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# Ecological Consequences of Inorganic Pesticide Usage (A Case Study of Larkana District Sindh, Pakistan)

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## Abstract

*Pesticides assume a central role within the realms of agriculture, serving as agents for pest eradication and crop protection. However, their utilization introduces a dual spectrum of outcomes, both advantageous and disadvantages. This research explores the intricate ecological aftermath stemming from the application of inorganic pesticides, with a specific focus on the geographical expanse of the Larkana district in Pakistan. Employing a qualitative anthropological approach that encompasses interviews and participant observational methodologies, the study delves into the repercussions of pesticides on diverse dimensions: animal life, soil quality, water reservoirs, and the realm of beneficial insects. Forty farmers, doctors, and pesticides sellers were selected as sample. The findings lay bare compelling evidence of substantial contamination in both surface and ground water sources, concurrent with the degradation of soil integrity. Moreover, the study highlights the adverse ramifications endured by livestock and eco-friendly insects due to pesticide exposure. The findings brought to light through this inquiry undeniably emphasize the pressing need for increased awareness and precise pesticide application, serving as the foundation for a shared commitment to alleviate environmental risks.*

**Keywords**: *Pesticides, Agriculture, Livestock, Environment*

## 1. Introduction:

Pesticides are formulations or blends of compounds that are employed to eliminate, deter, and diminish pests, along with the destruction these pests' cause. Pests encompass organisms that inflict harm upon animals, humans, and crops. Pesticides encompass a broad array of substances, ranging from herbicides and rodenticides to insecticides and fumigants, all aimed at safeguarding crops against the onslaught of pests such as insects like cockroaches, vermin like mice, and undesirable plants and weeds. Pesticides play a pivotal role in both agricultural and public health spheres. On the domestic front, farmers utilize them to shield crops from the detrimental effects of insects and rodents, which can lead to crop damage in the form of diseases (Lubomir I, Fliur, & Biana, 2013).

Pesticides bring about both beneficial and adverse effects. The overabundant application of pesticides carries significant drawbacks for ecosystems (Sharma, V, & Shahzad, 2018). These substances

influence the environment, affecting a multitude of different organism species. Ecosystems function through interconnected roles, where each element shares a certain relationship with others. Within this ecosystem process, if a specific component fails to operate effectively, it reverberates across the entire system. Likewise, while pesticides serve to prevent, manage, or diminish pests, they also yield negative repercussions (Panuwet, Siriwong, Prapamontol, & Fiedler, 2012).

Numerous studies regarding pesticides have directed their focus towards key areas, notably examining the effects of pesticides on both fauna and flora, as well as the contamination of water sources. Diverse categories of chemical pesticides exert varying environmental influences, influenced by factors such as machinery precision and environmental conditions, including weather patterns (Hassaan & Nemr, 2020). As an agrarian nation, Pakistan's economy is significantly reliant on its substantial agricultural sector. Within the rural regions of Pakistan, approximately 42.5 percent of the population engages in agricultural pursuits, with chemical pest control methods prominently employed to enhance crop yield. Comparable to numerous other developing nations, including Pakistan, there has been a notable rise of 9% or more per hectare in the adoption of pesticide usage (Bakhtawer & Afsheen, 2021).

Pesticide usage commenced in Pakistan back in 1954 and is presently experiencing an upward trend. Among the entire spectrum of pesticides, insecticides have commanded a significant share. Notably, in the Punjab Province, the application of pesticides constitutes a substantial proportion, followed by other regions like Sindh, Khyber Pakhtunkhwa, and Baluchistan (Khan, Alam, & Bashir, 2020). The predominant focus of pesticide application revolves around the cotton crop, encompassing nearly 70-80% of the overall usage. Additionally, various other crops including wheat, maize, rice, vegetables, sugarcane, and fruits are subject to pesticide application. Across different regions of Pakistan, the detection of organochlorine residues has been particularly observed in soils and water bodies (Shahid , Ahmad, & Khalid, 2016).

In the Larkana district of Sindh, it has come to light that farmers predominantly resort to pesticides as a means to safeguard their crops from pest attacks, often without comprehending the detrimental repercussions of these chemical substances. Over the past few years, the soil in Sindh has been grappling with a significant shortage of organic matter due to the prevalent practice of employing pesticides for achieving high crop yields in major agricultural endeavors. Regrettably, there appears to be a lack of a well-structured framework for the cautious utilization of these chemicals. This disregard not only fosters the development of pest resistance but also diminishes the populations of beneficial insects, triggers outbreaks of secondary pests, and contributes to environmental contamination (Oves, Khan, Iqbal, & Ismail, 2018).

Within the realm of anthropology, the sub-field of Environmental Anthropology has gained traction, owing to the mounting challenges associated with comprehending and tackling human-induced environmental issues, including climate change, species extinctions, plastic pollution, and habitat degradation. Addressing these issues necessitates an understanding of the intricate cultural, political, and economic systems that have culminated in their emergence (Sarfaraz & Zokaei, 2020).

In light of these considerations, the present study was undertaken to delve into the consequences of inorganic pesticides on the environment. This study serves to illuminate the ecological dynamics of the region, augmenting the anthropological body of knowledge. By shedding light on the utilization of pesticides and their adverse environmental effects, this research contributes to the understanding of

these critical matters. Consequently, the primary objective of this study is to investigate the ramifications of employing inorganic pesticides on the environment.

## 2. Research Methods

Research methodology addresses to the underlying philosophy guiding the research process. This encompasses the underlying assumptions and values that provide a foundation for the research, as well as the criteria and standards used to collect and interpret data and ultimately draw conclusions. Conversely, methods simply refer to the specific techniques or tools employed for data gathering.

For this current study, the methodology employed for collecting empirical data was rooted in qualitative anthropological research methods. These methods encompassed various approaches such as participant observation, conducting in-depth interviews and discussions with key informants, and respondents, and conducting case studies during in-depth interviewing and participant observation.

During the initial phase of building rapport, two key informants were carefully selected to provide valuable insights. One of them was a farmer with eight years of experience in the field, aged forty. The other was a pesticide seller specializing in supplying chemical pesticides to farmers, aged thirty-two. A total of one hundred households were chosen for the socio-economic survey using a simple random sampling method. Socio-economic census are directly tied to the research findings, establishing a significant connection between the gathered data and the research outcomes.

The sample of the study included thirty farmers aged 25-50, who were engaged in the use of chemical pesticides. Additionally, a group of five pesticide sellers and five doctors were also selected to contribute to the comprehensive data collection on the subject. To gather meaningful insights, in-depth interviews were conducted following an interview guide. The selection of the research sample was carried out using purposive sampling technique, ensuring a targeted and representative participant group. The exploration of the pesticide impacts on the surrounding environment involved participant observation and in-depth interviews, facilitating open and comprehensive conversations on the topic. The data collected through these methods was subjected to thematic analysis, allowing for the identification of recurring themes and patterns within the information.

## 3. Locale of the Study

The research is centered within the geographical confines of Larkana district. The term "Larkana" traces its origins to the Lariks tribe, who settled in the region several years ago. The urban hub within this district, Larkana city, was historically known as "Chandka." Positioned to the south of Shikarpur by approximately 40 miles along the banks of the Ghar canal, and situated about 36 miles north of Mehar, Larkana city's context is established.

The total expanse of Larkana district encompasses 5,091 square miles. The district's administrative headquarters is Larkana, which resides in the upper reaches of Sindh, positioned at an 85-kilometer distance to the west of Sukkur. Larkana district enjoys a strategic location within the broader map of Sindh province. Nestled on the western bank of the Indus River, it holds the distinction of being the second-largest city in Sindh, following Karachi. The city's elevation rests at 167 feet above sea level. Notable townships in the vicinity of Larkana include Dokri and Naudero. Geographically, Larkana spans between 27° 33' - 40.4" North latitude and 68° 12' - 30.8" East longitude.

## 4. Theoretical Framework

Neoliberalism is an economic and policy ideology deeply rooted in the principles of a free-market economy and a substantial shift of economic control to the private sector. It draws heavily from neoclassical economics and champions the reduction of government subsidies, increased open-market competition, and minimal state intervention. This concept has been in practice since the early 20th century and bears resemblances to classical laissez-faire economic liberalism. Neoliberalism has gained considerable prominence over the past 25 years, originating from the foundational ideas of classical liberalism as articulated by Adam Smith in his seminal work, "The Wealth of Nations," in 1776. It emerged as a response to economic challenges during the 1970s when economists such as Friedrich von Hayek and Milton Friedman argued fervently against government fiscal policies, asserting that excessive government intervention could lead to totalitarianism. Neoliberalism garnered strong support from conservative political parties in the United States and gained significant influence when the British Labor Party relinquished ownership of means of production in 1995 (Jones & Stafford, 2021).

In contemporary settings, neoliberalism manifests as a set of reform policies aimed at markets and production, encompassing the removal of trade barriers, the deregulation of price controls, and the privatization of capital markets. This ideology is closely tied to the economic policies championed by figures like Margaret Thatcher in the United Kingdom and Ronald Reagan in the United States. Key tenets of neoliberalism include privatization, decreased government regulation, the promotion of unrestricted free trade, reduced public expenditure, and an emphasis on individualism and competition. While it seeks to enhance efficiency and economic growth, critics argue that it often results in wealth concentration and the neglect of public welfare.

The theory of neoliberalism provides a conceptual framework for examining the environmental implications of inorganic pesticide use in the Larkana district of Sindh, Pakistan. Neoliberalism, grounded in free-market principles, advocates for minimal state intervention and privatization. In the agricultural context, neoliberal policies may contribute to the unregulated application of pesticides, prioritizing market competition over environmental considerations. The study delves into how deregulation in the pesticide industry, influenced by neoliberal ideals, could result in environmental degradation. The article validates this theory by exploring the widespread use of chemical pesticides, the absence of a well-structured framework for their careful application, and the ensuing contamination of water sources and soil integrity. In the findings section, the impact of neoliberal policies on pesticide usage will be connected to the observed environmental consequences in Larkana. By highlighting the adverse effects on water, soil, livestock, and beneficial insects, the study seeks to establish a link between neoliberal economic principles and their tangible effects on the environment, contributing to a broader understanding of the ecological dynamics influenced by neoliberalism in agricultural practices.

## 5. Results and Discussion

Excessive utilization of pesticides in agricultural fields has become a prevailing practice. While this heightened use does bolster crop protection and enhance yields, it also leads to a multitude of adverse effects on the environment and ecosystems. Unfortunately, the majority of pesticides employed possess limited degradability, and this slow degradation further compounds the problem.

### a. Environmental Implications

According to the farmers, an overwhelming number of pesticides are applied to crops. Likewise, a huge number of herbicides find their way to unintended targets, utilizing mediums such as air, water, and soil for their dispersion. This movement across these channels results in far-reaching impacts on the ecosystem. The utilization of pesticides is chiefly responsible for the decline in insect biodiversity, affecting both plant-eating and carnivorous insects, alongside moths and others.

Moreover, these agents function as pollinators. Their reduced participation in pollination processes directly affects the production of fruits and green vegetables. This interplay of events culminates in pesticides becoming substantial contributors to global warming and air pollution. Under higher temperatures, pesticides evaporate, eventually returning to the surface through mechanisms like snow, rain, and transportation via rivers, groundwater, and soil. Consequently, they become entrenched in the ecosystem's intricate web.

The unbridled use of chemical pesticides directly impacts the environment, reflecting the heavy reliance placed on them by farmers. The environmental factor is often overlooked amidst the application of pesticides and its ensuing repercussions. It is evident that both farmers and pesticide vendors are cognizant of the environmental risks associated with chemical pesticide use. The pesticide industry, driven by deregulation, privatization, and unfettered trade among companies, has made the reliance on chemical pesticides practically inevitable for achieving high crop yields. The accessibility of these pesticides, facilitated by these factors, has led to their widespread use among farmers, in turn adversely affecting the environment.

#### i. Contamination of Surface and Ground Water

Based on research findings, the contamination of surface water in agricultural regions with pesticide residues occurs through various pathways. Instances of this contamination arise from actions such as the application of pesticides near water sources, cleaning spray equipment in water reservoirs, and using pesticides during windy conditions, all of which heighten the risk of water pollution.

When a farmer employs pesticides on crops or plants, whether through spraying or other methods, and subsequently experiences rainfall in the area, the result is the contamination of surface water with these chemical agents. The consequences of this extend further, causing soil poisoning as well. Unintentional spills of pesticides on land can also lead to their absorption, eventually seeping into nearby water sources. Notably, within the agricultural domain of Larkana, the extensive utilization of pesticides has notably curbed pest and insect infestations, but not without giving rise to a range of environmental shifts.

A farmer narrated: "*"Asan khy aksar fhumra thiyan tha Pani peean je kare cho Pani ji pipeline un ee Zameen man achy thi"* (We often get diarrhea by drinking water as water in our homes are supplied from nearby pipelines fitted in ground).

A particularly concerning outcome is the contamination of groundwater due to the excessive use of pesticides. This issue is prevalent due to the misapplication of pesticides by farmers, particularly within their cotton fields. The consequences of this misapplication reverberate in the form of tainted groundwater resources.

According to a respondent: "*"Hik dafe aaon parsan ware wah man hath dhota ta kuch minutes bad monkhy hathan men elergy thi"* (Once I washed hand in a nearby pond. After few minutes I got irritation in my hands).

### b. Soil Contamination from Pesticide Use in Larkana Farms

The farms in Larkana face a significant issue of soil contamination resulting from the diverse array of pesticides, insecticides, and fungicides employed. These toxic substances directly permeate the soil, leading to the ongoing utilization of chemical pesticides culminating in soil pollution. Presently, the practice of sowing chemically treated seeds and mitigating various plant diseases through pesticide spraying exerts further strain on the soil.

Numerous nematicides, which are directly applied to the soil, contribute to the degradation of soil microorganisms. These chemicals, rich in carbon, nitrogen, and phosphorous, disrupt the carbon cycle of microorganisms, especially decomposers. Within the soil, there exists an array of beneficial insects that contribute to soil nutrition and the breakdown of organic matter. Their presence plays a pivotal role in enhancing crop productivity. However, the frequent application of toxic chemicals detrimentally impacts these crucial organisms, leading to a decline in soil structure and fertility.

A respondent narrated: *"Hik fasul Khan Poe Zameen ji zarkhazi ghatiji wanje thi, Poe hari wadhik khad and zarae dawaon istmal kare tho zarkhazi wadhin lae"* (After one season cultivation, the soil fertility become decreased. We have to use many fertilizers to increase its fertility).

### c. Pesticide Impact on Eco-Friendly Insects

Pesticides serve as agents of eradication against a range of pests and insects found within field areas. In the pursuit of safeguarding their crops, farmers aim to eliminate detrimental insects. However, the dilemma lies in the lack of pesticides capable of exclusively targeting harmful insects. Consequently, the prevalent approach involves the use of pesticides that affect not only the negative pests but also inadvertently impact beneficial insects. This approach is deemed necessary to avert potential crop damage.

One such beneficial insect is the parasitoid Trichogramma, a male parasite that lays eggs in females. This category of diminutive advantageous insects falls victim to the effects of pesticides. While around two hundred varieties of harmful pests exist, Trichogramma chilonis is among them, serving as a natural control for stem borers in sugarcane crops. Notably, within the research realm, Trichogramma pests are harnessed specifically for controlling stem borers in sugarcane. This strategy is valued as an optimal solution since this insect preys on the eggs of detrimental pests, showcasing a natural approach to pest management.

A respondent narrated: "*Pesticides jo chhaani jo pahinje zor nafrat chhaanandiaan maawaan mein aahiyun. Jo bugs asan rakhna chahayaa, weendriyun ja waran ji aandhi mein phas gaya aahiyun".* (Pesticides trying to kick out pests end up messing with the helpful bugs. The bugs we want to keep around end up caught in the crossfire).

### d. Implications for Wildlife Environments

The ramifications of pesticide use extend to animals, as the agricultural and livestock sectors are

intricately intertwined. Livestock graze on the grass and drink water from nearby ponds, often coming into contact with areas treated with pesticides. Consuming pesticide-laden grass can have profound effects on their digestive systems, leading to bacterial and viral infections, genetic alterations, and even death. The dried crops, commonly used as animal feed, carry a burden of toxic chemicals. The decline of animal species in society is, in part, attributed to the deleterious influence of pesticides.

### e. Case Study

This case study revolves around a farmer who maintains livestock for both sustenance and agricultural purposes. Tragically, his buffalo succumbed to poisoning caused by the application of inorganic pesticides. The farmer had previously sprayed pesticides on his field, and later, his buffalo ingested grass from that same area. The repercussions of this incident extended beyond mere animal life, permeating the farmer's agricultural economy.

The respondent recounted, "*Zarai zahar jo fuharo Karin khan poe jadhen menhon zamen ty aayon ta aaon kon huyus na ta monkhy khbar hue ta bharsan ware goth waran joon ganiyon menhon mari wayon huyon, na ta aaon zahar je asar khy behatr tareqe san janan tho aen menhon khy zamen je wejho achan ee kon diyan han"* "I wasn't present at the farm when my buffalo grazed on the field after pesticide spraying. I recalled a similar occurrence in another village where numerous cattle perished due to the same cause. This memory led me to be cautious about keeping my cattle away from the fields post-pesticide application to safeguard their well-being."

In the research locale, livestock holds paramount importance within the community, serving as a cornerstone of the local economy. Farmers tend to their animals with the same care and dedication they would extend to their own children. However, the introduction of chemical pesticides and other inorganic substances into the fields poses equal hazards to these animals. While pesticides undeniably confer pest control benefits, they concurrently exert adverse impacts on livestock.

The aforementioned farmer's narrative elucidates the unfortunate consequences of pesticide usage on his livestock. Several factors, including insufficient awareness of chemical effects and inadequate application practices, culminated in this regrettable experience. The loss of livestock due to chemical pesticide exposure not only inflicts a direct toll on the animals but also casts a shadow on the overall farm economy.

### f. Aquatic Ecosystem Consequences

With the advent of chemical use in farming, there's a lack of awareness about their potential consequences. Insufficient mechanisms are in place to ensure the judicious application of these chemicals. Pesticides, while effective for pest control, pose significant threats to aquatic life, particularly fish, and the delicate ecosystem they inhabit. Although modern chemicals like organophosphates might be considered more environmentally friendly compared to their predecessors, their higher toxicity per application can render them even more perilous for species.

Herbicides, which are employed to thwart weed growth, inadvertently hinder photosynthesis and enzyme function. While certain pesticides might be less harmful to humans and animals, they still significantly impact fish populations and contribute to groundwater pollution. The introduction of toxic substances into water sources stems from various routes, including spillage, surface runoff, and treated soil.

The consequences of pesticide contamination on aquatic species are classified based on the duration of exposure, ranging from lethal to sub-lethal effects. These toxic agents infiltrate animals' bodies through their skin, gills, and dermal pores. The aquatic realm hosts a diverse array of life forms, encompassing invertebrates, plants, microorganisms, fish, and amphibians. Pesticides wield a direct or indirect influence on all these inhabitants, inducing chemical poisoning and disrupting the delicate balance of aquatic ecosystems.

### i. Case Study

The farmer of the research area also relies on fish selling and use fish as a source of food. The inorganic chemical pesticides are dangerous for aquatic life mainly for fish. A farmer told the researcher about the negative impacts of pesticide use on aquatic life. A pond nearby a farm was owned by a farmer and his maternal uncle. His uncle once washed the container of the pesticide in the pond after pesticide spraying in the field. Later, he threw the container in the pond. Due to the poison, all the fishes in the pond died.

The respondent narrated: *"Muhanjo mamo zarai zahar je asar khan waqif nahy ta zarai zahar wariyon shishiyon zindgi lae ketriyon nuqsankar aahen"* (My maternal uncle was not aware about the poisonous impacts of pesticides that the container of the pesticide was full of poison and harmful for all living things).

Fish are the majorly affected animal as they are directly affected by being fed on the chemical or drinking contaminated water. Pesticides contains many chemicals which are lethal for fish species. The proper disposal of pesticide container has been important for the life of humans as well as animals. The remains of pesticide chemicals in the container are highly dangerous for aquatic animals. In above mentioned case study, the improper disposal of pesticide containers has detrimental effects on fishes which illustrates the negative impact of chemical pesticides on animals.

## 6. Theoretical Discourse

The findings of the article on the ecological consequences of inorganic pesticide usage in Larkana district align with key aspects of neoliberalism, shedding light on the intricate relationship between economic policies and environmental impact. Neoliberal principles, emphasizing minimal state intervention and privatization, appear reflected in the unbridled use of chemical pesticides driven by market competition. The lack of a structured framework for cautious pesticide utilization, as highlighted in the study, resonates with neoliberal deregulation in the agricultural sector. This laissez-faire approach fosters an environment where the pursuit of economic efficiency takes precedence over environmental considerations. The observed contamination of water sources and soil integrity serves as tangible evidence of the repercussions of neoliberal policies, where the unchecked application of pesticides, often without thorough comprehension of their consequences, contributes to environmental degradation. The study thus underscores the urgent need for a balanced approach that considers both economic interests and environmental sustainability in agricultural practices within the framework of neoliberalism.

## 7. Conclusion

This study delves into the impact of specific pesticides in Larkana highlights the connection between economic concepts, specifically neoliberalism, and their effects on the environment. Neoliberalism

promotes less government intervention and more reliance on private businesses, and in this context, it translates to the widespread use of pesticides without much oversight. The findings reveal repercussions such as water and soil pollution, illustrating a trade-off between maximizing crop yields and maintaining environmental health. It emphasizes the need to strike a balance that considers both economic interests and environmental well-being when deciding how to use pesticides in agriculture.

The field of anthropology, particularly environmental anthropology, plays a vital role in unpacking the socio-cultural factors that contribute to pesticide usage and its consequences. By understanding the drivers behind pesticide application, researchers, policymakers, and communities can collaborate to devise holistic solutions that prioritize both human needs and the environment. The study emphasizes the urgent need for holistic and informed approaches to pesticide usage. Proper education, awareness campaigns, integrated pest management strategies, and stringent regulatory frameworks are essential components of a sustainable path forward. Through a collective effort encompassing farmers, researchers, policymakers, and consumers, it is possible to curtail the adverse effects of pesticides, foster a harmonious relationship between agriculture and the environment, and pave the way for a more resilient and sustainable future.

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