

2013



study of "The Effects" due to eutrophication & chemical pesticides in JAMUAARI river, Samastipur north Bihar .

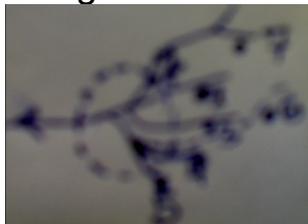
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Abstract-

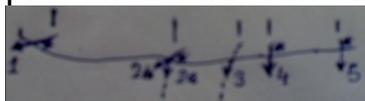
Eutrophication in river is an increase of nutritive factors. Jamuaari is a seasonal river, which is compartmented after end of rainy season. Effects of river eutrophication is seen only in seasonal river, lotic running river hasn't show such effects. Resulted several effects on river system is not only due to nutrient enrichment alone, but combined with planktonic stimulants. pesticides is not specifically targeting the pest only, during their application they also **affect non-target plants and animals**. Repeated application leads to change in ecosystem & **loss of biodiversity**. Jamuaari river is an old route of Budhi Gandak of samastipur, It made old tributary at Indravara (named after Indradyumn Paal) where Ganga, Jamuaari, Balan (Kamla), Baya (with Noon), Bagmati were meeting each together. Now day it is a big reservoir known as Gang Mohan Ghaat.



It was riched with biodiversity mainly birds and wild animals. Now social and cultural impact altered its biodiversity. A number of bird, animal and minute species are disappeared and some are endangered position.



Phosphate rich herbicide and fertillizer makes eutrophic water, which allow to spread water hyacinth and algal bloom. so water course is being shallow per each year, turning of water course in several steps result into present Budhi Gandak.



now eutrophication is enhanced by rapidly seasonal input. it was analyzed through water and soil samples collected from main six sites, which show positive sign of phosphate input and possible impact. A observation made during may 2011 to may 2013 for long term rate and speed of change.



Theory:

a-pH elevate and leach out calcium " $3Ca^{2+} + 2HPO_4 = Ca_3(P_2O_4)_2 + 2H^+$ ".
 PO₄ keep pH high.

b.-HCO₃ presence show load of algal mass and water hyacinth which is degraded by bacteria " $CH_2O + O_2 \rightarrow CO_2 + H_2O$ ".

$CO_2 + H_2O \rightarrow H_2CO_3$.

$H_2CO_3 \rightarrow H^+ + HCO_3^-$. Pesticides are not easily degradable, they **persist in soil and surface water**. Pesticides application results in several effects in the ecosystem, although through direct toxicity or enriched as nutrients (eutrophication).

Introduction -

first warning signals about pesticides effect:

- **In 1962, Rachel Carson**, an American woman and scientist, wrote down her observation and pointed out sudden dying of birds caused by spraying of pesticides (**Silent Spring**).

pesticides has low water solubility and thus potential to **accumulate in** living organisms. They effects both ecosystem and biodiversity.

- Martinique pesticides disaster-

After its **spraying on bananas plantations** (1993-2002). In 2003 men were to develop congenital malformation and birth defects in children.

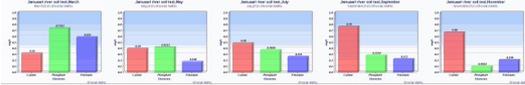
Today we do not have so much early knowledge about possible effects on the biodiversity and ecosystem. Results and Graphics - Effects of pesticides, & eutrophication in different compartments.

- 1. Change of water course- Jamuaari river takes itself different route in different period named as a-Badi jamuaari, b-Chhoti jamuaari |, c-Chhoti jamuaari ||, d-Budhi Gandak.

- **2. Soil contamination**

Pesticides (herbicide) enter the soil via spray treatment, wash-off from treated land in soil. Some pesticides such as soil fumigants and nematocides are applied directly into soil to control pests and plant diseases.

The transport or degradation of pesticides in soil depend on their chemical properties as well as physical, chemical and biological properties of the soil. these factors affect sorption/ desorption, volatilisation, degradation, uptake by plants, run-off and leaching of pesticides.



increase their sorption and formation of **bound**.

Although bound residues are inactive and nonavailable, it has been detected that they can release in some time. Change in soil pH or addition of phosphate fertilizers can induced a release of this residues.

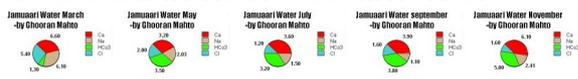
3. Water contamination

Pesticides can get into water via **drift** during pesticide spraying, by **runoff** from treated area, **leaching through the soil**. In some cases pesticides can be applied **directly onto water surface** e.g. for control of mosquitoes. Water contamination depends mainly on nature of pesticides (water solubility, hydrophobicity), soil properties, weather conditions, landscape and also on the distance from an application site to a water source. Rapid transport to groundwater may be caused by heavy rainfall shortly after application of the pesticide to wet soils.

pesticides detected in soil included Pronofos, Glycel, Roundup.

- More recent studies also reported presence of pesticides in surface water and groundwater close to agriculture lands over the world . In general, the compounds **most frequently detected were currently used pesticides** (herbicides Glycel, Roundup), and **organophosphate compounds** due to their long persistence.

The geographic and seasonal distribution of pesticide occurrence follows patterns in land use and pesticide use. **rivers were frequently more polluted** near the areas with substantial agricultural land use. Pesticides usually occurred in **mixture of multiple compounds and** were detected in river sediments.



3. Effects on organisms

Soil organisms and processes

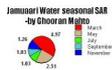
Soil microorganisms . They are essential for mineralization of organic matter and making nutrients available for plants. Soil microorganisms are also able to metabolise and degrade a lot of pollutants and pesticides . On the other hand, microbial degradation can lead to formation of more **toxic and persistent metabolites**. Although soil microbial population can cause significant irreversible changes in their population. Inhibition of species which provide key process, can have a significant **impact on function of whole terrestrial ecosystem**.

- Fungicides** were found to be **toxic** to soil fungi and Other species, such as **nitrification bacteria**, are **very sensitive** to pesticides . Inhibition of nitrification. studies show that some the his effects loosely comparable to endocrine disruption in human and animals. Its **reduced soil fertility**.

- Some pesticides can also **negatively affected symbiotic mycorrhizal fungi**, which facilitate plant nutrient uptake . Moreover, agricultural practises such us tillage, crop rotation, fertilization, pesticide application, irrigation can also reduce root colonisation .

Soil invertebrates

Nematodes, springtails, mites and further micro-arthropods, earthworms, spiders, insects and all these small organisms make up the soil food web and **enable decomposition of organic compounds** such as leaves, manure, plant residues and they also **prey on crop pests**. Soil organisms enhance soil aggregation and porosity and thus **increasing infiltration and reducing runoff**.



.Earthworms represent the greatest part of biomass of terrestrial invertebrates (>80 %) and play an important role in soil ecosystem. They are used as bioindicator of soil contamination providing an early warning of decline in soil quality. They serve as model organisms in toxicity testing. Earthworms are characterized by high ability to cumulate a lot of pollutants from soil in their tissues, thus they are used for studying of bioaccumulation potential of chemicals.

- Distruction of shelter-wild pig and white footed antelope became endanger and unsafe due to heavy land use for crop .
- Application **of pesticides** show a negative effects on growth and reproduction.
- **adverse effects of spraying pesticides (Chlorpyrifos and Azinphos methyl)** on earthworm were detected cholinesterase and neurotoxic activity. .
- **Glyphosate** herbicide and **chlorpyrifos** insecticide, belong to the most worldwide used pesticides. **Roundoup showed deleterious effect on earthworm population**. Earthworms avoided soil with glyphosate, their feeding activity . Glyphosate and chlorpyrifos caused also several adverse effects at cellular level (DNA damage) . effects on the reproduction and avoidance could contribute to earthworm decrease.

Other soil species are also often affected by pesticides application and non-target soil community structure can be strongly affected.

- **glyphosate also affects predatory arthropods** (spiders) in shore field and herbicides can affect arthropod community with their impact on the plant community .
- Decrease in **number of spiders and diversity**, and species richness after two years application of pesticide on grassland JAMUAARI lea .

- The negative impact of pesticides spraying on invertebrate communities might be seen **detrimental effects**.
- **only presence of bivalve and holly shell in bed (extinct)**.
- Few number of snail species (endangered). We can see impact of chemical treatment on arthropod community in the agriculture area near against non agricultural area . Overall, more arthropod taxa were present in the non- agricultural field, with a higher number of predators such as coccinelles, than on field treated by broad-spectrum herbicides and insecticides several times during two years .
- In **the review of a numbers of article and observance we investigate the impact of pesticide restriction in arable crop edges** on naturally occurring terrestrial invertebrates conclude that the restriction of herbicides in crop edges has a **positive influence on arthropod populations, especially for chick-food insects, Heteroptera and other herbivores**. Predatory insects may be affected indirectly by the exclusion of herbicides alone, or as a result of changes in their prey availability .

Other non-target species

- **Effect of pesticides on bees** are closely watched because their crop pollination. However, little is known about the impacts of pesticides on wild pollinators in the field. Few years before we were seeing three type of wild bees (small, midium, big) In recent year we can detected **decline of wild bees per year** .
- Several negative effects of pesticide **on butterflies populations** .
- Impact of pesticides on insect is determined by the **timing of application** because susceptibility to exposure differs between species and at different life stages. Therefore, unconsidered agricultural practises can harm butterfly populations.
- It has been shown that **using herbicides to control of invasive plants can significantly reduce survival, wing and pupa weight of butterfly at treated areas**. Importance of careful consideration in the use of herbicides in habitats harboring at-risk butterfly populations. Reduction of adverse effect may be reached by applications in late summer and early fall, post flight season and during larval diapause.

Water organisms – invertebrates, amphibians, fishes

Pesticides can enter fresh water streams directly via spray drift or indirectly via surface runoff or drain flow. Many pesticides are toxic to freshwater organisms. **Acute and chronic effects** are derived from standart toxicity tests. Within the ecological context, sublethal effects of toxic contaminants are very important. chemical contamination result in significant **changes of structure of lotic communities**.

- **Downstream drift** was shown for several pesticides such as pyrethroid, neonicotinoid, organochlorine, organophosphate insecticides or lampricides. Neurotoxic insecticides exhibited the strongest drift-initiating effects on stream-dwelling insects and crustaceans. Moreover, it was detected that macroinvertebrate drift can be induced even by long **-term pulse exposures (within 2 years) at field-relevant concentrations** .
- **A large-scale investigation** of pesticides effects on stream **macroinvertebrate community structure** was observe **in JAMUAARI river** . It proved that pesticides **stress** was associated with a decrease in the relative abundance and number of sensitive species and suggested that **effects may also occur below levels that are commonly thought to be protective** . This finding could be use in constitute a valuable measure .

In ecotoxicological risk assessment of pesticides, attention is also focused on the **ability of treated aquatic ecosystems to recover**. After pesticide application structural and functional changes in ecosystem were monitored. Whereas some species can be reduced, other may profit from lower predation and food competition. The time needed for recovery depends on biotic factor such as presence of dormant forms, life cycle characteristics, landscape as well as on the season when exposure occur.

- It has been detected, **isolated ecosystems were more susceptible to damage** and community structure changed to lower biodiversity states. Recovery in these ecosystems depends on the availability of immigrating organisms . **Long-living species might not recover** until very long time .
- Adoption of **no-spray buffer zones** were shown as an **effective mitigation measure** that reduced impact of pesticide application on bentic macroinvertebrate.
- Several studies reported toxicity of pesticides on aquatic vertebrates – **amphibians and fishes**
- **Carbaryl has been found toxic for several amphibian species**, additional combination with **predatory stress caused higher mortality** . Also herbicide Roundup, glyphosate, caused high mortality of tadpoles and juvenile frogs .
- Impact of **Malathion a broad spectrum insecticide**, on aquatic ecosystem has been demonstrated. Malathion is the most commonly applied insecticide around the world and can be **legally directly sprayed over aquatic habitats** to control the mosquitoes. This study showed that relatively small concentration of malathion caused direct and also indirect **effect on aquatic food web**. Changes in plankton

and periphyton abundance and composition consequently affected growing of frog tadpoles and reduced predation rates on amphibians . Moreover, **repeated low dose application caused large impact than single exposure** . A Similar results were observed also for insecticides carbaryl and herbicides glyphosate and 2,4-D .

These results pointed out that although single species laboratory experiments are important starting point the full understanding of possible effects (direct and indirect) could only be observed when organisms are embedded within a natural community. All these evidences might contribute to explanation of a global decline in amphibian diversity.

- **A Mixture of pesticides** are commonly detected in the environment and exposition to organisms can be more dangerous than individual effect.
- An Environmental Health Perspectives gave evidence of **synergistic and additional effects of pesticide mixture**. We can see vivo effects of combination of common used **organophosphate and carbamate** pesticides on acetylcholin enzyme inhibition in the brains of **juvenile** .

Birds:

Decline of farmland bird species has been reported over several past decades and often attributed to changes in farming practises, such as increase agrochemical inputs, loss of mixture farming or unfarmed structures. Besides lethal and sub lethal effects of pesticides on birds, concern has recently focused on the indirect effects. These effects act mainly via **reduction of food supplies and sexuality** (weeds, invertebrates), especially during breeding or winter seasons. As consequence insecticide and herbicide application can lead to **reduction of chick survival and bird population**. Time of pesticides application plays also important role in availability of food.

Several **practises** (generally Integrated crop management techniques) can be used **to minimize unwanted effects** of pesticides on farmland birds, such as use of selective pesticides, avoiding spraying in during breeding season and when crops and weeds are in flower, minimise spray drift or creation of headlands.

4. Effects of pesticides and farming practises on biodiversity

Intensive pesticides and fertilizers usage, loss of natural and semi-natural habitats and decreased habitat heterogeneity and all other aspects of agricultural intensification have undoubted impact on **biodiversity decline during last years**.

Intensive agriculture

- A **negative effects of agricultural intensification** on wild plants, carabid and bird species diversity. Insecticides also reduced the biological control potential.
- It was found out that, as result of **eutrofication and N surplus**, vegetation diversity surrounding cropped land shifted to a composition typical for more fertile conditions. However, species richness of plants and breeding **birds were more affected by broad habitat diversity** .
- Loss of fodder and medicinal grass species.
- poisoning in grass feeder-during year 2010 many ram die due to feeding sprayed grass(herbicide). The pressures of agricultural changes may be reduced by:
 - - minimizing loss of large habitats,
 - - minimizing permanent loss of agricultural land,
 - - maintaining habitat diversity in agricultural landscapes in order to provide ecosystem services,
 - - minimizing pollution from nutrients and pesticides from the crops themselves.
- This study show impact of insecticides, herbicides and fungicides drift on terrestrial biodiversity outside treated area demonstrated that under **scenarios based on wider buffer zones and 'best available practise'** the **pesticide impact could be cut to zero**. This study suggests that increasing unsprayed buffer zones around crops is critical to the success of any new strategy to prevent the harmful impact of pesticides. **Literature**

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