

Geo-Environmental Analysis of Saline Soils in Mauje Digraj, Sangli District, Maharashtra

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Article Info	ABSTRACT
Article History: Received: 15th Dec 2025 Accepted: 19th Dec 2025 Published: 20th Dec 2025	Soil chemistry is the study of the chemical characteristics of soil. Soil chemistry is affected by mineral composition, organic matter and environmental factors. Until the late 1960s, Soil chemistry focused primarily on chemical reactions in the soil that contribute to pedogenesis or that affect plant growth. Soil contains high amounts of salts (Nitrogen, Potassium, Chloride), which is called saline soil. Soils that have high electrical conductivity. Therefore, the crops needed in agriculture are not suitable. Maharashtra is facing the problem of increasing saline soil area. To study these problems geographically, we selected the village of Mauje Digraj in Miraj taluka which is situated on the banks of Krishna River in Sangli District. The present paper based on primary and secondary data. Primary data collected through observation, interview and questionnaire. The secondary data of groundwater records office (ground water survey and agency) has been used for taken Survey numbers of the saline soil area at Present village. Google Earth Pro is a software platform that allows to view satellite images from the past. For study changes over location and time, were used satellite imagery to determine the polygon of the saline soil area in 2010 and 2023. Also, visited this saline soil sites and collected soil samples there for pH studies. These samples were studied in the pH laboratory and its distribution has been studied in the geographic information system. Field visits examined the ground truth of the village geomorphology and the authenticity of the satellite imagery. Also taken interview of farmers about saline soils to understand the problems and analyzed all the data and suggested solutions. This leads to the conclusion that saline soils are no longer a problem but solutions have been found to rehabilitate them. So that the saline land can be made fertile again. E.g. Drainage of soluble salts by making small plots of 20-20 gunthas to remove soluble salts in the field. Applying 20 to 25 tons per hectare of organic fertilizers to saline soils etc. to increase soil fertility.
Keywords: <i>Geo-Environmental</i>	

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Introduction

Saline soil studies in India have been conducted by various experts. The saline soil area in India is 6.73 million hectares and is estimated to reach 11.7 million hectares in 2025. The area under saline soil in Maharashtra is 6.06 lakh hectares. Maharashtra has the third largest area of saline soil in India. Maharashtra is also facing the problem of saline soil. The area of saline soil in Maharashtra is recorded at 403410 hectares. In Maharashtra, Pune, Ahmednagar, Solapur, Kolhapur, Satara, Sangli, Thane, Raigad, Ratnagiri, Sindhudurg, Aurangabad, Jalna, Beed, Latur, Amravati, Parbhani, Nanded, Osmanabad, Nashik, Dhule, Akola, Buldhana etc. There are saline soils in the district. But Sangli district has the highest number of villages with saline soil. According to the survey, the saline soil in Sangli district is 3675 hectares, the land on the verge of salinity is 7895 hectares and wetlands are 5843 hectares. This research paper seeks to understand how this soil area in Miraj taluka has changed over time and what are the problems.

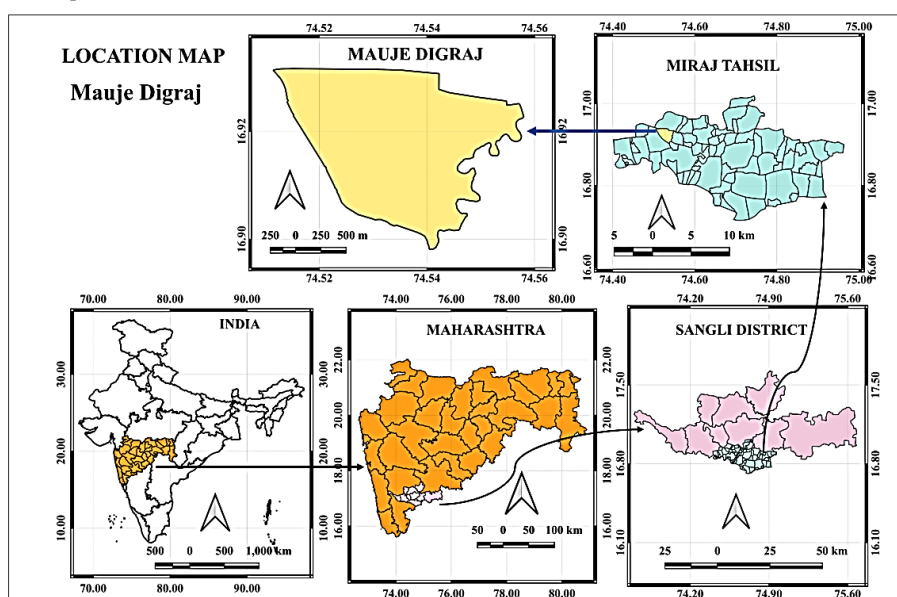
Objectives

1. To study the change over time in the saline soil area of Mauje Digraj village.
2. Identify and suggest solutions to the problems of saline soil in Mauje Digraj village.

Location of Study Area

Mauje Digraj village is located in Sangli district and is one of the 67 villages in Miraj taluka. The village is located in the Krishna River valley, 8 km from Sangli city. and 20 km west of the town of Miraj, located in the taluk. The village is located at a distance. There are other small villages in the border area around this village. The village is bordered by Karnal to the east, Nandre to the north, Kasbe Digraj to the west and Padmale and Sangli municipal corporations to the south.

Digraj village is located in the west of Sangli district in the state of Maharashtra. The village is located on the western side of Miraj taluka and has a total geographical area of 1053 km². It's Hector. The latitude of the village ranges from 16° 53' 53.06" N latitude to 16° 53' 53'96" N longitude and 74° 30' 40'94 E longitude to 74° 33' 28.86 E longitude. The location of the village of Digraj is clear as shown in the study area and spatial map No. 2.1



Map No. 1: Location of Study Area

Database and Methodology

A variety of research methods were used for this study. Preliminary information has been obtained using observation methods, interview methods, sampling methods. Data analysis has been performed using geographic information systems and standard field approaches.

The secondary data of groundwater records office (ground water survey and agency) has been used for taken Survey numbers of the saline soil area at Present village. Google Earth Pro is a software platform that allows to view satellite images from the past. For study changes over location and time, were used satellite imagery to determine the polygon of the saline soil area in 2010 and 2023. Also, visited this saline soil sites and collected soil samples there for pH studies. These samples were studied in the pH laboratory and its

distribution has been studied in the geographic information system. Field visits examined the ground truth of the village geomorphology and the authenticity of the satellite imagery. Also taken interview of farmers about saline soils to understand the problems and analyzed all the data and suggested solutions.

Discussion and Analysis

In classical studies, it is possible to know from the definition which soil should be referred to as saline soil. Generally, saline soil is defined as the soil having electrical conductivity (EC) of the saturation extract (EC_e) more than 4dSmL⁻¹ (approximately 40mM NaCl) in the root zone at 25°C and exchangeable Na 15% (Shrivastava and Kumar, 2015).

Generally, soils whose saturation is greater than 4 dSmL⁻¹ are called saline soils when the temperature of the soil area with the roots of the plant is 25 °C and the free sodium is 15%. (Srivastava and Kumar, 2015).

There are three types of saline soil in the Krishna River basin.

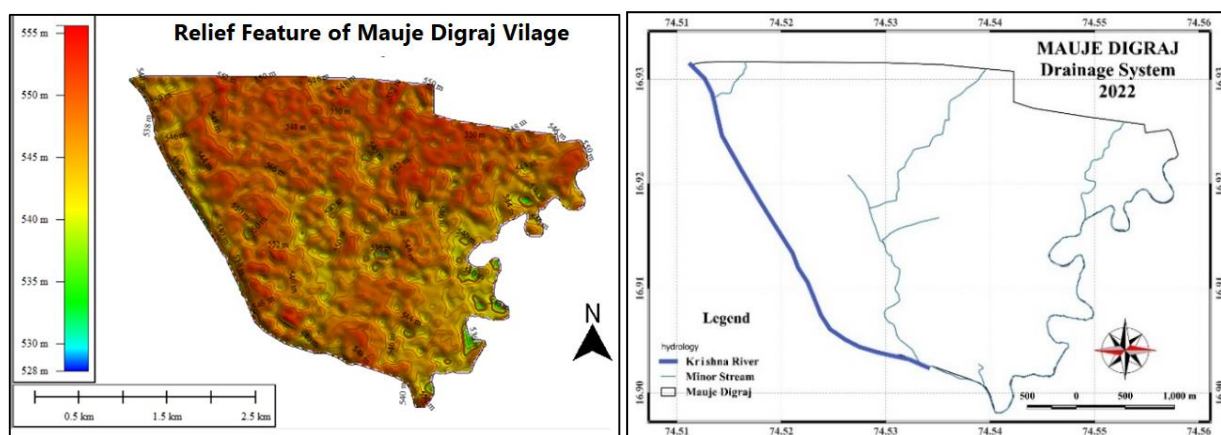
1. Saline soil- The mass of saline soil is up to 8.1/2. The amount of soluble salts is more than 4 ml mohj per cm. The amount of free sodium on soil particles is less than 15%.
2. Saline chopan soil- Soil content is less than 8.1/2 to 10 or the amount of soluble salts is 4 ml mohj/cm. It's more than that. The amount of free sodium on clay particles is more than 15%.
3. Chopan soil- The soil has a mass of more than 8.1/2 while the soluble salt content is 4 mm. / cm. It's less than that. But the amount of free sodium on clay particles is more than 15%.

The ECE value indicates the intensity of salinity. Soils with a pH of less than 8.5 are called acidic saline soils, these soils are also called "white alkali" or "solonchack". In general, saline soils can be identified even by the naked eye. A layer of white salt appears to have accumulated on the surface of the soil. In short, soils that contain high amounts of salts (nitrogen, potassium, chloride) are called saline soils. Soils that have high electrical conductivity. Therefore, the crops needed in agriculture are not suitable.

Saline soils are high in salts, which makes it difficult for crops to grow. Salts are water-soluble salts and minerals. They can be found naturally in soil or added by irrigation water, fertilizers, or other methods of agriculture. There are several reasons why soils become saline, including:

1. Weather: In dry weather, water evaporates. Leaving salts behind in the soil.
2. Geology: Some rocks are naturally high in salts. When these rocks decompose, salts are released into the soil.
3. Irrigation: Irrigation with saline water can cause salts to accumulate in the soil.
4. Fertilizers: Some fertilizers contain salts, which can accumulate in the soil.
5. Farming practices: Some farming practices, such as continuous cultivation and lack of proper drainage, can increase soil salinity.

To know which of these factors led to the formation of saline soil area in Mauje Digraj village, it is necessary to study the natural structure of the study area Mauje Digraj. The study was based on satellite imagery called ASTER DEM.



Map No.2: Relief Feature and Drainage System of Village Mauje Digraj.

The natural structure is a slow slope from satellite image ASTER 5. In general, the slope of the land is found in the direction of the river. However, since this is a land area with sugarcane area, farmers have levelled the land for cash crops. This has led to changes in the natural structure of the natural streams and streams

of the village, which has created the present saline land.

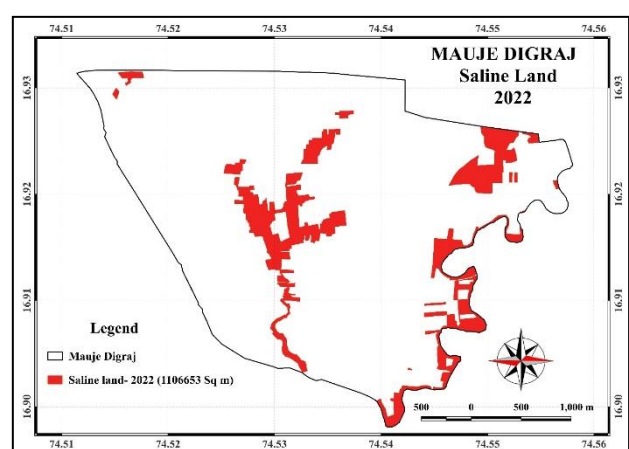
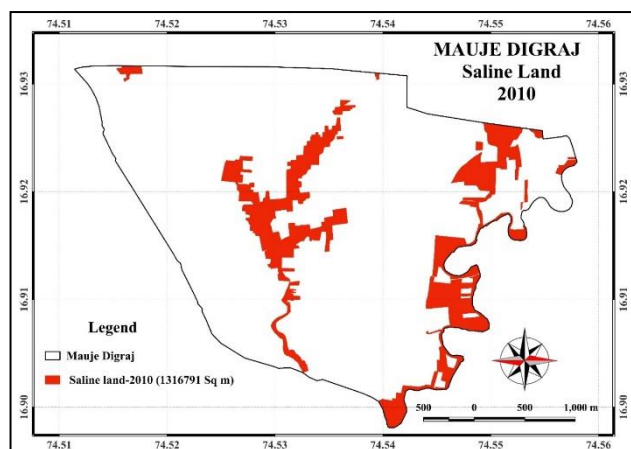
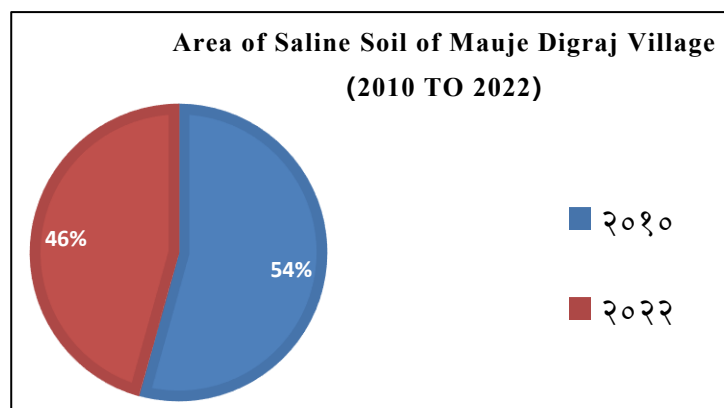
Based on field surveys and observations, several effects have been observed in the saline soil area in the village of Digraj.

1. Reduced crop growth: The roots of salt crops have reduced their ability to absorb water and nutrients.
2. Soil erosion: The natural structure of saline soils has changed. They have become clovey, sandy, and succulent. As a result, they have become more sensitive to being swept away by wind and water.
3. Biodiversity loss: Saline soils have created a stressful environment for many types of plants and animals. Crops like turmeric, sugarcane and vegetables have become impossible to grow and commercial cultivation of lawn grass has also disappeared.

Area of Saline Soils in 2010 and 2022

In the accompanying figure and table, the saline area at Mauje Digraj in 2010 and 2022 is sq. I. Given in.

Table no.: 1 Area of Saline soil (2010 to 2022)	
Year	saline soil area (sq.m)
2010	1316797
2022	1106653



Map No. 3: Area of Saline Soil of Mauje Digraj (2010-2022)

The above table, diagram and map show that the total area of the village is 1053.5914 hectares (10535914 sq mi). As of 2010, the total area of saline land in the village of Digraj was 1316797 km². Was. It is 12.49% of the total area. It will be 1106653 sq. ft. in 2022. I. It's been so much. That's 210,138 square feet over a 12-year period from 2010 to 2022. Also, while the salinity area has decreased in 2022, it has increased in some places. Two main streams flow from north to south and east to south from the central part of the village of Moje Digraj and meet the Krishna River. The most saline area of this village can be seen around these two oases.

Changes in the saline land area in Moje Digraj

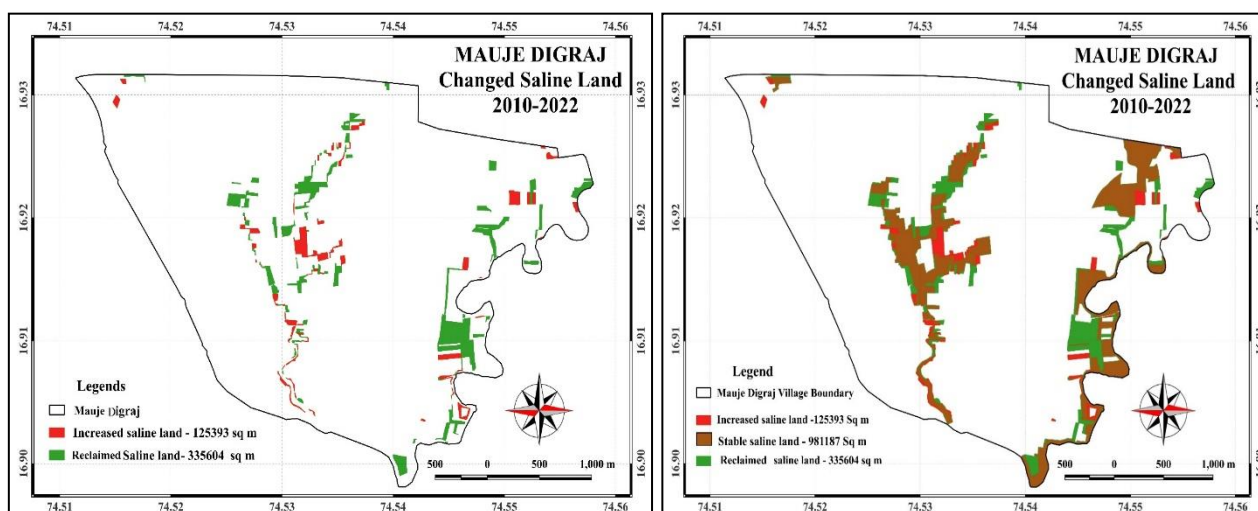
There are two types of changes in the saline soil area at Present Digraj. One is the restoration of the soil and the other is the increase in the area of saline soil. They are as follows: -

Table no. 3.2 Change in the area of saline soils at Mouje Digraj (2010-2022)	
Change in saline land area	Area of saline soils (Sq. Km.)
Reclamation Area	335604
Stable saline area	981187
Increased saline area	125393

The above table and figure show that the restoration of saline land area in this village has increased from 2010 to 2022. So, in comparison, very few areas seem to have grown. That's only 9 percent. It's still a big area as it is. It appeared that repair work was underway.

Reclamation of saline soils

The following map shows the area of the saline land at Digraj that has been restored. Soil restoration means that saline soil is made cropped. Different measures are taken. E.g. Leveling of land, soil testing, soil recharge etc.



Map No.: 4 Changes in the saline land area in Moje Digraj (2010 to 2022)

Above map and chart no. 2 shows that during the period 2010 to 2022, about 335604 sq.m. It has decreased so much. This decrease is 655, 516, 822, 539/28, 714, 666, 227, 383 and 384 group no. appear more in Although saline land is a problem faced by the farmers, they have overcome that problem and made the land fertile. Sugarcane, wheat, turmeric and other vegetables are taken in it. Turmeric crop is coming well. This was evident from the actual observation made there. While rehabilitating the agriculture, it is seen that the capital problem is the main problem for the farmers. A large area of reclaimed saline land can be seen to the east of the village.

During the period 2010 to 2022, the area of saline land at Mauje Digraj is 125393 sq. I. has grown so much. A complete survey of the village reveals that the maximum saline area has grown in the center of the village and around the stream in the east. This increase is 686, 501, 407, 251, 252, 408, 138, 124 and 547 group no. appear more in this means that the water has a high salt content. Water testing is also necessary here. The reasons behind the increase of this saline area include financial difficulties of farmers, production of less saline water, excessive use of chemical fertilizers, pesticides and lack of soil testing.

A comparison of the increase and decrease in the area of saline land in Mauje Digraj between 2010 and 2022 shows that more area has been restored. The rehabilitated area is 335604 sq.m. So, the increased area is 125393 sq.m. That's it. More area of 210211 sq.m has been restored.

There are several ways to manage saline soils, including:

1. Drainage: Improve drainage to remove excess water and salts from the soil.
2. Leaching: Excessive watering to remove salts from the soil.
3. Amendment: Improving soil fertility by adding organic matter and chemical fertilizers to the soil.
4. Saline-Tolerant Crops: Planting crops capable of growing in saline soils.

It can be seen that the study of saline land area has been done by various experts. The work of improving saline land was started in the year 2001 through a joint scheme of Land Resource Development, Ministry of

Rural Development, Department of Water Conservation and Government of India. Through this scheme, the natural structure of Mauje Digraj village was improved.

If the salts present in the ground are carried away by water, the land can become arable, so a perforated pipe is laid under the ground. The salts in the ground will be carried by the water and will pass through this saline water porous pipe. It is designed like this. 25000 per acre has been spent in 2003 for this purpose.

Summary

Saline soils are a serious problem affecting millions of hectares of land worldwide. However, by using proper management practices, saline soils can be improved and returned to productive agriculture.

1. The total area of Mauje Digraj village is 1053.5914 hectares (10535914 sq.m.). Out of which in 2010, 1316797 sq.m. was It is 12.49 percent of the total area. So, it is 1106653 sq. in 2022. I. So much has happened. That is, in the period of 12 years from 2010 to 2022, 210138 sq. I. There has been a change in so many areas.
2. A comparison of the increase and decrease in the area of saline land in Mauje Digraj between 2010 and 2022 shows that more area has been restored. The reclaimed area is 335604 sq.m. So the increased area is 125393 sq.m. That's it. More area of 210211 sq.m has been restored.
3. This leads to the conclusion that saline soils are no longer a problem but solutions have been found to rehabilitate them. So that the saline land can be made fertile again. E.g. Drainage of soluble salts by making small plots of 20-20 gunthas to remove soluble salts in the field. Applying 20 to 25 tons per hectare of organic fertilizers to saline soils etc. to increase soil fertility.

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