Biodiversity Risk Assessment Report

Contents

List of Figures:

List of Tables:

1. Background

1.1 Introduction

Climate change and biodiversity loss represent pressing crises. Global temperatures have risen by approximately 1.2°C since pre-industrial times (Forster, 2023), highlighting the interdependence between human societies and economies with nature and biodiversity (Stoeckl, 2018). According to estimates from the World Economic Forum, nature, biodiversity, and its services account for 44 trillion USD of value creation, or more than 50% of the world's GDP (Celine Herweijer (PPL UK), 2020).

A significant portion of global trade traverses through the oceans, with ports as the entry and exit points for a nation's trade. Consequently, coasts attract people, businesses, and industries, with some coastal regions ranking among the world's top places in population and value accumulation (Kron, 2013). However, coastal regions worldwide face the risks of cyclones, tsunamis, floods, and storm surges. Specifically, to the Indian subcontinent, the vulnerability of coastal areas to natural disasters, as evidenced by the history of floods, cyclones, and tidal ingressions, amplifies the importance of understanding and mitigating potential impacts on Industries. The Super Cyclone in 1999 and Cyclone Phailin in 2013 are significant events in recent times. Further emphasizing the susceptibility of coastal regions. Consequently, Odisha emerges as one of the states with a high risk of nature-related disasters on the east coast of India (Parida, 2018).

"Coastal land use change and climate change are swiftly altering coastlines, significantly increasing physical risks associated with extreme climatic events. The share of the world's GDP annually at risk of tropical cyclones has risen from 3.6% in the 1970s to **4.3%** in the first decade of the 2000s "(UNISDR, 2011).

In the context of these coastal dynamics, Paradeep Phosphate Limited (PPL), located on the east coast of Odisha, stands out as an industry with associated risks due to its location and nature of operations.

Therefore, PPL has taken cognizance of managing its operations' biodiversity/nature-related risks. This involved recognizing biodiversity issues, evaluating potential business risks, and finding ways to minimize these risks. The initial step in this journey was to assess biodiversity near its area of operation. This was followed by biodiversity risk assessment, which not only helps avoid costs and reduce operational risks but also brings broader benefits such as an improved reputation, better access to finance and land, and ongoing support from local communities and stakeholders. A biodiversity risk assessment tool was employed to understand PPL's operations' risks comprehensively. The tool helped identify potential biodiversity risks linked to industrial operations by analyzing biodiversity at Paradeep, Odisha, and Zuarinagar, Goa; the tool assisted in gauging the potential impacts of PPL on biodiversity in these coastal regions. This comprehensive approach was intended to inform sustainable practices and mitigate adverse environmental effects while considering the significant role of coastal areas in global trade and industry.

The tool, developed by the World Wildlife Fund, assesses and prioritizes biodiversity risks. The biodiversity risk filter is intended for corporate and portfolio-level applications, aiding companies in evaluating risks at their operational and supplier locations. The outcomes of evaluating potential biodiversity risks can assist in refining business plans, goal setting, and investment choices, enhancing business resilience, and fostering a more sustainable future. (WWF, 2023). The methodology for the biodiversity risk assessment - BRF filter is addressed in the next section.

2. Biodiversity Risk Management Methodology:

During the assessment phase, three modules—inform, explore, and assess—were used to run the filter. These modules help gather information and evaluate potential impacts. (Maria Walsh (WWF Germany), 2023)

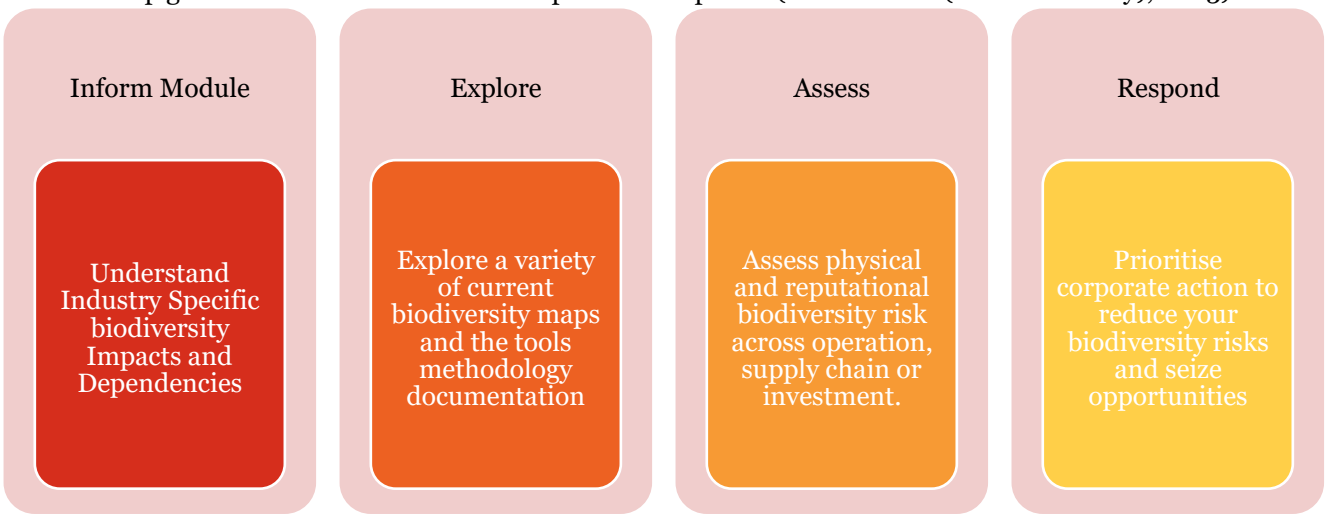


Figure 1- WRF- Four Modules

2.1 Classifying Biodiversity-Related Risks

Biodiversity loss and the decline in ecosystem services can pose risks to businesses. These risks are heightened as we move towards an economy that values nature. There are four primary types of risk. Each type can be further divided to pinpoint specific threats or causes, such as a reduction in a crucial ecosystem service that a company relies on. The list of risk categories, factors, and drivers includes:

Physical Risk:

Companies relying directly on biodiversity and ecosystem services face physical risk, typically location-specific. This risk arises from the decline of ecosystem services in various ways.

Regulatory Risk from Biodiversity Impact:

A company's impact on biodiversity can lead to regulatory risk when changes in environmental laws or enforcements alter the legal operational context. This risk is linked to evolving regulations affecting business practices.

Reputational Risk Due to Biodiversity Impacts:

Biodiversity impacts can result in reputational risk, manifesting as negative publicity regarding a company's actual or perceived impacts on nature. This risk extends to local economic impact and downstream exposure.

Market Risk Across Categories:

Market risk may arise from any of the previously mentioned risk categories. Changes in physical, regulatory, or reputational conditions, coupled with stakeholder dynamics, can contribute to market risk. This includes potential impacts on input prices, alterations in the competitive landscape, and shifts in brand value, thereby impacting revenues.

Figure 2 Classifying Risk

2.2 Overview of Risk Types, Categories and Drivers

The classification system organizes the four types of risks outlined in section 2.1 into specific risk categories. Each category is linked to fundamental threats, for example, the reduction of an essential service a company depends on. The elements affecting each risk category's likelihood are considered risk factors and drivers.

Category	Risk type	Risk subcategory	Risk factor and example metrics
Physical risk	Inputs: Lack of natural inputs	Depletion of essential raw materials	Availability of phosphate rock, extraction rates
	Pollution	Chemical discharge	Water Contamination: Runoff from fertilizer production affects aquatic ecosystems.
	Disturbances: Acute disturbance of the value chain or operations	Extreme temperature events	Occurrence of extreme heat or cold (Terrestrial/Marine) (NASA)
Regulatory risk	Current Legislation: Risk of project operation-specific interventions	Proximity of sites under protection	Number and size of areas under formal protection
	Future Legislation – Sites: Risk of new sitespecific restrictions and requirements	Proximity of sites of specific designation (not yet protected)	Key Biodiversity Areas (KBA Partnership), Vulnerable Marine Ecosystems (FAO), Intact Forest Landscapes (IFL), Large Mammal Areas, Climate Stabilization Areas (Global Safety Net)
Reputational risk	Business: Reputational damage due to media scrutiny	Shareholder Perception	Negative Public Perception: Media coverage or public opinion portraying the company negatively
	Environmental: Reputation damage due to environmental impact	Negative impacts on local environmental assets	KBAs (KBA Partnership) and other areas of importance
	Socioeconomic: Reputation damage due to social impact	Potential to negatively impact the local economy	Exposure to food insecurity (FAO)

Table 1 Overview- Risk Types (Sample)

2.3 Risk Hierarchy

The WWF BRF has a complete risk hierarchy that includes four different risk levels, covering risks related to biodiversity that affect the geographical areas where a company operates.

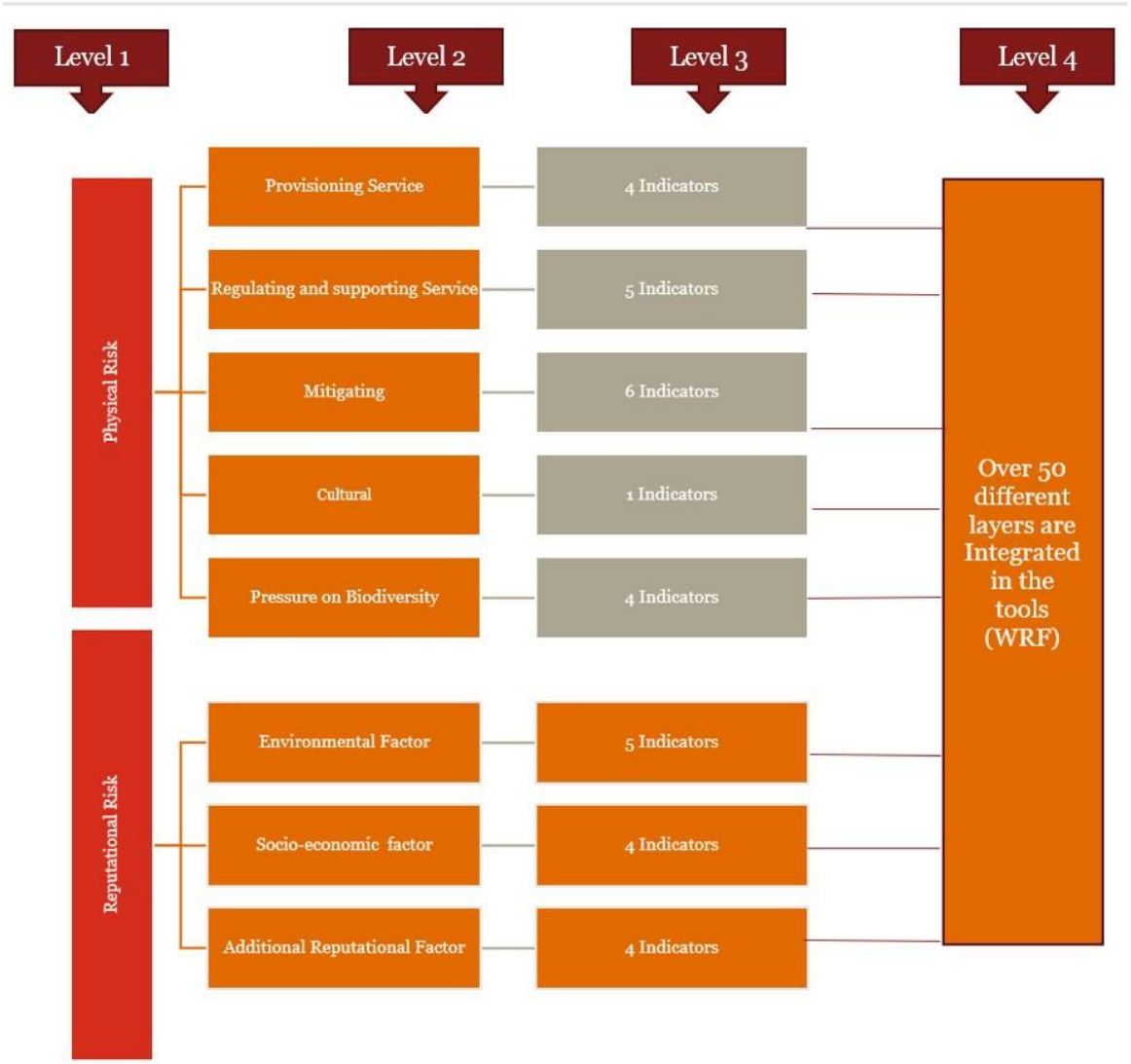


Figure 3 WWF BRF Risk Hierarchy (Maria Walsh (WWF Germany) R. C., 2023)

2.3.1 Type of Risk Involved

Physical risks occur when a business and its supply chains rely heavily on natural and human-induced conditions of land and seas. These risks can adversely affect ecosystem services, leading to potential decreases in productivity (like less fertile soils and pollination) or higher input costs (due to shortages of raw materials or harvest losses) and include damages to infrastructure and disruptions in operations due to nature-related events.

Reputational risks arise from a company's negative impacts on biodiversity and people, whether real or perceived. These risks are connected to how stakeholders and local communities perceive a company's commitment to sustainability and responsible practices on biodiversity. The consequences of reputational risks can be diverse, including harm to the corporate brand, reduced sales, increased scrutiny from investors, and a drop in share prices.

3. Biodiversity Risk Assessment Process

To assess biodiversity risk, the WWF biodiversity risk filter (WWF BRF) was used to determine physical and reputational risks. This tool helps evaluate potential risks and impacts on biodiversity related to a company's operations, focusing on specific locations. It considers a range of factors, such as threatened species, ecosystems, and protected areas, based on the location of operations.

LEVEL 1:	
	• Combines risk categories into broader risk types (physical risks and reputational risks).
LEVEL 2:	
	• Group indicators into higher-level risk clusters relevant to companies and financial institutions.
	• Includes five physical risk categories and three reputational risk categories.
LEVEL 3:	
	• Comprises information on the importance and local integrity of aspects of biodiversity. • Presented in an assessment unit with a risk score derived from 33 indicators (20 physical risk and 13 reputational risk indicators).
LEVEL 4:	
	• Involves raw global data sets measuring biodiversity and ecosystem aspects in specific locations.
	• Currently, the WWF BRF tool holds 56 global biodiversity data metrics.

Figure 4 Biodiversity Risk Assessment Process

4.0 Biodiversity Risk Assessment Results (Scoping the Assessment)

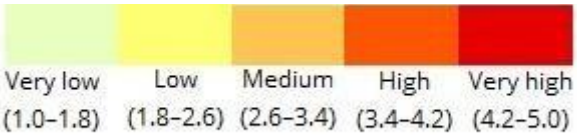
The Following are the Assessment results on dependency and impact.

Indicators #	BRF Indicators	Paradeep-Site	Goa- Site
SPH	**Scape Physical Risk**		
SRC1	**1. Provisioning Services**		
S1_1	1.1 Water Scarcity	3.55	2.85
S1_2	1.2 Forest Productivity and Distance to Markets	No dependency or impact	No dependency or impact
S1_3	1.3 Limited Wild Flora & Fauna Availability	3	3
S1_4	1.4 Limited Marine Fish Availability	NA	NA
SRC2	**2. Regulating & Supporting Services - Enabling**		
S2_1	2.1 Soil Condition	No dependency or impact	No dependency or impact
S2_2	2.2 Water Condition	3.5	3
S2_3	2.3 Air Condition	3.5	3
S2_4	2.4 Ecosystem Condition	No dependency or impact	No dependency or impact
S2_5	2.5 Pollination	No dependency or impact	No dependency or impact
SRC3	**3. Regulating Services - Mitigating**		
S3_1	3.1 Landslides	3	4
S3_2	3.2 Fire Hazard	3.5	3
S3_3	3.3 Plant/Forest/Aquatic Pests and Diseases	No dependency or impact	No dependency or impact
S3_4	3.4 Herbicide Resistance	No dependency or impact	No dependency or impact
S3_5	3.5 Extreme Heat	4	4
S3_6	3.6 Tropical Cyclones	4.5	3.5
SRC4	**4. Cultural Services**		

S4_1	4.1 Tourism Attractiveness	No dependency or impact	No dependency or impact
SRC5	**5. Pressures on Biodiversity**		
S5_1	5.1 Land, Freshwater, and Sea Use Change	1.5	1.25
S5_2	5.2 Tree Cover Loss	1	1
S5_3	5.3 Invasives	No dependency or impact	No dependency or impact
S5_4	5.4 Pollution	4.62	4.38
SRP	**Scape Reputational Risk**		
SR6	**6. Environmental Factors**		
S6_1	6.1 Protected/Conserved Areas	2.5	2
S6_2	6.2 Key Biodiversity Areas	2.5	3
S6_3	6.3 Other Important Delineated Areas	1.5	2.5
S6_4	6.4 Ecosystem Condition	2.62	2.75
S6_5	6.5 Range Rarity	1.5	3
SRC7	**7. Socioeconomic Factors**		
S7_1	7.1 Indigenous Peoples (IPs); Local Communities (LCs) Lands and Territories	NA	NA
S7_2	7.2 Resource Scarcity: Food - Water - Air	3	3
S7_3	7.3 Labor/Human Rights	3.5	3.5
S7_4	7.4 Financial Inequality	2	2
SRC8	**8. Additional Reputational Factors**		

S8_1	8.1 Media Scrutiny	4.5	4.5
S8_2	8.2 Political Situation	2.5	2.5
S8_3	8.3 Sites of International Interest	3.5	1.5
S8_4	8.4 Risk Preparation	3	3

Table 2 Biodiversity Risk Assessment Results



Risk Filter levels

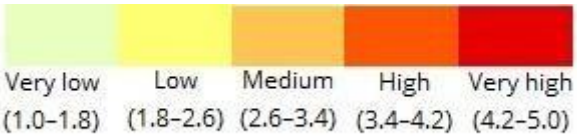
4.1 Findings

The dependency indicators identified as priorities:

BRF Indicators	Paradeep-Site	Zuarinagar- Site
1.1 Water Scarcity	3.55	2.85
2.2 Water Condition	3.5	3
2.3 Air Condition	3.5	3
3.2 Fire Hazard	3.5	3
3.5 Extreme Heat	4	4
3.6 Tropical Cyclones	vcx4.5	3.5

The Impact indicators are identified as priorities.

BRF Indicators	Paradeep-Site	Zuarinagar- Site
5.4 Pollution	4.62	4.38
6.4 Ecosystem Condition	2.62	2.75.
7.3 Labor/Human Rights	3.5	3.5
8.1 Media Scrutiny	4.5	4.5



Risk Filter levels

In this situation, "dependency" refers to how much the selected industry depends on ecosystem services. These services include providing water and raw materials, as well as regulation and mitigation. For the Paradeep Operation, the measures of dependency used for assessing biodiversity at both the Paradeep Site and Zuarinagar Site show different levels of risk related to key environmental elements. Among these, water and its quality are crucial for the industry's daily operations and are identified as high-risk factors.

On the other hand, industries also impact biodiversity in their places through direct or indirect exploitation, pollution, land use change (including the conversion, degradation, and modification of ecosystems), etc. For instance, the data in the assessment, pollution, and media scrutiny indicated high risk. The interconnectedness of both indicators reveals that the industry operations could emit significant air pollutants, which may cause media scrutiny; it is crucial to recognize that these scores are integral in comprehending the potential impacts on biodiversity, with medium, high, and very high-risk categories guiding conservation and management strategies to mitigate environmental threats.

4.2 Site Assessed (Scoping the Assessment)

Type of Sites	Location	Site
Own operation	Paradeep, Orrisa	Paradeep Phosphate Limited (1.8 million MT)
	Zuarinagar, Goa	Paradeep Phosphate Limited (1.2 million MT)

5.0 Biodiversity Risk Assessment Results (Collecting location-specific company and supply chain data)

This step specifies the geographic location of the assessed site using coordinates or an approximate address/zone on the map. The industry sector and the importance of the business were identified for each site, and preparation for the next step was specified. Additionally, all facilities were classified into three business importance levels based on the following criteria:

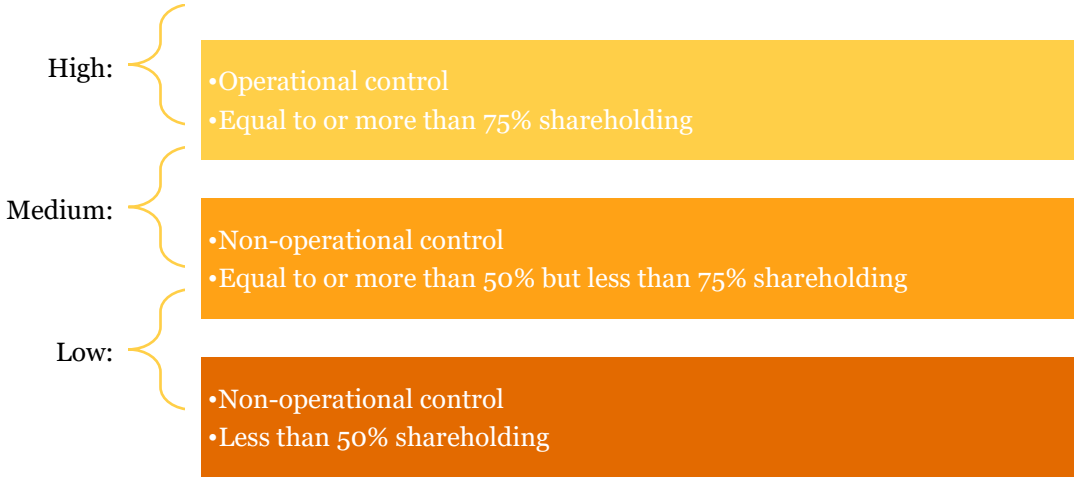


Figure 5 The Three Business Importance Levels

The Table represents the Site-wise business Importance and Coordinate details:

Type of site	Location	Industry Capacity	Business importance level	Site	Coordinate	
Own Operations	Paradeep, Orrisa	1.8 million MT	High	Paradeep Phosphate Limited (1.8 million MT)	20°16'43"N	86°38'25"E
	Zuarinagar, Goa	1.2 million MT	High	Paradeep Phosphate Limited (1.2 million MT)	15°22'28"N	73°52'21"E

Table 3: Business Importance

6.0 Biodiversity Risk Assessment Results (Assessing biodiversity-related risks)

The assessment plays an essential role in identifying high risks and taking steps to avoid or mitigate their impacts on biodiversity by integrating the identified biodiversity risks into multi-disciplinary, company-wide risk management processes.

6.1 Overall Biodiversity Risk Assessment Maps Analysis

Sites: Paradeep and Zuarinagar

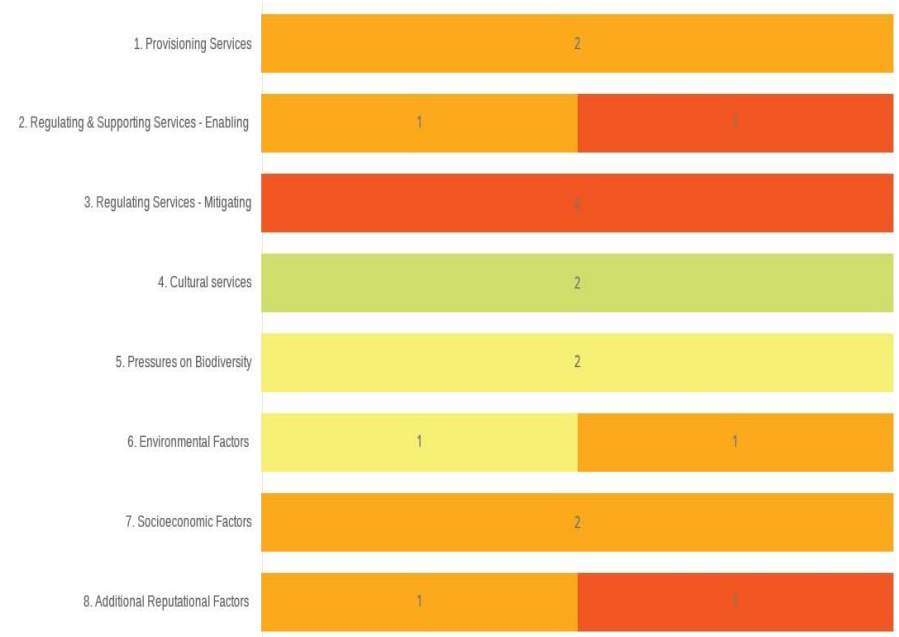


Figure 6 No of sites by risk category

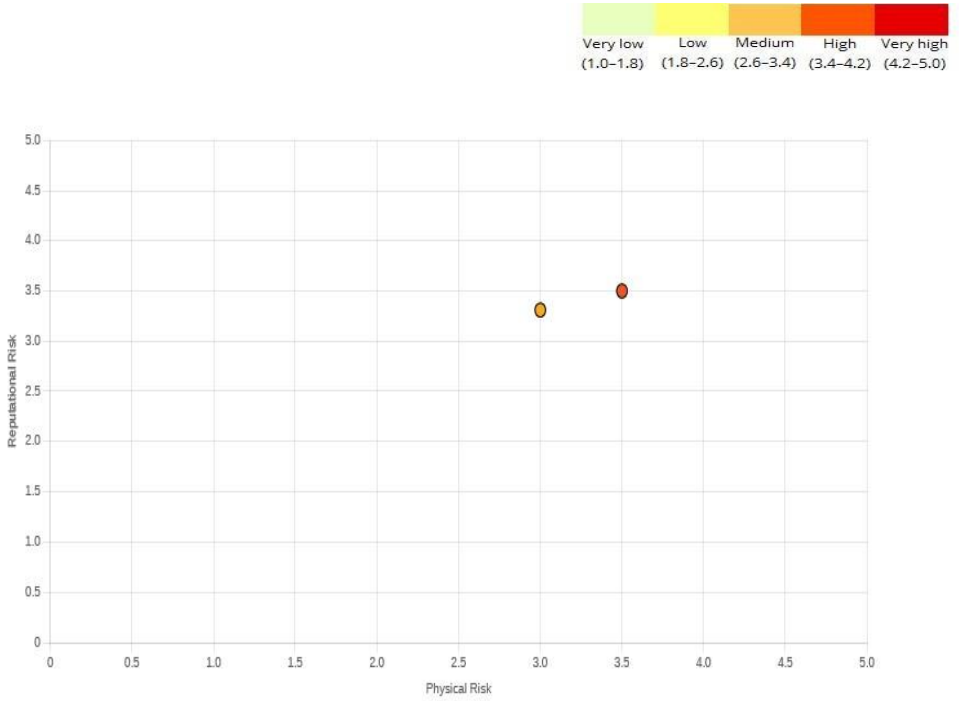
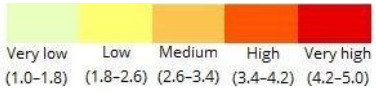


Figure 7 Physical vs reputational risk

Inference:

- In the assessment, the Paradeep site was identified as a representative site with a high biodiversity risk level, both reputationally and physically, as shown in Figure 7.
- Both sites are categorized under risk in **Category 3** (Regulating Services – Mitigating); at a high level, it suggests a significant risk associated with the ability of ecosystems to supply regulatory services.
- Paradeep site under risk **category 2** (Regulating and supporting services – Enabling); at a high level, Paradeep site in this category is likely to experience a lack of enabling ecosystem services.
- The Paradeep site in Odisha and the Zuarinagar site in Goa exhibit a low to elevated level of biodiversity risk in **category 5**. Areas of low location risk within this category are likely to face less exposure to high pressures on biodiversity."
- The findings show that the Paradeep site has a high level of additional reputational factors, as seen in **category 8**. On the other hand, the Zuarinagar site has a medium-level risk of additional reputational factors. The biodiversity risk assessment revealed a higher risk for reputational damage at the Paradeep site than at the Zuarinagar site. This suggests that the company's activities or effects on biodiversity at **Paradeep** are more likely to attract public attention, which could affect its reputation and revenue.
- A low to medium range of biodiversity risk indicates moderate, manageable pressure on the environment, suggesting a less severe impact on plant and animal diversity. Monitoring and mitigation efforts may still be necessary for sustainability.

The assessment indicated that the Paradeep site in Odisha faced a significantly higher biodiversity risk than the Zuarinagar site in Goa. Paradeep was particularly vulnerable regarding physical and reputational risks, with its compromised ability to provide essential regulatory and enabling ecosystem services. This elevated risk level suggested a greater likelihood of reputational damage and public attention, emphasizing the need for urgent and intensive intervention. In contrast, the Zuarinagar site, while not risk-free, exhibited a lower level of biodiversity risk, indicating more manageable environmental pressures and a lesser impact on biodiversity. Therefore, while both sites required monitoring and mitigation efforts, Paradeep demanded a more focused approach due to its higher risk profile.



WWF Biodiversity

Risk Filter levels

6.2 Biodiversity Risk Assessment Data /Analysis of top 10 risk Indicators

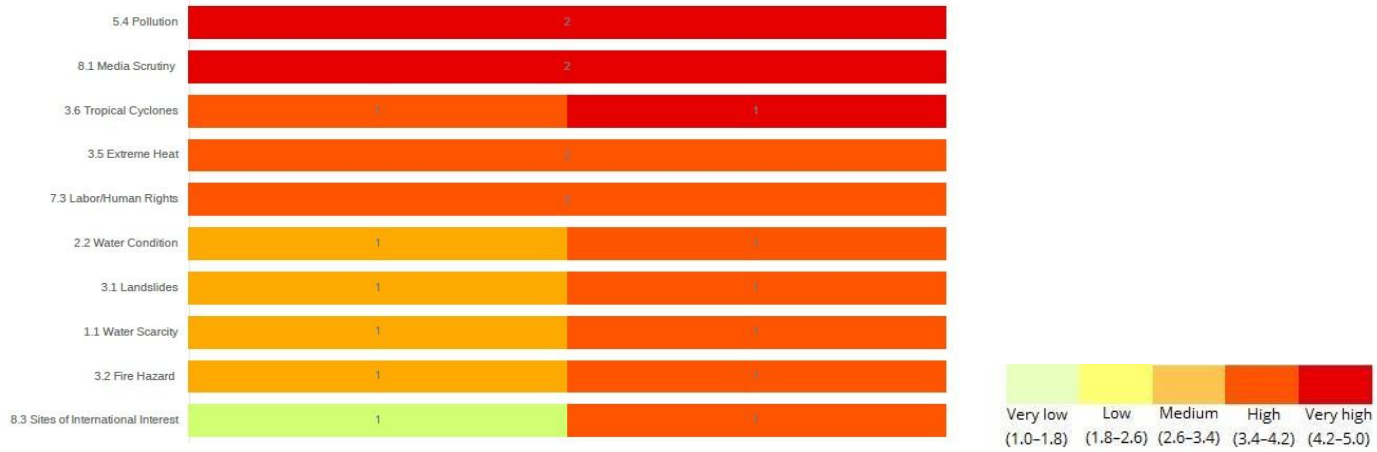


Figure 8 Risk by Top 10 Risk Indicators

Inference:

The findings identified the top 10 biodiversity-related risk indicators, divided into two categories: physical risk, which includes 6 indicators, and reputational risk, with 3 indicators. The details are as follows:

Physical risk:

1. **Extreme Heat (3.5):** Both sites are subject to a high-risk level with a Wet Bulb Globe Temperature (WBGT) ranging from **30 to 32** degrees Celsius– a 5-year return period.
2. **Water Scarcity (1.1):** The regions could experience a water shortage, as the demand for industrial water is rising due to various companies setting up their operations.
3. **Water Condition (2.2**): The Paradeep site could experience harsh water conditions because of seawater backflow, resulting in a higher Total Dissolved Solids (TDS) level.
4. **Tropical Cyclones (3.6):** Paradeep, with a very high risk, is forecasted to face maximum wind speeds over **120 mph** in a 50-year return period, while Zuarinagar, at a high-risk level, is expected to withstand extreme maximum wind speeds ranging from **80 to 120 mph.**
5. **Pollution (5.4):** Both sites are at very high risk, with indicators showing more than **5.9 kg/ha** of total pesticides used, over **77 kg/ha** of total nitrogen used in agriculture, freshwater nutrient pollution exceeding **2.6 mg/L** in total nitrogen concentration, and marine nutrient and pesticide pollution above 0.156. Additionally,

they face very high-risk air pollution levels, with ground-level fine particulate matter (PM2.5) concentrations of 2.5 micrometres or smaller exceeding **50 micrograms per cubic metre**. These indicators highlight concerns related to nutrient, pesticide, and air pollution.

6. **Fire Hazard (3.2):** The fire hazard in Paradeep presents a high biodiversity risk driven by conditions like dryness, high temperatures, or easily ignitable vegetation. It is predicted to experience a fire weather intensity between 60 to 120 for a 10-year return period.

Reputational risk:

1. **Media Scrutiny (8.1):** The biodiversity risk assessment indicated a very high risk for media scrutiny in both sites, suggesting a significant likelihood that the company's actions or impacts on biodiversity attracted attention from the media.
2. **Labor and Human Rights (7.3):** High-risk areas imply that activities or industries affecting biodiversity also have implications for labour and human rights (Ex: Local community, workers)

The importance of BRF filter indicators in PPL's operations has been summarized in the table below.

Risk Type	**Reputational Risk**	**Physical Risk**
Water Scarcity	PPL sources its water from the Taladanda Canal, which could lead to reputational risks, particularly in areas experiencing significant water scarcity due to the intensive water requirements of the plant (DAP, etc.).	PPL's dependency on high water requirements posed physical risks, causing disruptions to production and supply chain operations for water-dependent plants (DAP, Coal Handling Plant, Ammonia Gasification, Urea, Nitrate, Nitric Acid, Aluminum Fluoride) using the Taladanda canal.
Air Condition	In Paradeep, assessing air quality through PM2.5 concentration levels is crucial. Industries relying heavily on this aspect of the ecosystem might encounter challenges to their reputation, particularly in high-risk areas where issues with air quality are more evident.	The PPL project is expected to emit significant air pollutants, including NOx, SOx, PM10, PM2.5, acid mist, NH3, and HF. The continuous release of pollutants poses physical risks to air quality in the project's vicinity.
Extreme Heat	PPL's strategies to cope with extreme heat may enhance its reputation, while inadequate responses could lead to reputational challenges in both sites.	The Paradeep specified temperature highlights the potential health implications, particularly during the summer, with mean maximum temperatures around 32.9°C. The shift to warmer temperatures, driven by climate change, adds to the physical risk, affecting human well-being and the built environment.
Cyclone	Reputational risks could arise from PPL's inability to manage and communicate responses to cyclonerelated challenges effectively.	Historical events like the super cyclone in Paradeep illustrate the physical risk associated with storm surges. This risk encompasses the potential for severe consequences, including loss of life and property damage.

Table 4 Reputational and physical risk based on high-risk Indicators

7.0 Biodiversity Risk Assessment (Aggregating biodiversity risk- Mitigation Measures to the company and portfolio level)

Key Aspect	Key Activity	Key Asset	Biomes & Ecosystems	Ecosystems
Description	• Site preparation, • Site installation • Infrastructure Design • Factory Operations: conveyor belt • Water use/ water discharge • Maintenance of Storage and distribution of products	• Infrastructure for chemical production • Machinery and warehouse • Gypsum Pond • STP/ETP	Proximity to the sea and river involves considering mangroves, estuaries, seashore habitats, ponds and lakes, Streams, and rivers.	Marine and aquatic Ecosystems

Table 5: Key Aspects and Description of Industry

There is a strong emphasis on assessing the potential impact on biodiversity risks from the Production sector and its activities, based on key activities outlined in Table 5. Mitigation measures are prepared at the site level to prevent and decrease risks or impacts; the report on the Biodiversity Management Plan provides a detailed analysis and strategy for preserving and enhancing biodiversity.

8. Subsequent actions and Recommendations

- **Implementation** and adoption **roadmap to improve** nature-related financial disclosures.
- **Transparency** and accountability regarding the impact on biodiversity and **natural** risks.
- **Engage** with stakeholders and **collaborate** with existing reporting **frameworks; Coordinate** and **promote collaborative efforts** towards sustainable practices and biodiversity **Conservation.**

References

1. Forster, P. M., Smith, C. J., Walsh, T., Lamb, W. F., Lamboll, R., Hauser, M., & Zhai, P. (2023). Indicators of Global Climate Change 2022. *Annual Update of Large-Scale Indicators of the State of the Climate System and Human Influence*.
2. Stockl, N., Larson, S., Thomas, J., Hicks, J., Hicks, C., Pascoe, S., & Marsh, H. (2018). Socioeconomic impacts of changes to marine fisheries and aquaculture brought about through climate change.
3. Herweijer, C., & Evison, W.(2020). *Nature Risk Rising*. World Economic Forum.
4. World Wildlife Fund. (2023). *Risk Filter Suite*.
5. Walsh, M. (2023). *WWF Biodiversity Risk Filter*. WWF.
6. Parida, B. R., Behera, S. N., Oinam, B., Patel, N. R., & Sahoo, R. N. (2018). Investigating the effects of episodic Super-cyclone 1999 and Phailin 2013 on hydro-meteorological parameters and agriculture: An application of remote sensing. *Remote Sensing Applications: Society and Environment*, *10*, 128137.
7. Shaw, R., Islam, A., & Mallick, F. (2013). Disaster, risk and evolution of the concept. *Disaster risk reduction approaches in Bangladesh*, 3-21.
8. Kron, W. (2013). Coasts: the high-risk areas of the world. *Natural hazards*, *66*(3), 1363-1382.