitigate soil pollution. Adopt more effective waste management strategies to mitigate urban pollution. Promote the utilization of organic additions to enhance soil organic matter. Apply soil remediation methods to mitigate the presence of heavy metals. Enhance the level of organic matter by incorporating compost or biochar. Consistently assess the condition of the soil to proactively prevent additional deterioration.
Utilize phytoremediation methods employing plants with the ability to uptake heavy metals and mitigate their detrimental impact on plants, animals, and human existence. Regular surveillance and control of industrial waste, including waste management procedures, are employed to avert soil contamination. The government implements these solid waste management procedures.

These interpretations offer a thorough assessment of the soil quality in Ballarpur's industrial, agricultural, and urban regions, providing guidance for future soil management strategies. Heavy metal (Cd) bioremediation: Bioremediation is a subfield of biotechnology that employs living organisms, such as plants and bacteria, to clean up and restore contaminated environments. Bioremediation is a procedure that involves using living organisms, such as plants and microorganisms, to treat and improve a given environment. We are employing the Phytoremediation technique with Hyper accumulator Plants. Phytoremediation is a sustainable and economical technique that use plants to eliminate, break down, or stabilize pollutants in soil and water. It utilizes the inherent mechanisms of plants to absorb and collect heavy metals from the soil. A hyper accumulator is an organism that has the ability to accumulate high levels of certain substances, such as heavy metals, in its tissues. Plant species that are tolerant of or have the ability to accumulate cadmium. Some plants have the ability to endure and gather substantial amounts of cadmium in their tissues. These plants are referred to as hyper accumulators. The research report focuses on Brassica juncea (Indian mustard) because of its high efficacy in absorbing cadmium and its ability to thrive in different soil conditions.

Steps in Phytoremediation of Cadmium.

1. **Selection of Hyper accumulator Plants:**
   - Identify and select plant species known for their ability to accumulate cadmium, such as Brassica juncea.
2. **Soil Preparation:**
   - Test soil for cadmium concentration to establish baseline contamination levels.
   - Prepare the soil by ensuring proper pH and nutrient balance to support plant growth.
3. **Plant Cultivation:**
   - Sow seeds or transplant seedlings of Brassica juncea in the contaminated soil.
   - Ensure optimal growing conditions, including adequate irrigation and pest management.
4. **Monitoring and Maintenance:**
   - Regularly monitor plant growth, health, and cadmium uptake.
   - Measure cadmium levels in plant tissues using Atomic Absorption Spectroscopy (AAS) or Inductively Coupled Plasma Mass Spectrometry (ICP-MS).
5. **Harvesting:**
   - Harvest the plants after they have accumulated significant amounts of cadmium.
   - Dispose of the cadmium-laden biomass safely to prevent secondary contamination.
6. **Post-Harvest Soil Analysis:**
   - Test soil cadmium levels after plant harvesting to assess the reduction in contamination.
   - Repeat the phytoremediation cycle if necessary to achieve desired cadmium levels.

Conclusion

The influence of industrialization, agriculture, and urbanization on soil texture in Bilaspur district is substantial and diverse. The process of industrialization and urbanization frequently results in soil compaction, pollution, and the depletion of natural soil characteristics. Similarly, agricultural activities can either deteriorate or enhance soil texture, depending on the specific methods employed. Implementing sustainable land management strategies is crucial for reducing adverse effects and enhancing soil health. To obtain a comprehensive and precise examination of the Bilaspur district, it is important to gather and examine soil samples from several sites that accurately represent industrial, agricultural, and urban sectors. This would aid in quantifying the alterations in soil texture and determining the main causes that are causing these alterations. Gaining insight into the influence of different land use patterns on soil health is essential for promoting sustainable development. This study aims to provide significant findings regarding soil management techniques in Bilaspur, which will enhance agricultural productivity and improve environmental well-being. To enhance soil health in

Bilaspur a comprehensive strategy is necessary, encompassing scientific methodologies, realistic agricultural practices, and active community participation. By following these measures, it is possible to improve soil fertility, boost agricultural productivity, and guarantee environmental sustainability for future generations. An appropriate technique for this research paper on enhancing soil health in Bilaspur, Chhattisgarh would be to use a combination of qualitative and quantitative methodologies. This methodology combines qualitative and quantitative research methods to thoroughly examine soil health and evaluate the efficacy of different improvement measures. Below is an elaborate delineation of the methodology.

References:

[1]. Pulleman, M.M., Bouma, J., vanEssen, E.A. and Meijles, E.W. 2000 "Soil organicmatter content as a function of different landusehistory," Soil Science Society of America Journal, vol. 64, no. 2, pp. 689–693.

[2].Barua, P.K., & Bora, P.K. (1975). Fertility status of the soils of North Easternregion. Journal of the North Eastern Council, 1(2), 21-26.

[3]. Wang, B.R., Cai, Z.J., Li, D.C. (2010) Effect of different long-term fertilization on the fertility of red upland soil. Journal of Soil and Water Conservation 24: 85–88.

[4]. Yadav, M. P. Mohd, and Kushwaha, S. P.2005. "Effect of integratednutrientmanagementonrice (*Oryzasativa*)-wheat (*Triticumaestivum*) croppingsystemincentral plains zone of Uttar Pradesh," Indian Journal of Agronomy, vol.50, no.2, pp.89–93,

[5]. Blair, N., Faulkner, R., Till, A., Poulton, P. (2006)Long-termmanagementimpacts on soil C, N and physical fertility: PartI: Broadbalkexperiment. Soil and Tillage Research 91: 30–38.

[6] Jaiswal Usha, Pandey Ambuj, Shriwas s.p. 2022. Impact of the industrialization on soil surrounding Sirgitti industrial area in Bilaspur, CSVTU Research Journal VOL.11(1), 40-47, 2022 ISSN: 0974-8725 Research.

[7]. Jaiswal Usha, Pandey Ambuj, (2023) A Study of Physico-Chemical Parameters of Soil at Tifra industrial area in Bilaspur District Chhattisgarh India, An Interdisciplinary Research Area in Physical, Biological and Environmental Science ISBN: 978-93-93403-13-1/109-117.

[8]. P. A. N., & Zhang, W. J. (2009). Effect of long-term fertilization on organic carbon andnitrogeninasubtropicalpaddy soil. Pedosphere, 19(6),727-734.

[9]. Gillman, G.P. and E.A. Sumpter. 1986. Modification to the compulsive exchange method for measuring exchange characteristics of soils. Aust. J. Soil Res. 24: 61-66.

[10].Hendershot,W.H. and M. Duquette. 1986. A simplebariumchloridemethodfordeterminingcationexchangecapacityandexchangeable cations.Soil Sci. Soc. Am. J.50:605-608.

[11]. Sultani, M. I., Gill, M. A., Anwar, M. M., & Athar, M.(2007). Evaluation of soil physical properties as influenced by variousgreenmanuringlegumes and phosphorusfertilizationunderrainfedconditions. International Journal of environmental Science & Technology, 4(1), 109-118.

[12]. Singh, S. R., Zargar, M. Y., Singh, U., &Ishaq, M. (2010). Influence of bio-inoculants and inorganic fertilizers on yield, nutrient balance, microbial dynamics and quality of strawberry (*Fragariaxananassa*) underrainfed conditions of Kashmir valley. Indian Journal of Agricultural Sciences, 80 (4), 275.

[13]. Bowman, R. A., Vigil, M. F., Nielsen, D.C., & Anderson, R. L. (1999). Soil organic matter changes inintensivelycroppeddryl and systems. Soil Science Society of America Journal, 63(1), 186-191.

[14]. Richards L.A. (1986) Diagnosis Improvement of Saline and Alkaline Soil", vol.60 of US Department of Agriculture Hand Book, United States Salinity Laboratory Staff.

[15]. Walkley, A., & Black, I. A. (1934). Anexamination of the Degtjareffmethodfordeterminingsoilorganicmatter,andaproposedmodificationof the chromic acid titration method. Soil science, 37(1), 29-38.

[16]. Black, C. A., Evans, D. D., White, J. L., Ensminger, L.E., Clark, F. E., & Dinauer, R.C. (1965).

Methods of soil analysis. Pt.1. Physical and mineralogical properties, including statistics of measurement and sampling. Pt.2. Chemical and microbiological properties (No.631.42B627). American Society of Agronomy, Madison, WI (EUA).

[17]. Chopra S. L. and Kanwar, J. S., (1986) Analytical Agricultural Chemistry, Kalyani, New Delhi, India.

[18]. Prasad R. N. and Patiram, 1981, Annual Report ICAR Research Complex for North Eastern Hill Region, Meghalaya, India.

[19]. Tiwari, K. N. Fundamental of Soil Science, Indian Society of Soil Science, New Delhi, India, 2003.

[20]. Khattak, R. A., & Hussain,Z.(2007). **Evaluation of soil fertility status and nutrition of** orchards. Soil & Environment, 26(1), 22-32.

[21]. Subba Rao, A. (1993). Analysis of soils for available major nutrients. Methods of Analysis of Soils, Plants, Waters and Fertilizers. Fertilizer Development and Consultation Organization, New Delhi, 13-35.

[22]. Adamchuk VI, Lund ED, Sethuramasamy raja B, Morgan MT, Dobermann A, Marx DB (2005) Direct measurement of soil chemical properties on-the-go using ion-selective electrodes. Computers and Electronics in Agriculture, 48 (3): 272-294. DOI: https://doi.org/10.1016/j.compag.2005.05.001.