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**STUDY ABOUT IMPACTS
ANALYSIS OF GREEN REVOLUTION IN
PURI DISTRICT IN ORISSA**





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INTRODUCTION

The situation in Orissa is very different than in others states of India. Actually, Orissa is one of states the most poor of India. The economy of this state is dependant of Agriculture. Indeed, 85% of the population lives on Agriculture. However, about 52.25% of farmers in Orissa are small and marginal. It is known that 70% of population in India depends on Agriculture.

So about Agriculture pollution, the situation in Orissa is very different also than in other states. The population is poorer, so these farmers use less pesticides and fertilizers than in other states of India. Yields of Orissa are very low than in other states. This state is less polluted than other states but some parts of this state are polluted. Actually, this state splits in 30 districts. Lots of these districts are not polluted. We notice some pollution in about 10 districts in Orissa: Bargarh, Jharsuguda, Sambalpur, Ganjam, Puri, Jagatsingpur, Kendrapada, Bhadrak, Baleshwar and Cuttack. We can observe two polluted areas: one in the central table land of state and the other in the coastal areas. We can ask for why?

Actually in the coastal, people are richer than in other parts of Orissa. So farmers use more pesticides and chemical fertilizers. In others districts of Orissa (Except the little part of west), farmers use less or not use pesticides and chemicals fertilizers, these areas are not polluted by agriculture. My study is going target in a specific area. I am going to point my seeking in one coastal area, Puri district, because is the main problem in Orissa and there is no industry in this area, so pollution come from only Agriculture or Housework. Besides, in Orissa, pesticides and chemical fertilizers are applied only in paddy fields and mostly in vegetable crops. So, I am going to point my seeking in paddy fields and in vegetable crops.

In this specific area, firstly, I am going to discuss about Agriculture in Puri district. Secondly, I am going to study impacts of pesticides and chemical fertilizers on the soils. In a third time, I am going to study impacts on the water and in the last time impacts on the biodiversity with notably use of HYV seeds.



1. PURI DISTRICT

In Puri district farmers brought chemical products in their lands, 40 years ago. This contribution started during the Green Revolution in India.

1. Before the colonization

Before the colonization, Agriculture in India was doing in a good way. Farmers practiced a subsidiary agriculture. Farmers used traditional seeds.

→ *Lands were fertile.*

2. During the colonization

The colonization has distracted this stability. The settler had escalated and impoverished crops. Lands started to become infertile. And the colonization had to get in scarcities in India notably in 1966.

→ *These scarcities did lots of death.*

3. The decolonization

So after the colonization, the aim of India was to come through to feed all the population. The Green revolution started. Agriculture in India developed on the western model. Farmers in Puri district started to use more and more chemical products.

In first time, these contributions allowed feed plants and got better yields. But, now, the effects of Green Revolution in India are arriving. The Green Revolution has seriously degraded Environment and Farming in Puri district. All the areas where farmers use these products, lands impoverish

and the structure of soil degrades. So, farmers have to use bigger quantity of chemical products than before.

Thereby, in Orissa, the consumption of fertilizer was 35.51kg per hectare in 1998-1999 and this consumption had become 41kg per hectare in 2001-2002. So, the consumption has increased to 13% in two years.

Lands ask more and more nutrients, costs of production increase more and more. Farmers are already poor, they have to take loans.

→ *Farmers in Orissa are in precarious situations.*

4. Orissa: the smallest consumer of fertilizer in India.

The consumption of fertilizers in Orissa is very low in comparison to other states. For example, in 2001-2002, in Orissa, farmers put about 35.55 kg fertilizers per hectare and in Andhra Pradesh 143.46 per hectare, in Bihar 87.39kg, in West Bengal 126.87 per hectare, in Karnataka 101.48kg per hectare and in Punjab 173.38kg per hectare.

But in Orissa, only some districts use fertilizers. So, in average the number is not high but some areas are polluted by agriculture. Actually, in Puri district, 33kg per hectare are applied. The number is very low in comparison to the national average. But, in Puri district fertilizers are applied only in the small parts. So average consumption of fertilizer in Puri district is less.

Even though rice is the single most agricultural production of the state, the yield rate of rice is much lower than many states. The yield rates of rice for Orissa stood at 1210kg per hectare in 1998-1999, for Bihar, 2260kg, for West Bengal, 2780kg, 2530kg for Andhra Pradesh, 2240 for Haryana, 3150kg for Punjab. Such low yield for Orissa is mostly due to scanty use of fertilizer, organic manure and inadequate crop protection.

Since the use of fertilizers and pesticides is very low and agriculture is largely subsistence, no serious pollution problem due to modern agriculture has been observed.

→ *But there is saline water ingress to agriculture land in some coastal district, so in Puri district.*

5. The climate, group soil

Orissa contains ten Agro-Climatic Zones and Puri district belongs to **North eastern coastal plateau**. These coastal areas can be divided in 3 zones, Puri district is in alluvial plain. In this zone, the climate is hot, moist and sub-humid. However, soils are alluvial.

The soil condition in Orissa is typical, consisting primarily of red loam and red sandy soil and mixed red and yellow soil that hardly has any moisture retaining capacity. Further in view of the light texture such lands are easily erodable. The soil require huge amount of manure/fertilizer which is cost intensive.

→ *Orissa's soil are poor in organic matter and nitrogen content and respond linearly in production to nitrogen application, quadruplicate to phosphorous application, favorably to potassium and other nutrients.*

6. Crops

Of the total cropped area rice (water intensive crop) commands more than 75%. Kharif crop is dominated by rice. Farmers diversify the cropping pattern to some extent during the Rabi crop.

Orissa is not self sufficient in fruits and production of flowers. However, vegetable production over the years has increased and the state in favorable situation. The per capita vegetable consumption is around 540g/day, higher than the national average.

→ *There is string potential to increase production to make the State sustainable in cereals, pulses, oil seeds and fruit production.*

7. The irrigation

In Orissa, 3.65 million hectares is irrigated. The distribution of irrigation facilities is not uniform in all the districts. The coastal districts are more irrigation facilities than other districts which are mostly rainfed. The coastal areas receive 51.3% of irrigation, so 1.87 million hectares is irrigated.

There is urgent need for providing irrigation facilities, to encourage crop diversification and cultivation of flowers and fodders.

8. The activities

In Puri district there is 157 649 cultivators, 112 887 agricultural labourers, 0 mining workers, 13 528 household industry, 402 industry other than household and 166 444 in other services.

So in comparison to other districts of this state, this district has not industry. All the people work in agriculture, in their household or in services. This state is polluted. And sources of pollution come from only of agriculture or households.

→ *Actually here is more easy to study the pollution come from agriculture because there is no industry or very low.*



2. IMPACTS ON THE SOIL

Out of the geographical area of 155.707 lakh hectares, the total cultivated comes to 60 lakh hectares. The cultivated area was 63.04 lakh hectares in 1990 and in 2001 it was 56.80 lakh ha. The cultivated area has been reduced to 9.8%.

We don't forget that the soil has not to be only as a support for crops but the soil has to be a life milieu. Use of chemical fertilizers and pesticides are very bad for the soil and this structure.

1. Healthy soil

Healthy soil is a combination of mineral, rock, water, air, organic matter (plant and animal residue), microorganism, including bacteria, fungi and protozoa and a variety of insects and worms. This intricate web carries out a process that continually replenishes the soil and maintains long-term soil fertility. Soil health is the net result of on-going conservation and degradation processes, depending highly on the biological component of the soil ecosystem, and influences plant health, environmental health, food safety and quality. Healthy soil will have about 24% air, 25% water, 45% minerals, 3-5% humus, and up to 1% living organism.

The soil has to promote the quality of air and water environments, and maintains plant, animal and human health.

2. Eutrophication

The consumption of fertilizers in Orissa is very low in comparison to other states. For example, in 2001-2002, in Orissa, farmers put about 35.55 kg fertilizers per hectare and in Andhra Pradesh 143.46 per hectare, in Bihar

87.39 kg, in West Bengal 126.87 kg per hectare, in Karnataka 101.48 kg per hectare and in Punjab 173.38 kg per hectare.

But in Orissa the consumption of fertilizer is concentrated only in some part of state. Those parts are polluted. Nevertheless, people should be made aware of the serious consequences of unscientific use of chemical fertilizers and toxic pesticide encouraged using more bio-fertilizers and bio-pesticides.

3. Decreasing of microorganisms number

Usually between one and ten million microorganisms are present per gram of soil with bacteria and fungi being the most prevalent. However, the availability of nutrients is often limiting for microbial growth in soil and most soil microorganisms may not be physiologically active in the soil at a given time. Soil microorganisms are very important as almost every chemical transformation taking place in soil involves active contribution from soil microorganisms.

Microorganisms are key players in the cycling of nitrogen, sulphur, and phosphorus, and the decomposition of organic residues. Thereby they affect nutrient and carbon cycling on a global scale. The energy input in the soil ecosystems is derived from the microbial decomposition of dead plant and animal organic matter. The organic residues are, in this way, converted to biomass or mineralized to CO₂, H₂O, mineral nitrogen, phosphorus and other nutrients. Mineral nutrients immobilized in microbial biomass are subsequently released when microbes are grazed by microvores such as protozoa and nematodes. However, the effect on nutrients cycling, microorganisms also affect the physical properties of soil. Production of extra-cellular polysaccharides and other cellular debris by microorganism help in maintaining soil structure, as these materials function as cementing agents that stabilize soil aggregates. They also affect **water holding capacity, infiltration rate, crusting, erodibility and susceptibility to compaction.**

Soil microorganisms can be differentiated as beneficial or harmful according to their functions and how they affect soil quality, plant growth and yield, and plant health.

The beneficial microorganisms can do fixation of atmospheric nitrogen, decomposition of organic wastes and residues crop, recycling and increased availability of plant nutrients, production of simple organic molecules for plant uptake, complexation of heavy metals to plant uptake, solubilization of insoluble nutrient sources, and production of polysaccharides to improve soil aggregation.

The harmful microorganisms can induce plant diseases, immobilization of plant nutrients, inhibition of seed germination, inhibition of plant growth and development, production of phytotoxic substances.

Microorganisms respond quickly to changes, hence they rapidly adapt to environmental conditions. So microorganisms possess the ability to give an integrated measure of soil health. Changes in microbial populations or activity can precede detectable changes in soil physical and chemical properties, thereby providing an early sign of soil improvement or an early warning of soil degradation.

4. Waterlogged areas: Salination and alkalization

In Puri district, use of chemical fertilizer is mainly concentrated in coastal plains for growing High Yielding Variety rice has created concern in terms of increased soil salinity. Puri has problems drainage in the irrigation area during the monsoon.

5. Loss of fertility of soil

For example, in Orissa, some numbers show the degradations of soil.

- Total cultivated area = 72,085 sq km
- Well-protected irrigated area = 18,450 sq km → 25.6%
- Eroded land under agriculture = 43,360 sq km → 60.15%

- **Water logged area** = 995 sq km → 1.38%
- **Salt affected area** = 2541 sq km → 3.52%

Using chemical fertilizer is very dangerous. In Puri district farmers are starting to see the impacts of this use. Today, yields follows increasing more and more so there is necessity to put chemical fertilizers more and more too. While greater use of chemical fertilizer increases yield, it has serious effects on soil and future fertility of land.



3. IMPACTS ON THE WATER

Agriculture is the largest consumer of freshwater. An average 1000L of water required to produce 1kg wheat and 3000 to 5000L of water required to produce 1kg of rice. About 50 to 60% of the water resources are used for Irrigation purpose.

In 2001, there was 2051 million cum of surface water and 2051 million cum of ground water. The average annual rainfall in Orissa is more than 1482mm and 80% of this happens during June to September.

But 80% of the rainfall is carried to the Ocean as surface run off and adequate storage facilities have not been developed.

1. Eutrophication: Proliferation of fresh water weed and other invasive species

The streaming in the cropland contains high concentrations of nitrogen and phosphorus compounds, which are essential nutrients for growth of plants and algae. But excess nitrogen and phosphorus can stimulate rapid

growth of algae, which lead to eutrophic condition: leading to hypoxia (dangerously low oxygen levels) or anoxia (absence of oxygen).

2. Waterlogged area

Water logging occurs due to steady rise of ground water table after introduction of irrigated agriculture without adequate drainage. In Puri district, the water logged areas have estimated by various agencies as **National Commission on Agriculture in 1976, Ministry of Agriculture and Orissa Remote Sensing Application Centre (ORSAC) in 1993.**

So, In Puri district, the average of waterlogged areas is 14 thousand hectares, it is very big number. Puri district is the district who there is the most waterlogged areas in Orissa after Cuttack with 31.4 thousand hectares. So, for example, in Balasore it is 6.3 thousand hectares, in Bolangie it is 3.4 thousand hectares, in Dhenkanal it is 0.9, in Ganjam it is 5.9, in Kalahandi it is 6.3, in Keonjhar it is 1.0, in Koraput it is 3.8, in Mayurbhanj it is 1.2, in Phulbani it is 1.1, in Sambalpur it is 7.7, in Sundergrah it is 1.8. With a total of waterlogged in Orissa who is 84.8 thousand ha. So Puri district have 16% of waterlogged areas in Orissa and Cuttack 37%.

The worst effect of waterlogged areas is the development of salinity. Salinity arises because of upward movement of soluble salts in the soil. This is caused due to concentration of chlorides and sulphates of sodium, calcium and magnesium in soil at a level that would affect the plant growth.

One the worst affected area due to drainage congestion and resulting loss of agricultural command is in Mahanadi Delta. It is estimated that out of 3.03 lakh ha irrigated area in Mahanadi delta, about 1 lakh ha out of command due to drainage congestion.

3. Salinity of water

A considerable area of about 5.39 lakh hectares of the coastal alluvial tract is beset with salinity hazard. In a narrow tract it starts from Chandereswar in Balasore district in the north east and extends upto Brahmagiri in Puri district.

So the pattern of Saline aquifers in Puri district extends in 11 blocks: Astargn, Brahmagiri, Delang, Gop, Katatpur, Kanas, Khrushnaprasad, Nimarapa, Pipli, Puri and Satyabadi.

Puri district is one of most affected in Orissa for saline aquifers. So fresh water overlying saline water is prominent in Puri district and Saline water at all depths unto 600m is conspicuous in Puri district.

4. Surface water: Nitrogen discharge in a surface water.

In Puri district, the average of rainfall is 1300mm. Puri district is in Mahanadi delta and is crossed by lots of rivers as Daya, Bhargavi, Devi, Kushabhadra. Knowing that Mahanadi river represents 42.15% of basin area.

Some studies and estimation had done on the consumption of surface water in Orissa. 70 000 million CM of surface water are available in Orissa. In 2001, 40 504 million cum are used, so 58%. Knowing, agriculture used 18 000 million cum of this water, so 25%. And in 2051, if nothing alter, 64 152 million cum of surface water are used, so 92% of surface water. Knowing, agriculture used 40000, so 57%

5. Groundwater: contamination of groundwater from pesticides and nitrate

In Orissa, the hydrological parameters are conducive for steady replenishment of ground water. Groundwater utilization is of about 14.8%. But saline aquifers occur in some coastal alluvial track as Puri district. Orissa has an annually replenishable ground water resource of 21.01,128 hectares-metre (HM) and 60% of it is considered as safe use.

In one years, in Puri district, the groundwater resource assessed is 88 348 HM. The utilizable resource for domestic and Industrial use is 3187. And 4431 HM is used for for irrigation, 6470 HM for all uses. So Puri

district use only 7.32% of your ground water. Knowing in Bhadrak and Balasore district, the utilization of ground water is about 40%.

The ground water in Orissa is generally slightly alkaline. In the consolidated and semi-consolidated formations, the quality of ground water is generally fresh and is suitable for all types of uses including drinking.

However, the ground water in shallow aquifers in general is suitable for irrigation and other purposes.

But in coastal tracks, sea water ingress and tidal incursions have contaminated the ground water. The depth wise hydro chemical quality profile is also non-uniform. This is due to a variety of situations that has evolved depending upon the nature of sediments, aquifers properties, fresh water head and hydrology of the basin. Complexity of situation arises due to non homogeneity of aquifer resulting in penetration of sea water wedge into the coastal track. All the properties play a vital role in the hydrological regime.

So, aquifers in Puri district depends to:

- Permeability
- Porosity
- Hence water holding
- Water yielding capacity of aquifers

6. Quality of water

In India, water quality is usually assessed in respect of the following five broad categories.

Class A - Drinking water source without conventional treatment, but after disinfection.

Class B - Organised outdoor bathing.

Class C - Drinking water source with conventional treatment followed by disinfections.

Class D - Fish culture and wildlife propagation.

Class E - Irrigation, Industrial cooling or Controlled Waste Disposal.

7. Quality of water river Mahanadi

Some studies and estimation had done on the consumption of surface water in Orissa too. 21 000 million cum of surface water are available in Orissa. In 2001, 14 486 million cum are used, so 68%. Knowing, agriculture used 4688 million cum of this water, so 22%. And in 2051, if nothing alter, 20 011 million cum of surface water are used, so 95% of surface water. Knowing, agriculture used 9408 million cum, so 45%.

The situation is alarming and the requirement of water for agriculture increase more and more and faster than other disciplines as use domestic, use industry. Management of water and agriculture is essential in Orissa to get a suitable development. Now, Orissa is leading towards a crisis, "**crisis of available water**" and towards a failure.

When Mahanadi river arrives in Cuttack district, this river arrives in the delta and this delta region is characterized by high population density and intense agriculture activity. Hence there is some deterioration in the quality of water entering into Cuttack, particularly in respect of total Coliform.

The quality of river before Cuttack was **Class B** and in Cuttack this quality become **Class C**. Within the city, the river receives considerable quantity of untreated wastewater and the water quality gets deteriorated up to a distance of about 2km down stream of Cuttack, after which it starts showing improvement.

Access to safe drinking water is to be augmented. There is urgent need is to manage water resource to achieve sustainability. Though the status of water resources in Orissa is reasonable good, it requires constant monitoring and efficient management.

In Puri district, there is 117 523.75 hectare of wetlands. So, 63% of coastal wetland in Orissa and 34% of all the wetlands in Orissa.



LOSS OF BIODIVERSITY

Biodiversity is defined as the variability among living organisms and include diversity within species, between species and of ecosystems. The ecosystem covers a dynamic complex of plant, animal and microorganism communities, and there are non-living environment interacting as a functional unit found in large numbers of soil.

1. Impact about estuaries: Mahanadi estuary in Puri district

Puri district is in alluvial plain and in the delta of Mahanadi river. A delta is an estuary. An estuary is an area where fresh water meets salt water, such as a bay, the mouth of a river. Estuaries are among the most productive ecosystems in nature. Estuaries maintain exceptionally high levels of biological productivity and play important ecological roles including: exporting nutrients and organic materials to outside waters through tidal circulation. Estuaries are transition zones between rivers and the sea and provide habitat for a unique assortment of plants and animals.

Rivers bring silt and nutrients to the estuary in varying quantity. Estuaries serve as good nurseries because they offer protection from most marine predators, and the rich food supplies from the estuarine food web favours rapid growth of the juveniles. The health of estuaries depends of the quantity, quality and timing of fresh water input.

- Chemical fertilizer → toxicity: Pesticides, herbicides and other nutrients in form of fertilizer can pollute a river flowing through cropland.

- Erosion of soil → closure of the river mouth: The land degradation in the river basin can lead to excessive silt load in the river water. The excessive silt load may tend to closure of the river mouth.

- The irrigation → Alteration of flow: Damming of rivers and the use of water for irrigation can lead to alteration of freshwater flow in to the estuary, which can adversely affect the integrity of the estuarine ecosystem.

Impacts of the Mahanadi estuary in Puri district

Mahanadi estuary is considered as most polluted one and is still under potential threat from the future industrial expansion.

Chemical fertilizers: This estuary receives effluents from 2 phosphatic fertilizer plants: Paradeep Phosphate Limited and IFFCO. Actually, Mahanadi estuary shows higher concentrations of inorganic phosphate and total phosphorous in comparison to other estuary in Orissa. The low pH and high phosphorus content of the Mahanadi estuarine water indicates the influx of acidic effluents from the phosphatic fertilizer plants situated in the estuarine region. This has a far-reaching impact on the biota of the estuary, the spawning and the migration of the fish, shrimp and crab.

Alteration of flow: Due to the alteration of the flow and the pollution of the estuary the migration of the catadromous fish like *Hilsha ilisha* is adversely affected. IFFCO Ltd. is another phosphatic fertilizer plants manufacturing diammonium phosphate with installed capacity of 1,60,000 MT/month.

2. Deforestation

Pressure on forest area by grazing lands.

The natural regeneration in many forests is poor due to forest fire. Intense grazing, invasion of exotic species and loss of endemic flora and fauna are problems.

→ *There is urgent need of a germplasm bank to keep the wild crop species and other wild species for future requirement.*

3. Livestock

The distribution of livestock is not uniform in Orissa, the concentration is maximum in the coastal district, so in Puri district.

Mostly, production of livestock and availabilities of products is increasing. But, the production of milk and eggs stay behind the national level. It is proposed to increase the pig breeding programme and increase too the weights of goats and increase their production. The farmers are being trained for raising fodder in their lands.

4. Fisheries

Fish production in Orissa is lowest among the coastal states though the state has immense potentiality. The state has 480km long shoreline suitable for marine fisheries, which can double the fish production easily.

Orissa is one of the poorest fishery producing states of India. In spite of its long coast line of 480kilometres and continental self area of 15,000 sq. kms. Among the nine maritime states of the country, Orissa's place is sixth in terms of continental self area.

So in 1999-2000, the fish production in Orissa was 261.24 whereas in West Bengal, it was 1045.70, in Maharashtra, it was 533.29, in Kerala, it was 649.40, in Karnataka, it was 24932.30, in Gujarat it was 741.28 and in Andhra Pradesh it was 547.06.

However, in Orissa the consumption of fish per capita has decreased. In 1998-1999 it was 8.23kg per year and in 2002-2003 it was 8.14kg per year. So, this consumption has decreased of 1.1% in two years.

5. Environmental health in Puri district

Environmental health hazards include agriculture contamination of air, water, food and land.

Water pollution - Microbial pollution: An estimated 80% of the diseases and over one third of deaths in developing countries are caused by consumption of contaminated water and on an average one tenth of each persons productive time is sacrificed to water related diseases.

According to present scientific thinking, there is no threshold level which could be considered safe in case of synthetic organics as pesticides. Any amount of the substance ingested contributes to increase in cancer and other serious health problems.

CHILIKA LAKE: Problem with shrimp/prawn ; Construction of shrimp ponds around the Chilika Lake and use of feed material rich in nitrogen and phosphorous have brought algal blooms and depletion of oxygen in Chilika lake.

6. Modification of flow of rivers

In many cases, these modifications have affected the ecological and hydrological services provided by water eco systems, which in turn has increased the vulnerability of people especially the poor, who depend on such services.



BIBLIOGRAPHY

- * **Amis de la terre**, file: *Chronique d'une catastrophe planifiée: suicide en masse de fermiers indiens.*

< <http://www.amisdelaterre.org/Chronique-d-une-catastrophe.html> <http://www.amisdelaterre.org/Chronique-d-une-catastrophe.html> >, consulting the 15/07/08.