कहानी संग्रह 'नहर में बहती लाशें' में 'जलन' एक सामाजिक कहानी है। कहानी में शशिबाला और रजनीबाला नामक दो नारी पात्र हैं और जो बहने हैं। शशिबाला बड़ी और रजनीबाला छोटी। मनहरलाल और मदनलाल दो भाई है। बड़े भाई मनहरलाल ने शशिबाला से शादी की। कुछ साल बाद शशिबाला ने अपना छोटी बहन रजनीबाला का विवाह अपने देवर मदनलाल के साथ करवा दिया। शशिबाला के दो बेटे थे तथा रजनीबाला की तीन बेटे और एवं एक बेटी थी। शहर से थोड़े दूरी पर दोनों परिवार रह रहे थे। उनकी एक छोटी सी किराने की दुकान थी जिससे पूरे परिवार का गुज़ारा होता था। परिवार के सदस्य ज्यादा थे एवं रोजगार का स्रोत केवल वह दुकान थी। दिन भर परिश्रम करने पर भी गुज़ारा बहुत मुश्किल था। आर्थिक स्थिति ठीक नहीं होने के कारण, वे बहुत परेशान हो गये। आर्थिक स्थिति के अच्छे न होने के कारण छोटी बहन रजनीबाला ने अपनी बड़ी बहन शशिबाला से कुछ इस प्रकार कहा-"दीदी, क्या ये सब झेलने के लिए पैदा हुए थे। इससे तो कुकुर अच्छे हैं। अलग-अलग घर का भरपूर जूठन तो मिल जाता है कम-से-कम। हमारे तो ढाक के वही तीन पात। रोज एक ही राग, वही झमेले... मैं तो बाज आई दीदी... आँखें खोलो तो वही जंगाला, वही आँगन, रोज मशीन की तरह पिसो और रात को निकले वही धुन लागा गेहूँ... रोज चिल्लर गिनते रहो और बाचता है वही दो आना...।" इस कथन के माध्यम से रजनीबाला पारिवारिक जीवन की आर्थिक स्थिति को दर्शाता है। इससे दृष्टिगत होता है कि उनकी आर्थिक स्थिति उनकी सामाजिक जीवन शैली को प्रभावित कर रही थी।

कहानी संग्रह 'नोटिस-2' में 'हम सैनिक फार्म्स की बदौलत' कहानी में जज साहब एक पुरूष पात्र है। उन्होंने जीवन के तीस बरस इन अदालत में बिताये। जज साहब के परिवार में पत्नी शीरी एवं एक बेटी थी। जज साहब की पत्नी शीरी ने रिटायरमेंट के बाद बंगले में न रहकर फ्लैट में रहने की माँग की जिसके लिए जज साहब ने मना कर दिया। पत्नी की जिद करने पर जज साहब अपनी आर्थिक स्थिति को खंगालने लगे। जो की इस प्रकार थी-

"जज ने बचत और खाते का हिसाब लगाया। कितने पेंशन होगी। पी एफ और ग्रैचुइटी। लीव का नकद। कितना कर्जा ई एम आई पर उठा सकता है। इतने से इस सफेद के जोड़ से, पूरा नहीं हो रहा था। पर और भी पैसा था।" इससे प्रतीत होता है कि जीवन को साधारण तौर से जीने के लिए आर्थिक स्थिति का ठीक होना आवश्यक है। जज साहब ने गलत तरीके से धन नही जूटाया जिसके कारण वह धनाढ्य एवं पूँजीपति न बन सके। जिसके कारण आज वे जिंदगी भर की कमाई को इकट्ठा करने के बावजूद एक फ्लॅट के लिए पैसे जुटाने में नाकामयाब रहें। पत्नी की इच्छा को पूरी नहीं कर पायी।

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Effect of Industries on Future Animals and Plants in Singrauli District

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Abstract- Singrauli District, located in northeastern Madhya Pradesh, India, has emerged as a critical hub for coal mining and thermal power generation, contributing significantly to the nation's energy needs. However, this rapid industrialization has inflicted severe environmental degradation, particularly on local flora and fauna. This research paper examines the multifaceted impacts of industrial activities—primarily open-cast coal mining and coal-fired power plants—on biodiversity, with a forward-looking perspective on future scenarios influenced by climate change and resource depletion. Drawing from environmental profiles, pollution indices, and ecological studies, the analysis reveals deforestation rates exceeding 35% over recent decades, heavy metal contamination in soils and water bodies, and habitat fragmentation threatening species such as the Asian elephant and native dry deciduous forest trees like *Shorea robusta* (Sal). Current pollution levels, including fly ash spills and acid mine drainage, have led to biodiversity loss, with vascular flora on mine spoils limited to 197 species dominated by pioneer herbs. Projections indicate coal reserve exhaustion in 15-20 years, exacerbating climate-induced stressors like erratic rainfall and rising temperatures, potentially rendering 50% of remaining habitats uninhabitable for endemic species by 2050. Mitigation strategies, including phytoremediation and compensatory afforestation, are evaluated for their efficacy in restoring ecosystems. The paper concludes that sustainable transitions to renewables are imperative to safeguard Singrauli's biodiversity for future generations, emphasizing policy reforms for integrated environmental management. This study underscores the urgent need for balancing energy security with ecological preservation in industrial hotspots.

Keywords-Singrauli District; Coal Mining; Thermal Power Plants; Biodiversity Loss; Habitat Fragmentation; Climate Change; Phytoremediation; Acid Mine Drainage; Fly Ash Pollution; Dry Deciduous Forests

Introduction-Singrauli District, spanning approximately 5,673 square kilometers in the Son Valley of Madhya Pradesh, represents a paradoxical landscape: a verdant

expanse of dry tropical forests juxtaposed against sprawling industrial complexes. Historically, the region was characterized by dense Northern Tropical Dry Deciduous Forests, harboring rich biodiversity including Sal (*Shorea robusta*), Teak (*Tectona grandis*), and Bamboo (*Dendrocalamus strictus*), alongside wildlife corridors vital for species like the Asian elephant (*Elephas maximus*) and Bengal tiger (*Panthera tigris tigris*). However, since the 1960s, the discovery of vast coal reserves—estimated at over 2,000 million tonnes—has transformed Singrauli into India's "Energy Capital," hosting over 13 thermal power plants with a combined capacity exceeding 21 GW and open-cast mines operated by Northern Coalfields Limited (NCL). This industrial boom, driven by national energy demands, has accelerated land-use changes, with forest cover declining by 35.76% between 1986 and 2001 alone, while mining areas expanded sevenfold.

The environmental toll is profound: air pollution from particulate matter (PM10, PM2.5), sulfur dioxide (SO2), and nitrogen oxides (NOx); water contamination via acid mine drainage (AMD) and fly ash leachates; and soil degradation from overburden dumps. These stressors not only degrade current ecosystems but portend dire futures for animals and plants amid global climate change. Singrauli's Comprehensive Environmental Pollution Index (CEPI) score of 81.79 in 2009 classified it as critically polluted, ninth among India's 14 worst industrial clusters. With coal reserves projected to deplete in 15-20 years, future industrial expansions—such as Adani's Gondbahera Udaipur project—could intensify habitat loss, while climate projections forecast 20-30% reduced rainfall, amplifying drought vulnerability for flora and migration disruptions for fauna.

This paper synthesizes existing literature to delineate current impacts and extrapolate future trajectories, employing a review methodology informed by secondary data from peer-reviewed studies, government reports, and environmental assessments. The thesis posits that unchecked industrialization will precipitate irreversible biodiversity collapse by mid-century unless proactive restoration and policy interventions are enacted. Sections explore industrial overviews, impacts on flora and fauna, future projections, and mitigation pathways, culminating in recommendations for sustainable development.

Overview of Industrial Activities in Singrauli District-Singrauli's industrial landscape is dominated by coal extraction and power generation, forming an interconnected "coal cycle" that amplifies environmental pressures. Open-cast mining, preferred for its cost-sites like Jayant, Amlohri, and Singrauli, yielding 100-120 million tonnes annually. These operations involve overburden removal—up to 10-15 meters deep—exposing sulfur-rich pyrite to oxidation, generating AMD with pH as low as 3.5 and mobilizing heavy metals like mercury, arsenic, and lead.

Adjacent thermal power plants, including NTPC's Vindhyachal Super Thermal Power Station (4.76 GW capacity), consume vast coal quantities, producing 25 million tonnes of CO2 yearly and generating 10-12 million tonnes of fly ash. Fly ash disposal via ponds risks breaches, as seen in the 2020 Sasan Ultra Mega Power Project incident, where slurry inundated villages, contaminating reservoirs and farmlands. Cement factories and chemical units further compound pollution, with limestone quarrying exacerbating dust emissions.Land-use shifts are stark: from 1986 to 2001, mining land surged from 2.6 to 9.29 sq. km, built-up areas from 4.71 to 14.73 sq. km, at the expense of forests (down 35.76%) and agriculture (down 19.31%). This "resource curse" manifests in displacement of over 50,000 people since 1970s and ecosystem conversion from forests to savannas. Future expansions, like Adani's 1,320 MW addition despite non-compliance with 2023 environmental clearances, signal intensified pressures.

Current Impacts on Flora-Industrial activities in Singrauli have profoundly altered vegetative cover, reducing forest density and introducing invasive species. Pre-industrialization, the district boasted 2,219.65 sq. km of forests, primarily Sal-dominated dry deciduous types covering 14% of the area. Mining-induced deforestation has fragmented these habitats, with clearance for overburden dumps and haul roads eliminating canopy species like *Butea monosperma* and *Boswellia serrata*. On mine spoils—barren, nutrient-poor substrates—vascular flora is impoverished, comprising 197 species from 45 families, dominated by herbs (57.36%) from Poaceae (18.27%), Fabaceae (20.30%), and Asteraceae (7.10%). Pioneer trees like *Nyctanthes arbor-tristis* and *Woodfordia fruticosa* colonize edges, but exotics such as *Prosopis juliflora* proliferate, outcompeting natives and reducing restoration potential. Air pollution tolerance indices (APTI) reveal tolerant species like *Cassia fistula* accumulating heavy metals (e.g., 15-20 mg/kg lead in leaves), while sensitive plants exhibit chlorosis from SO2 exposure.

Water and soil contamination exacerbate floristic decline: AMD leaches aluminum and iron, acidifying soils (pH 4-5) and inhibiting root growth in crops and wild plants. Fly ash deposition, rich in boron and molybdenum, causes toxicity in 30-40% of roadside vegetation,

per studies near Sasan plant. Overall, biodiversity indices on spoils show 40% lower Shannon diversity than undisturbed forests, signaling long-term impoverishment.

Current Impacts on Fauna-Faunal assemblages in Singrauli face acute threats from habitat loss and pollution, disrupting food webs and migration patterns. The district's forests once supported 200+ bird species, leopards (*Panthera pardus*), and sloth bears (*Melursus ursinus*), with elephant corridors linking to Bandhavgarh Tiger Reserve. Mining has fragmented 60% of these corridors, increasing human-wildlife conflicts; elephant crop-raiding incidents rose 25% post-2010 due to forage scarcity.

Aquatic fauna suffers from river contamination: Rihand and Son rivers, vital for fish like *Tor putitora* (mahseer), exhibit bioaccumulation of mercury (up to 0.5 mg/kg in tissues) from fly ash, reducing populations by 50% in polluted stretches. Terrestrial mammals face respiratory issues from PM2.5 levels exceeding 100 µg/m³ near mines, with dust settling on foliage diminishing herbivore forage quality. Avifauna diversity has plummeted, with insectivorous birds declining 35% due to pesticide-like effects of heavy metals.Soil invertebrates, crucial for nutrient cycling, show 70% mortality in overburden areas from metal toxicity, cascading to reptile declines like the Indian rock python (*Python molurus*). Noise from blasting (80-100 dB) disrupts breeding in nocturnal species, while light pollution from plants affects pollinators, indirectly stressing entomophilous plants.

Future Projections: Industrial Expansion, Resource Depletion, and Climate Synergies-Looking ahead, Singrauli's ecosystems face compounded threats from industrial inertia and climate variability. Coal reserves, fueling 16% of India's production, are slated for exhaustion by 2040-2045, prompting shifts to deeper mines or imports, but planned expansions—like NTPC's 1,320 MW addition—will spike emissions 20-30% by 2030. Adani's projects threaten 500+ ha of forests, depleting aquifers and inducing water stress for vegetation, potentially desiccating 40% of riparian flora.

Climate models project 1.5-2°C warming by 2050, with 20% rainfall decline, exacerbating AMD and drought mortality in Sal forests (already regenerating poorly due to grazing). Synergistic effects could halve faunal ranges: elephants may abandon corridors amid forage loss, while heat-stressed pollinators reduce plant reproduction by 25%. Black carbon from plants, contributing 0.3% to global CO2, accelerates glacial melt upstream, flooding habitats intermittently.

By 2050, 50% of current biodiversity hotspots may become uninhabitable, with invasive flora dominating spoils and endemic species like *Haldina cordifolia* facing extinction risks. Transition to renewables offers hope, but without enforcement, "black future" looms for locals and wildlife alike.

Mitigation Strategies and Restoration Efforts-Restoration in Singrauli hinges on phytoremediation and afforestation. NCL's efforts include seeding spoils with native grasses and trees on 4,320 ha, costing Rs. 32.96 crores, yielding 60% survival rates for species like *Acacia catechu*. High-APTI plants (*Azadirachta indica*) capture 20-30% dust and metals, per bioaccumulation studies.Check dams and silt arrestors mitigate AMD, while CCUS trials at Vindhyachal capture 20 tonnes CO2 daily, though scaled-up renewables are advocated. Community rights under FRA 2006 could empower locals in monitoring, reducing conflicts. Future success requires GIS-based planning for corridors and strict EIA compliance.

Conclusion-The inexorable march of industries in Singrauli has cast a shadow over its once-thriving ecosystems, with flora impoverished to pioneer assemblages and fauna besieged by fragmentation and toxicity. Future vistas, marred by reserve depletion and climate exigencies, herald potential biodiversity Armageddon unless interventions pivot toward sustainability. Policymakers must prioritize renewable transitions, enforce pollution norms, and invest in resilient restoration to bequeath a verdant legacy. Singrauli's plight is a clarion call: energy without ecology is ephemeral.

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