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# Assessment of Irrigation Facilities and Its Impact on Soil Degradation: A Case Study of Tamaswadi Village in Niphad Tahsil of Nashik District

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***Abstract:***

*Salinization is a global problem, particularly in semi-arid areas that use lots of irrigation water, are poorly drained, and never get well flushed. Unless proper measures are taken to overcome the problems of salinization and soil conservation, agriculture declines to the extent that it cannot be retrieved. The present study attempts to highlight the issue of salinization in Tamaswadi village. Over irrigation, percolation of canal water, overflow from well, the unclean outlets, use of overdose of chemical fertilizers, frequency of perennial crops like sugarcane, and the tendency of the farmer to practice such plants, characteristics of soil are some of the reasons for salinization in Tamaswadi village. The village having around 1148 hectares of land, which comprises about 86 percent irrigated area. It has been observed that the problem of salinization in the irrigated area seems to be a significant threat to sustainable agricultural development. Therefore, it was felt necessary to carry out the geographical analysis of irrigated agriculture and to decide the strategy for agricultural development through the reclamation of saline land. The present study used various types of data like irrigation and soil data collected from multiple sources, i.e., interviews, discussions with the farmers, Irrigation department, and soil survey & soil testing office, Nashik. The various thematic maps related to soil types, irrigation, salt-affected areas are prepared and analyzed with the help of a GIS environment.*

***Keywords:*** *Agricultural Development, Irrigation, Soil, Salinization, GIS*

## 1. Introduction:

Soil and water are the essential natural resources for living organisms, and soil & water are very much interactive and can influence the response of agro-ecosystems. The improper use and mismanagement of these resources lead to depletion in their quality and also quantity. The degradation of these resources is generally trigged by excessive pressure on land by a rapidly growing population (Singh and Dhillon,1984).

Soil degradation is one of the most significant global environmental problems faced by the world community. In India, the issue of soil degradation assumes more considerable significance because of the large-scale irrigation facilities and more area under sugarcane cultivation. Large scale irrigation for sugarcane cultivation, without considering the soil and water management principles has lead to the development of Salinization and waterlogging problems (Sharma and Bhargava,1988).

Maharashtra is one of the leading states in irrigated agriculture. So many small to big size dams, canals, wells, tube wells have been constructed for water supply to agricultural land and domestic use. Improper use and maintenance of canal irrigation have contributed significantly to the problem of soil degradation. Extensions of canal irrigation to arid and semi-arid areas have resulted in water logging and Salinization. Over irrigation has affected the fertility status of soils.

Salinization / Alkalization is defined as a net increase of the salt content of the (top) soil leading to a productivity decline. The degradation of the soil environment in the form of saline lands in the study area has the following possible causes (Pawar and Pujari, 2000). Agricultural lands in the study area are known to be one of the suitable lands for growing of cash crops. Irrigation in this area is widely spread over, and the land surface has a plain topography. Over irrigation, percolation of canal water, overflow from well, salty water wells, the unclean outlets, overuse of chemical fertilizers,

frequency of perennial crops like sugarcane and grapes and tendency of farmer of practicing such crops, characteristics of soil, etc. are some of the reasons for salinization in this area has resulted into the problem of saline land and low soil productivity (Mahmoud et al., 2009).

Therefore, it is felt to undertake a study of the assessment of irrigation facilities and their impact on soil degradation. This research work to suggest remedial measures for sustainable agricultural development.

**2. Study area:**

Tamaswadi village lies in the Saikhede circle in Niphad Tahsil, situated at 19º 58' 29" N latitude and 74º 09' 54" E longitudes with an altitude of 527 meters from mean sea level (Figure 1). The Godavari is a significant river in the northern site from flowing the west to east. Tamaswadi village covered the deep black to alluvial soil. Tamaswadi has located 22 km to the southeast of Niphad tahsil headquarter and connected by road. The general gentle slope of the village is from northwest to southeast. The village Tamaswadi has following boundaries towards the northern site is Godavari river, and center part covered the Godavari left bank canal (GLBC).

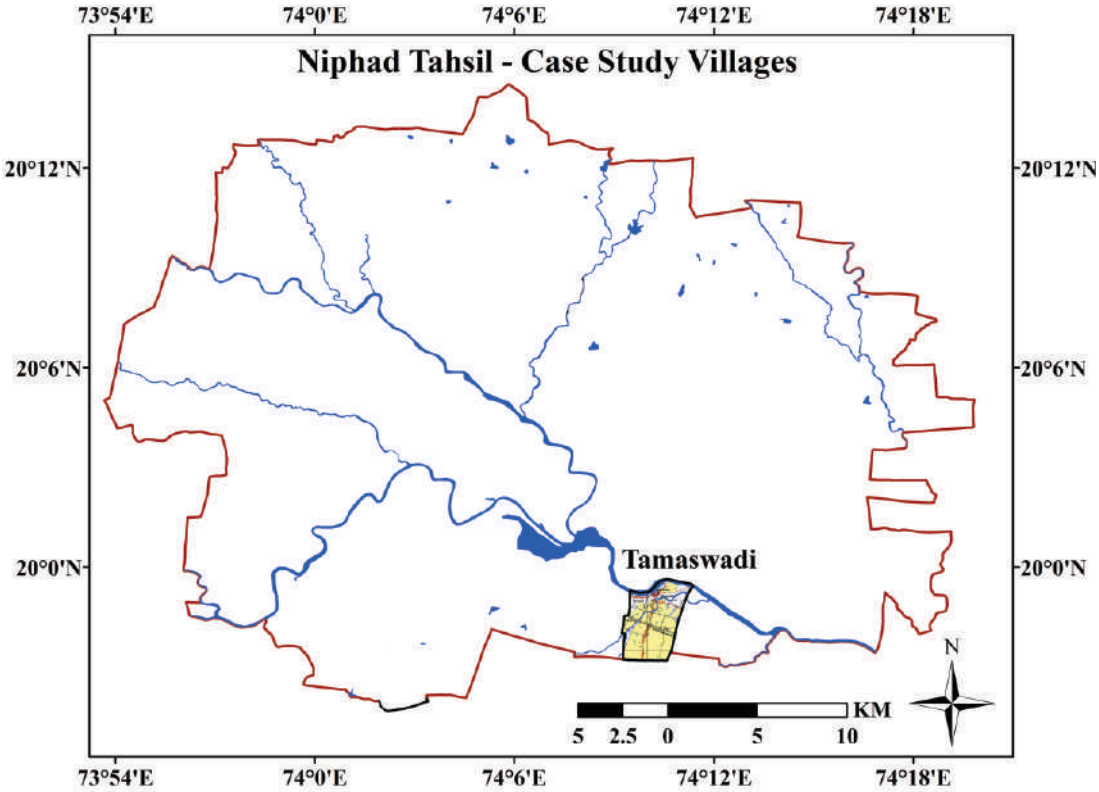


Figure 1: Study Area

The administrative boundaries of village Tamaswadi are well defined by the surrounded by villages like Karanji Kh., Sarole Thadi, Nandur Madhmeshwar, Tarukhedle, and southern site are Sinnar tahsil. The village extends 11.48 sq. Km. land with 2288 population as per the 2011 census. This village is high irrigation practices in a different source.

**1. Major Objectives:**

1. To assess the irrigation facilities and their impact on the soil in the study area.
2. To suggest the measures to overcome the problems of soil degradation.

**2. Database:**

In present research purpose used primary and secondary data. Primary data collected from the household scheduled survey, questionnaire, and conducted interviews of farmers. Secondary data collected by various government organization i.e., Irrigation Department, Soil Survey and Soil Testing Office, and District agriculture office. The different thematic maps related to soil types, irrigation, salt-affected area, etc. are prepared and analyzed in a GIS environment.

**3. Methodology:**

The present research work carried out the following methods. The methodology divided into two components i.e., fieldwork and laboratory work.

**5.1 Field Work Components:**

· In the time of fieldwork, selected villages are collect the questionnaire from farmer's various information collected through the questionnaire and discussion with farmers.

· Understanding of physiographic & Socioeconomic factors related to agriculture that effect on the soil environment.

· Field measurements and soil sample collection. Field measurement includes locating spot height with the help of SOI toposheets.

5.2 Laboratory Components:

· Survey of India (SOI) Topographic Map (46H/16, 46H/13, 46L/4, 47I/1, 46L/8, 47I/5) on 1:50,000 scales will be used to prepare a base map.

· Soil sample analyses to soil laboratory because of the findings the soil quality and fertility.

**4. Assessment of Irrigation Facilities:**

The present study village is using irrigation sources like a canal, well, and tubewell. The entire village covered by the Godavari river basin. Nandur Madhmeshwar Reservoir and Godavari Left Bank Canal (GLBC), Godavari Right Bank Canal (GRBC), and Nandur Madhmeshwar Express Canal (NMEC) these canals provide the irrigation facility. In these reasons substantiate to agriculture area is high.

Out of the total net sown area (NSA) in the village, 26.52 percent (167.00 ha), 96.19 percent (606.00 ha), and 86.10 percent (715.60 ha) area under irrigation during 1991, 2001 and 2011 respectively. In the last three decades (1991 to 2011) total irrigated area increased around 60 percent due to increasing irrigation facilities like canals, tube wells, and farm ponds (Table 1).

**6.1 Soils:**

The village Tamaswadi is located near the bank of river Godavari in the plain region. In the study area found the alluvial type of soil. Based on texture, depth, physical, and chemical characteristics, soils of the entire Niphad tahsil can be divided into four types.

i. Coarse Shallow Soil
ii. Medium Deep Black Soil
iii. Deep Black Soil
iv. Very Deep Black Soil (Alluvial Soil)

Table 1: Irrigation Status of Tamaswadi Village

| Sr. No. | Source | Net Irrigated Area (ha) | | | Percentage of NIA to NSA | | | Changes |
|---|---|---|---|---|---|---|---|---|
| | | 1991 | 2001 | 2011 | 1991 | 2001 | 2011 | 1991 to 2011 |
| 1 | Canal | 127.00 | 310.00 | 538.00 | 20.17 | 49.21 | 64.73 | +44.56 |
| 2 | Well | 19.00 | 168.00 | 90.00 | 3.02 | 26.67 | 10.83 | +7.81 |
| 3 | Tubewell | 0.00 | 0.00 | 32.00 | 0.00 | 0.00 | 3.85 | +3.85 |
| 4 | River | 21.00 | 56.00 | 46.00 | 3.33 | 8.89 | 5.53 | +2.2 |
| 5 | Other | 0.00 | 72.00 | 9.60 | 0.00 | 11.42 | 1.16 | +1.16 |
| **Total** | | **167.00** | **606.00** | **715.60** | **26.52** | **96.19** | **86.10** | **+59.58** |

Source: District Census Handbook, Nashik (1991, 2001 and 2011)

**6.2 General Landuse:**

Irrigation impacts on the general land use in the study area. The Tamaswadi village located near the bank of river Godavari. So, the riverside area is covered by the large size forest i.e., Subabul and Babhul, etc. An area accounted for under this category is 9.25 to 8.59 percent from 1991 to 2011. The Tamaswadi village has around 11 percent (124.98 ha), 10 percent (112.40 ha), and 4 percent (41.00 ha) of an area not available for cultivation during 1991, 2001, and 2011 respectively. But out of 1147.77 ha area under the total geographical area (TGA). In the study area observed around 25 percent of the land is culturable waste; this is decreasing in 2011. This around 15 percent of culturable wasteland in 2011. The NSA observed around 55 percent (629.67 ha) in 1991, around 55 percent in 2001, and 72 percent (831.10 ha) in 2011.

**6.3 Cropping Pattern:**

The total geographical area is available for cultivation is around 72 percent (831.10 ha). Out of that area, around 7150 hectares of the net sown area is irrigated. To make the use of the high irrigation, the farmers of the village have taken up pomegranate as the main commercial crop. But over-irrigation impacts are also indicated as some crop areas are decreasing. This village has high salinization and waterlogging problem high. Therefore, the sugarcane area is decreasing from 10.80% in 1991-2011 and 33.94 percent in 2001-2011. Similarly, jowar (13.34%), bajara (11.59%), tur (1.27%), mug (1.62%), gram (9.64%), groundnut (16.99%), fodder crops (4.11%), and condiments and spices (0.70%) area are decreases from village Tamaswadi. Moreover, wheat (15.38%), maize (19.06%), soybeen (12.51%), leafy vegetables (7.35%), grapes (0.19%), pomegranate (0.72%), have increased in the Tamaswadi village. Crop decreasing trends are high in the village because over-irrigation impact also affects the soil quality, fertility, etc. factors. So, a negative problem found in Tamaswadi village.

**6.4 Soil Quality and Fertility:**

The village Tamaswadi is located near the bank of river Godavari in the plain region. Area converted less than a 2 percent slope. The soil is alluvial type. The Tamaswadi village around 86 percent of areas is irrigated. Therefore, irrigation is highly obelized of this village. The village Tamaswadi pH range from 9.12; this indicates the very strong alkaline conditions of the soil. The electrical conductivity (EC) range 2.01 mmhos/cm, which indicates the injurious category soil. Remaining all parameters of the soil i.e. organic carbon (0.66%) is very considerable, which

ultimately shows the effect of crop yield. Organic matter increases water-holding capacity. The proportion of nitrogen (154.92 kg/ha) is high, potassium (350.20 kg/ha) are high and phosphorous (18.20 kg/ha) is moderate.

Therefore, the above information and interpretation indicate that the area is characterized by the saline condition and raising the water table. Because the landowner/farmers supply over irrigation for sugarcane area, excess salty water of wells, heavy application of fertilizers to the farms. During the time of filed visits, it is observed that this area also has salty water wells. The farmers are also supplied this water for sugarcane cultivation area. The formations of salts in the root zone hamper crop growth and its low productivity. Over irrigation seems to be the primary cause of this problem, and the draining condition of the soil is inferior. Therefore, it has been observed that in the present study, area irrigation practices are high, but only in the southern part of the study region soil degradation area is continuously increasing. In the last three decades, 8.91% sugarcane area has been converted to the saline as well as the water logging area (Figure 2).

Table 2: Soil Sample Data in Tamaswadi Village (2011)

| Sr. No. | Soil Properties | 2011 |
|---|---|---|
| 1 | pH | 9.12 |
| 2 | Electrical Conductivity (EC) in mmhos/cm | 2.01 |
| 3 | Organic Carbon in % | 0.66 |
| 4 | Nitrogen (N) in kg/ha | 154.92 |
| 5 | Phosphorous (P) in kg/ha | 18.20 |
| 6 | Potassium (K) in kg/ha | 350.20 |

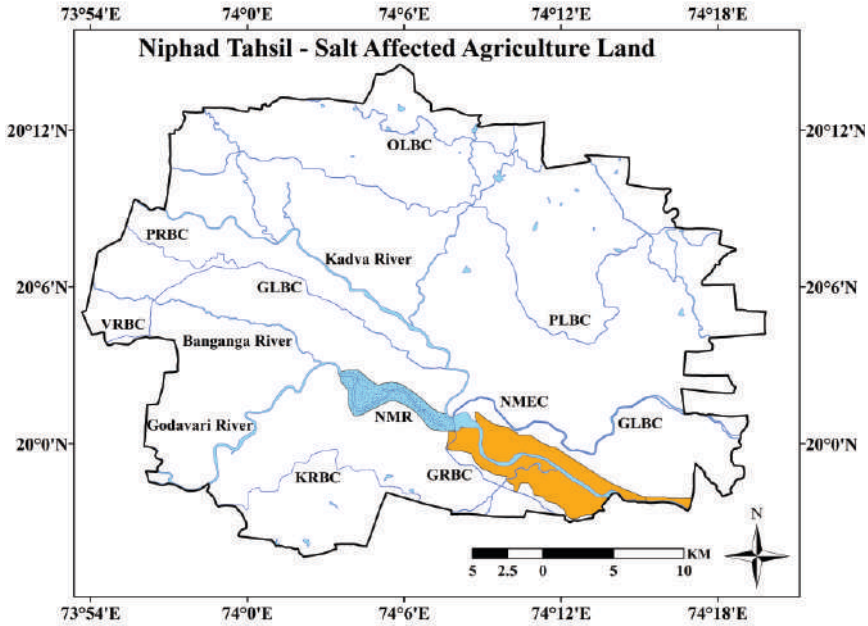


Figure 2: Salt Affected Agriculture Land

**1. Problems of the Village:**

The authors have observed the following problems encountered by the villagers of Tamaswadi.

- The village has availability of abundant water resources through the Nandur Madhmeshwar reservoir, Godavari river, and Godavari left bank canal (GLBC); therefore, irrigation practices are high.
- In the village Tamaswadi in the time of the filed survey, the salty water wells were observed farmers use this water for agriculture.
- Sugarcane area is high, but most of the area has been converted to saline as well as the waterlogged area.
- The entire village has a pH range from 8.00 to 9.12.
- The entire village's electrical conductivity (EC) ranges from 1.50 to 2.01 mmhos/cm.
- Salinization and waterlogging area are high.
- Farmers over use the fertilizers in the agriculture field.
- The entire village NPK status is medium to high percent.
- The irrigation trend in the last two decades is decreasing in this village.
- Net Sown Area (NSA) is high, but fallow land is also increasing from year to year.

**2. Suggestions:**

1. For the protection of land in irrigated areas, modern techniques should be used, namely drip, sprinkler irrigation, etc.
2. Salinization can be controlled by minimizing the area under sugarcane.
3. Biofertilizers should be increased for the fertility of soils; farmers should use them for the crops, and reduce the use of chemical fertilizers.
4. Crop rotation
5. Open trenches concerning slopes, draining salts.
6. To achieve rural development, the farmers should have sustainable income, and for this, the planning of short, medium, and long duration crop system is necessary.

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