

Assessment of Adverse Environmental Impactson the Environment: A Case of Plachimada

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Abstract:

The research study "Assessment of Adverse Environmental Impacts on the Environment: A Case Study of Plachimada" investigates the environmental consequences of industrial activities in the region. Focusing on the Plachimada region, which has been historically affected by intensive commercial exploitation of groundwater and hazardous waste disposal, the study seeks to comprehend the extent of damage caused to the environment and the surrounding communities.

This research serves as a valuable resource for policymakers, environmentalists, and stakeholders seeking to comprehend and address the adverse environmental impacts of industrial activities in vulnerable regions like Plachimada. It underscores the urgency of adopting a holistic and participatory approach towards sustainable development that safeguards both the environment and the well-being of affected communities.

Keywords —agriculture ; crops; environment

Introduction

Agriculture practiced all over the world for hundreds of years and still practiced worldwide. and feeding numerous people all over the world.

The term Agriculture is derived from two Latin words ager or Agri meaning soil and culture or Cultus meaning cultivation. Agriculture is an applied science that encompasses all aspects of crop production including horticulture, livestock rearing, fisheries, forestry, etc.

The definition goes as-

As a science: Utilizes all technologies developed on scientific principles such as crop breeding, production techniques, crop protection, economics etc. to maximize the yield and profit. For example, new crops and varieties developed by hybridization, Transgenic crop varieties resistant to pests and diseases, hybrids in each crop, high fertilizer responsive varieties, water management, herbicides

to control weeds, use of biocontrol agents to combat pests and diseases, etc.

As the business - aims at maximum net return through the management of land labor, water, and capital, employing the knowledge of various sciences for the production of food, feed, fibre and fuel. In recent years, agriculture is commercialized to run as a business through mechanization.

As art - It embraces knowledge of the way to perform the operations of the farm in a skillful manner, but does not necessarily include an understanding of the principles underlying the farm practices. (Raghvendra Singh. Dr. Vipul Singh, 2019)

Importance of Agriculture sector at the Global level

Healthy, sustainable, and inclusive food systems are critical to achieving the world's development goals. Agricultural development is one of the most powerful tools to end extreme poverty, boost shared

prosperity, and feed a projected 9.7 billion people by 2050. Growth in the agriculture sector is two to four times more effective in raising incomes among the poorest compared to other sectors. The demand for food is increasing today due to the increased scale of the urban population, which reflects the importance of agriculture at any level. (The world bank, 2022)

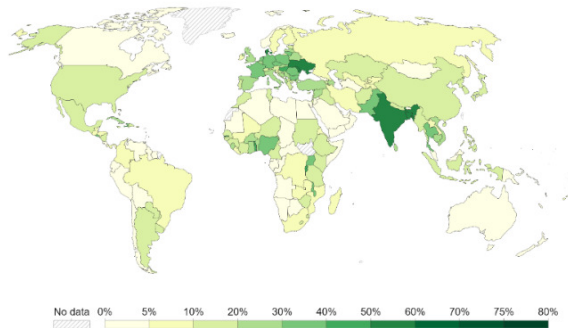


Figure 1 Shared arid area for agriculture, 2018.Source : Food and Agriculture Organization of the United Nation

Here shows the percentage of arid areas shared by agriculture, where the India holds more than 75% area for agriculture. Which reflects that the almost half of the population depends on the agriculture.

Agriculture in Indian context

India holds 2nd largest production in crop cultivation. The Indian civilization has always been agrarian. Right from the Vedic Saraswati civilization to the modern time and in agriculture for food and economy, is centuries-old story and still goes on and for the future too. Today India has agriculture practices as in modern and traditional methods. It not only contributes in the food section, in the economy section too.

(<https://iasbaba.com/2022/12/paddy-plantation-in-india>, 2022)

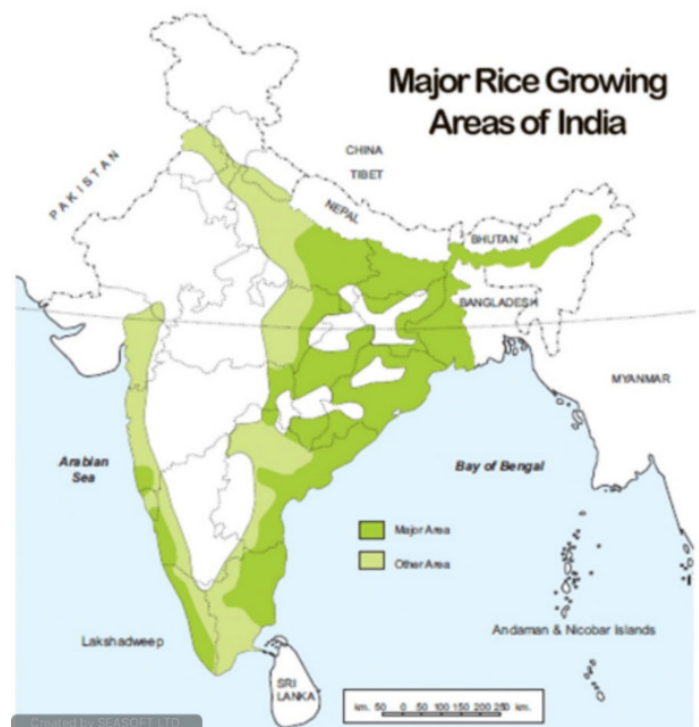


Figure 2 source -<https://iasbaba.com/2022/12/paddy-plantation-in-india>

According 2021 statistics Kerala has top 10 position in agriculture crop production.

Agriculture at Kerala context

The major products based on agriculture are exported from Kerala. Kerala has a major role in the agriculture sector in India.

Agricultural sector as an occupation it supports more than half of the population in Kerala, where

the 31,253 km² in 38,852 km² area of Kerala belongs to the rural area of Kerala. So, in the economic vice and social sector agriculture has a major role.

agriculture to urban service mainly for profit and stable profit.

In Kerala Palakkad hold the 1 position in agricultural crop production

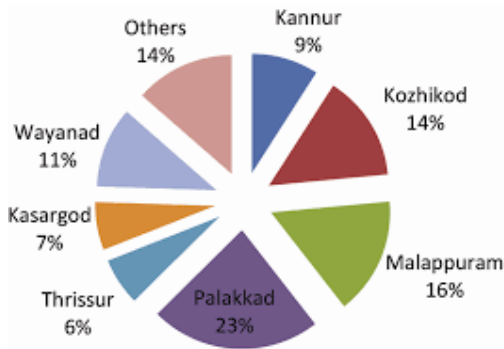


Figure 3 District wise Distribution of area under traditional rice varieties in Kerala, 2010-11. (Source: GoK, Panchayath Level Statistics 2011 for various districts 30 .)

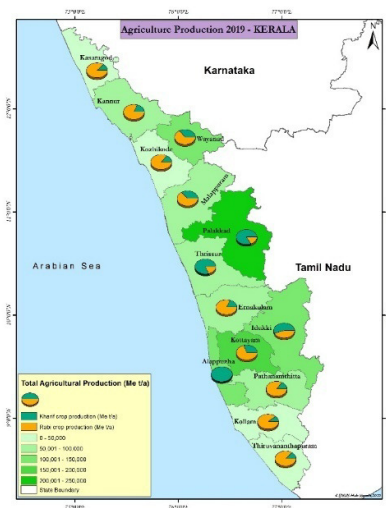


Figure 4 source http://www.kerenvis.nic.in/Database/MAPS_816.aspx

Palakkad is called the rice bowl of Kerala, and Palakkad holds 1st position in the agricultural field. Maybe due to the high scale of rural areas compared to Urban or town areas. Palakkad having almost in the midland and good irrigation and is suitable for agricultural production and growth.

These reasons make almost half of the population practice farming or farming-based jobs. In recent days people have changed their jobs from

Need of agricultural research.

The agricultural sector is in the road to recovery which was a little bit down in statistics for 2 years, even though several obstacles still exist. This makes the production scale go down and a shift in jobs depends on farmers to other jobs, which are more stable. As from Studies and articles in the news states several problems faced by farmers and other agriculture-dependent sectors as such suicide over debt for farmers. loss and stability in profit, and other things make farmers to move on from it, and to find more stable sector.

In rural areas, the agricultural sector is the main employment opportunity. Because of these, agricultural challenges are becoming a big problem in their life, without a livelihood.

(<https://www.fao.org/3/i6583e/i6583e.pdf>, n.d.)

Reasons for challenges -

Lack of profit

Lack of machinery and modern technology

Emergence of urban sprawl

Climatic challenges

Lack of communication between farmers and researcher and retailers

So, an agriculture research hub creates a platform to get together all the sectors that should support agriculture.

Aim

To assess the adverse environmental impacts: Case of the Plachimada region

Objectives

- To analyse the major impacts on crops due to the Plachimada Coca Cola factory.
- To identify crops that got affected due to the impacts that happened to the area.
- To identify the techniques used in agriculture.
- To identify techniques that can be used in the Plachimada region

Plachimada agriculture scenario

In Plachimada, where the rural people or the surrounding villagers homed over 80% of people depends on agriculture. But this scenario became affected by the Hindustan Coca-Cola Beverages Private Limited (HCBPL) factory was set up had been classified as 'arable'. It is natural that an industrial plant with heavy consumption of water set up in a socially and economically backward and drought-prone area would disrupt the ecological balance and adversely affect the life and livelihood of the people.

The Coca-Cola factory situated in an area of around 34 acres of land has been drawing water from 6 bore wells and 2 open wells. There are varying estimates of the factory's demand for water. According to the 2002 report of Dr. R.N. Athavale, a consultant for Coca-Cola, the factory would require at full capacity 6.35 lakh litres per day. The interim report says that the Plant would use roughly 5 lakh liters per day. The wastewater released was to the tune of 1.5 to 3 lakh liters per day. The extraction of over 5 lakh litres of water daily has upset the natural balance and adversely affected the availability of water. Bore wells and shallow open wells dried up. The quality of water deteriorated with reported increase in salinity and hardness of groundwater. The toxic chemicals in the waste water have contaminated the ground water making it unsuitable for irrigation.

The committee has found that the operation of the factory has caused excessive depletion of the groundwater resource. We have also found that it has caused the pollution of the ground water and it will take years to mitigate the pollution.

The factory had impressed upon the peasants that it was good manure. The sludge had no nitrogen content but dangerous levels of cadmium and high levels of lead makes it a hazardous waste. Too much of cadmium in the soil has led to the leaching into the wells. The presence of excess cadmium in the farmland has led to nutrient imbalance in the soil. The farmlands, which had apparently very good soil structure got deteriorated in due course.

Issues identified due to the Coco cola factory
The deterioration in the quality and quantity of groundwater and the consequential public health problems, displacement and migration of labour and the destruction of the agricultural economy are the main problems identified in Plachimada which have been caused and contributed by the Coca Cola Factory. The people living in the vicinity of the Company have been the worst affected.

The general health of the people has been affected with skin ailments, breathing problems and other debilities.

Low birth weight of children has also been noticed. The Coca Cola Company at Plachimada has been causing environmental degradation by over extraction of ground water and irresponsible disposal of the sludge.

By passing off the sludge as manure, the Company has not only misguided the farmers but has become responsible for the soil degradation, water contamination and consequential loss of agriculture. The Grama Panchayat has been providing drinking water in tanker lorries ever since the wells and water bodies have been rendered useless by the Company by its extraction of water and disposal and effluents.

Economical lost (coca-cola-kerala.pdf, 2018)

Plachimada betrayed

E. KRISHNAN L/MAR

Published: Feb 17, 2016 12:30 IST 0 Comments

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PLACHIMADA, KERALA, 02/02/2016: A view of the defunct Coca-Cola unit at Plachimada in Palakkad. Plachimada residents to meet Chief Minister and Opposition leader pressing for a new legislation in the next assembly session on the Coca-Cola Compensation Tribunal Bill. Photo: K. K. Muneer

The Centre and the State government of Kerala seem to be turning their backs on the people of Plachimada as the President denies assent to a Bill that aimed at setting up a tribunal to hear the compensation claims of victims of the local Coca-Cola plant.

Figure 5(Frontline magazine dated Mar 04, 2016.)

Their dispute with Coca-Cola related to its bottling plant drawing 20 lakh litres of groundwater per day. The charge was that the alleged over-drawing depleted groundwater levels causing wells to dry, creating water scarcity and adversely impacting agricultural output and livelihood. The casual disposal of sludge caused health problems for the locals.

Figure 6(www.newindianexpress.com/opinions/2022/sep/15)

People Power Shut Coke Down In Plachimada, But Wells Are Still Dry

Fifteen years after a people's agitation shut down a Coca Cola bottling plant, the water table is yet to recover.

By K.A. Shaji
Jan 22, 2019, 01:09 PM EST | Updated Jan 23, 2019



MAHERBAJ Women in Plachimada walk kilometres every day to get drinking water.

Figure (www.newindianexpress.com/opinions/2022/sep/15)

Water level in Plachimada

Zonation map also indicates that during December 2002, the drop in water level in the phreatic aquifer system was 10.6 – 12 meters in the area. In the north and central parts of the block, the depletion in the groundwater resources was comparatively very less during post monsoon period. This is a clear indication of the exploitation of groundwater by Coca-Cola Company. Water level data for May 2003 has been analysed using GIS tools to get a scenario on the water level during pre-monsoon period. Generated water level zonation map clearly indicates that the maximum depth to water level in the phreatic aquifer was near to the Coca – Cola factory area and the value ranges from 11.4-13 meter below ground level. This also substantiates the over exploitation of ground water by the factory.(Spatial_dimensions_of_land_administratio n_and_user_rights_over_groundwater_case_study_of_Kerala_India_vs_Coca_Cola, 2019)

Pollution rate in soil and water at Plachimada

The water sample collected from a well near a farm where waste was dumped contained 10micrograms/litre of cadmium and 65.7 micrograms/litre of lead (the permissible limit sprescribed by the WHO being three micrograms/litre and 10 micrograms/litre respectively).The permissible manganese level is 0.3, but was 6.18 in the tested sample. Likewise,iron was 1.58 while it should be 1 or less (R, 2006)

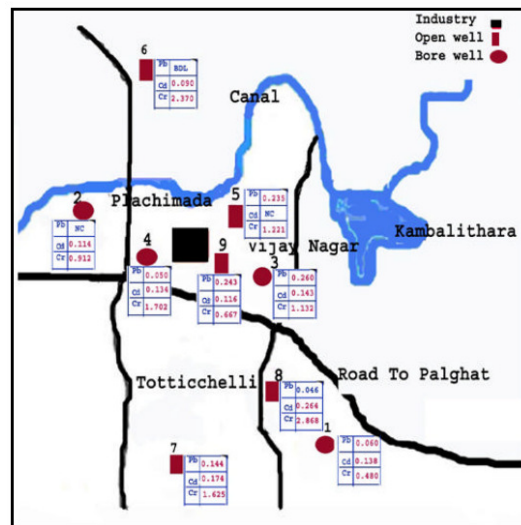


Figure 8 2006 soil cadmium and other metal content in soil in plachimada around industry (source: PlachimadaReportWaterPollution, hazard centre

Common techniques used to replenish agriculture.

Applying fertilizers in the proper amount, at the right time of year, and with the right method can significantly reduce how much fertilizer reaches water bodies.

Adopting Nutrient Management Techniques: Farmers can improve nutrient management practices by applying nutrients (fertilizer and manure) in the right amount, at the

right time of year, with the right method and with the right placement.

Using Conservation Drainage Practices: Subsurface tile drainage is an important practice to manage water movement on and through many soils, typically in the Midwest. Drainage water can carry soluble forms of nitrogen and phosphorus, so strategies are needed to reduce nutrient loads while maintaining adequate drainage for crop production. Conservation drainage describes practices including modifying drainage system design and operation, woodchip bioreactors, saturated buffers, and modifications to the drainage ditch system.

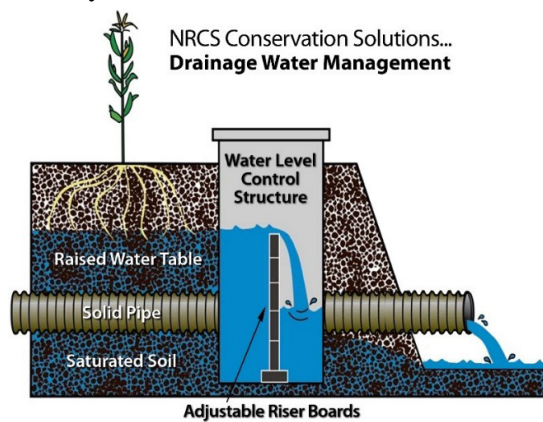


Figure 9 Drainage conservation process (source: USDA NRCS)

Ensuring Year-Round Ground Cover: Farmers can plant cover crops or perennial species⁸ to prevent periods of bare ground on farm fields when the soil (and the soil and nutrients it contains) are most susceptible to erosion and loss into waterways.

Planting Field Buffers: Farmers can plant trees, shrubs and grasses along the edges of fields; this is especially important for a field that borders water bodies. Planted buffers can help prevent nutrient loss from fields by absorbing or filtering out nutrients before they reach a water body.

Implementing Conservation Tillage: Farmers can reduce how often and how intensely the fields are tilled. Doing so can help to improve soil health, and reduce erosion, runoff and soil compaction, and

therefore the chance of nutrients reaching waterways through runoff

Managing Livestock Access to Streams: Farmers and ranchers can install fence along streams, rivers and lakes to block access from animals to help restore stream banks and prevent excess nutrients from entering the water.

Engaging in Watershed Efforts: The collaboration of a wide range of people, stakeholders and organizations across an entire watershed is vital to reducing nutrient pollution to our water and air. Farmers can play an important leadership role in these efforts when they get involved and engage with their state governments, farm organizations, conservation groups, educational institutions, non-profit organizations, and community groups. (<https://www.epa.gov>, n.d.) Techniques used for agriculture that has similar problems as Plachimada

The mechanisms leading to Cd toxicity in plants can be distinguished into two strategies, i.e., tolerance and avoidance. The avoidance strategy includes limiting the uptake of Cd into the plant. The tolerance mechanism in plants includes storing and accumulation of Cd by binding it to peptides, amino acids, and proteins. Strategies to deal with the toxicity of Cd involve the distribution and uptake of Cd and are known as hyperaccumulation). Similarly, other plants improved antioxidant activity against ROS to protect tissues and cells from Cd destruction (Henry, 2021)

Hyperaccumulation plants - Certain species classified as hyper accumulators are vegetable-mostly leafy vegetables such as spinach, lettuce and cabbage etc. (M.S. Danjuma, 2018)

Lime, biochar, organic wastes, phosphorus fertilizers, sepiolite, zeolite, hydroxyapatite and bentonite are commonly used amendments for amelioration of Cd contaminated soils. These amendments reduce Cd uptake and enhance immobilization by adsorption, complexation, and precipitation processes. The putative role of Fe-Si-Ca, organic fertilizers, and coconut shell biochar has been reported to enhance the Phyto stabilization ability of *Boehmeria nivea* L. for Cd (Res, 2020)

Agriculture technique in water depletion area –

Vertical farms can reduce transportation costs and the related environmental impacts because they localize operations. This allows farmers in San Diego, for example, to supply produce to regional customers rather than trucking in produce from farmers in California's Central Valley. Localized farming also reduces fuel consumption, increases freshness and reduces spoilage.

The cost profiles for indoor farming are similar to traditional methods. As water scarcity and associated costs continue to rise, indoor operations will likely become more attractive. The infrastructure for controlled indoor grow environments is easily adapted to existing structures like warehouses, and they're also suitable for urban environments. (Technology Can Help Farmers Survive The Water Crisis In The West, , 2022)

Wastewater recycling using phytoremediation and other methods.

Aquaponics is the integration of hydroponics with aquaculture in a recirculating system. The wastes and metabolites produced by cultured fish are removed by nitrification and taken up by the plants, while the bacteria living in the gravel and in association with the plant roots play a critical role in nutrient removal



Figure 10 Growing plants with tilapia in an aquaponic system is an effective way of removing nutrients from culture water

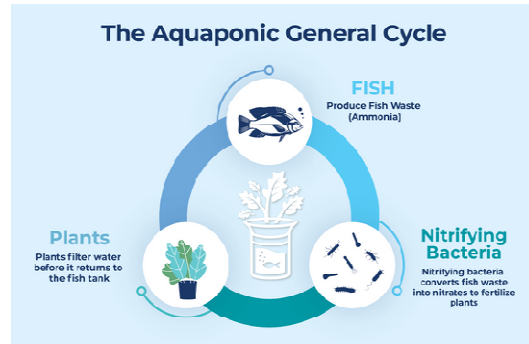


Figure 11 source <https://gogreenaquaponics.com>

Findings

Plachimada is a good area that comprises of much problems as the Coco cola factory started functioning. Including the agricultural practice depletion and effected on crops and environmental effect. That leads to health problems.

The major problems arise in that situations are metal contend in the soil and water increased. Mainly Cadmium which may lead to cancer and other diseases, where the rice type of crops can absorb much of this substance, which makes it problematic. And the other one is the water depletion. As far as we look into it, that it effects majorly the environment, agriculture and the economic situation in Plachimada where the sectors are linked to one another, which meant by that this area are under rural situation where the most of the population is depends on the agriculture sector.

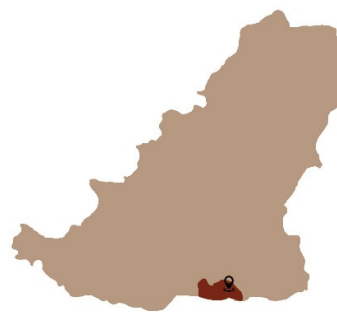


Figure 12 Shows the area effected by Coco cola factory : Plachomada Map



Major solution can be used in and around coca cola factory areas are

Phytoremediation, Transformation of heavy metals from an unavailable to available form is an important factor that decides the fate of phytoremediation.

Phytoremediation plant species

Plant Species	Genes	Phytoremediation Activity
<i>Indian mustard</i>	γ -glutamylcysteine synthetase (γ -ECS)	Higher phytochelatin production directly enhanced the Cd phytoremediation capacity of transgenic plants
<i>Oryza sativa</i>	<i>OsHMA3</i>	Keep the Cd at roots via sequestering into root vacuoles
<i>Solanum lycopersicum</i>	<i>FER</i>	<i>FER</i> lack of function mutant indirectly impaired the Cd translocation from root to aerial parts
<i>Arabidopsis</i>	<i>NRT1.1</i>	Controlled the uptake of Cd in roots

Plant Species	Genes	Phytoremediation Activity
<i>Arabidopsis</i>	<i>AtHMA4</i>	Better root to shoot translocation of Cd
<i>Arabidopsis</i>	<i>AtBCC3</i>	Facilitated the Cd phytoremediation in <i>Arabidopsis</i> by enhancing the chelation properties
<i>Oryza sativa</i>	<i>OsHMA3</i>	Loss-of-function enhanced root-shoot Cd translocation
<i>Arabidopsis</i>	<i>AtFC1</i>	Increased in the accumulation of Cd was observed
<i>Arabidopsis</i>	<i>AtPDF2.5, AtPDF2.6</i>	Improved the Cd tolerance accumulation in shoot
<i>Arabidopsis</i>	<i>CAL2</i>	Hastened the Cd accumulation in shoots
<i>Arabidopsis</i>	<i>BTS</i>	<i>BTS</i> lack of function mutant enhanced the Cd accumulative characteristics of <i>Arabidopsis</i> plants

Using this method not only cd can be reduced from the soil also used for recycling grey water from households.

some of the cheaper and more practical solutions to save water are drip irrigation systems, which use

frequent irrigation in small, targeted amounts. These systems consist of digging pipes underground and opening tiny holes in the pipes near the roots of the plants, ensuring minimal water is lost to evaporation in the air.

CONCLUSION

- making the safe and adequate water. In the exercise of this authority, the gram Sabhashall reasonably restrict the use of groundwater and minor water bodies to ensure the safety and adequacy of water. The gram sabha shall have the authority to take necessary steps and penalize the violators that threaten the quality and quantity of water resources. (R, 2006)
- Dry-season crop planning for a specific area depends on the aquifer type, groundwater extraction, monsoonal rainfall and the water table level. This would include some degree of shift towards higher-value and less-water consumption crops.
- Adoption of modern precision irrigation technologies such as drip and sprinkler systems will help reduce evaporation and other non-beneficial, non-recoverable fractions of water use in agriculture.
- Restrictions to control groundwater abstraction or use through regulatory measures. These may include restricting the depth of irrigation water wells and establishing and enforcing minimum distances between irrigation.

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