



Biodiversity Risk Assessment Report 2026

Nature-Related Risk Assessment of BCPG's Portfolio

Insights from ENCORE, the WWF Risk Filter Suite, and GIS Spatial Analysis



Contents: BCPG Biodiversity Risk Assessment Report

No.	Content	Page
1	Introduction	3-5
2	Scope of Assessment	6-7
3	Methodology & Framework Integration	8-10
4	ENCORE Assessment Results	12-17
5	WWF Biodiversity Risk Assessment Results	18-42
7	Conclusion	43-44
9	References	45

The Corporate Imperative for Nature

Why Biodiversity & Water Risk Assessments are now a fundamental requirement for enterprises.

Resource Dependency

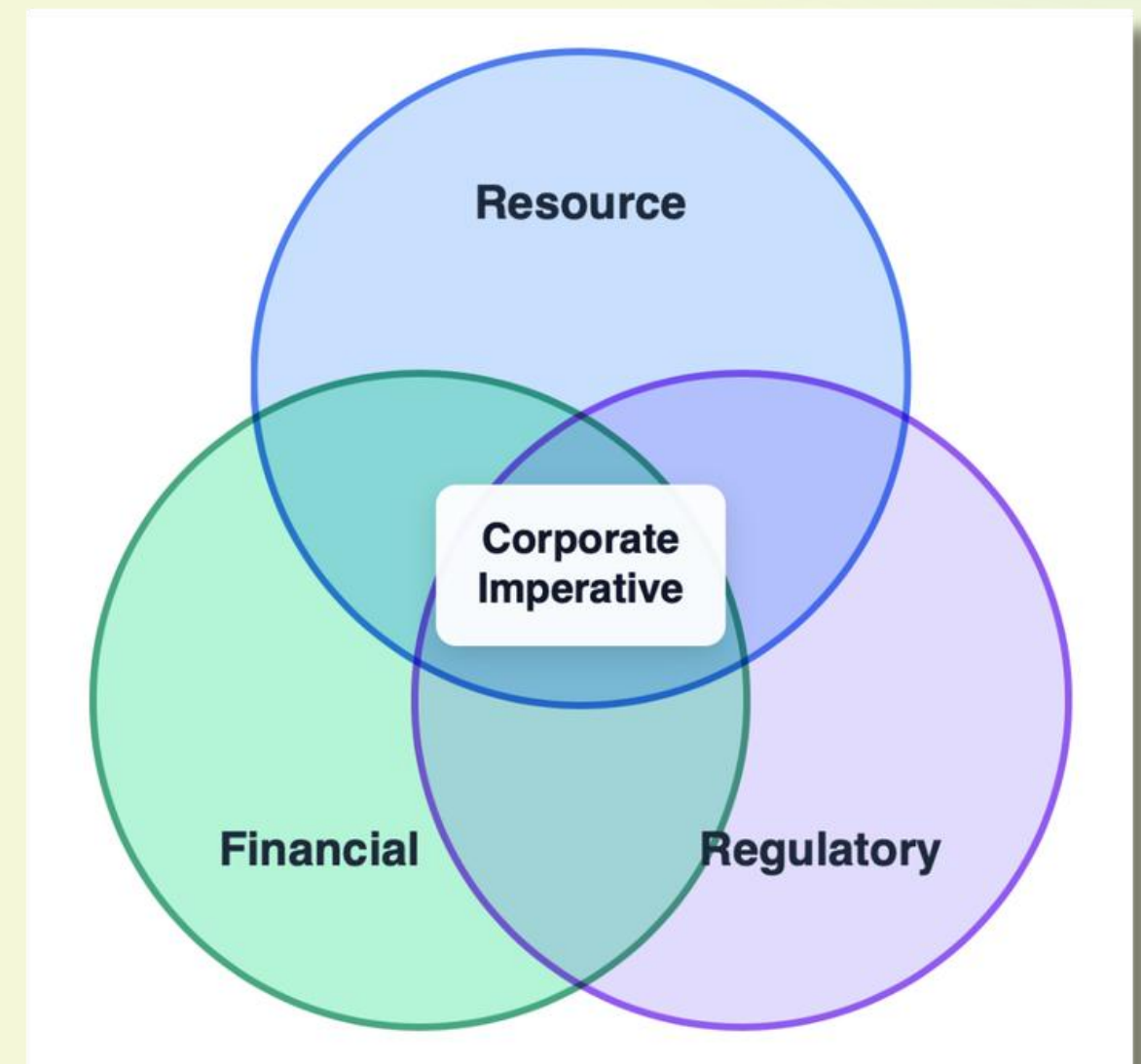
Operations inherently rely on critical ecosystem services. Assessing dependencies—especially water availability and quality—is vital to prevent operational bottlenecks and safeguard supply chains.

Financial Mitigation

Ecological degradation translates directly into financial risk. Proactive assessment mitigates the risk of stranded assets and meets the growing demands of ESG-focused investors.

Regulatory Alignment

With the rise of frameworks like TNFD and CSRD, nature-related financial disclosures are shifting from voluntary to mandatory. Early assessment ensures compliance and protects brand reputation.



METHODOLOGY & FRAMEWORK INTEGRATION

Global Assessment Tools



ENCORE (EXPLORING NATURAL CAPITAL OPPORTUNITIES, RISKS AND EXPOSURE)



Exploring Natural Capital Opportunities, Risks and Exposure. Maps BCPG's production processes (e.g., solar, wind, ALT) to dependencies and impacts on ecosystem services.



WWF RISK FILTER SUITE (VERSION 3.0)



- **Water Risk Filter (WRF)** Assesses basin-related and operational water risks. Evaluates physical (scarcity, quality), regulatory, and reputational water risks specific to BCPG site locations.
- **Biodiversity Risk Filter (BRF)** Analyzes spatial proximity of operations to key biodiversity areas, protected areas, and regions with high species richness or ecological fragility.

Biodiversity Risk Assessment

Objective

Assess biodiversity-related risks, impacts, and ecosystem dependencies associated with BCPG operations in Thailand to support CSA, TNFD, and ESG disclosures

Coverage

Power generation assets (21 site) and ALT

Key Assessment Areas

- Biodiversity-sensitive areas
- Protected areas & critical habitats
- Ecosystem dependencies & impacts
- Species-related risks
- Nature-related physical & reputational risks

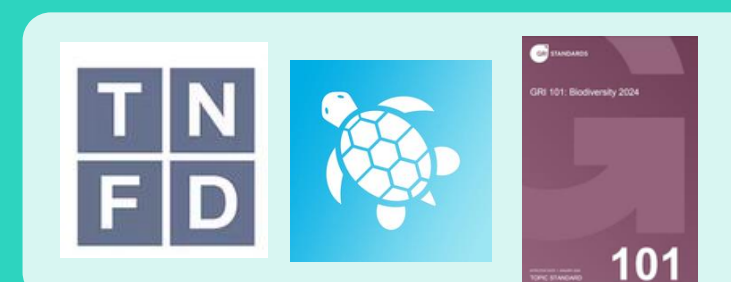
Assessment Tools

- ENCORE
- WWF Biodiversity Risk Filter
- WWF Water Risk Filter
- IUCN Red List
- GIS Spatial Analysis



Reference Standards

- S&P Global CSA
- TNFD
- International Finance Corporation Performance Standard 6 (IFC PS6)
- GRI 101



Deliverables

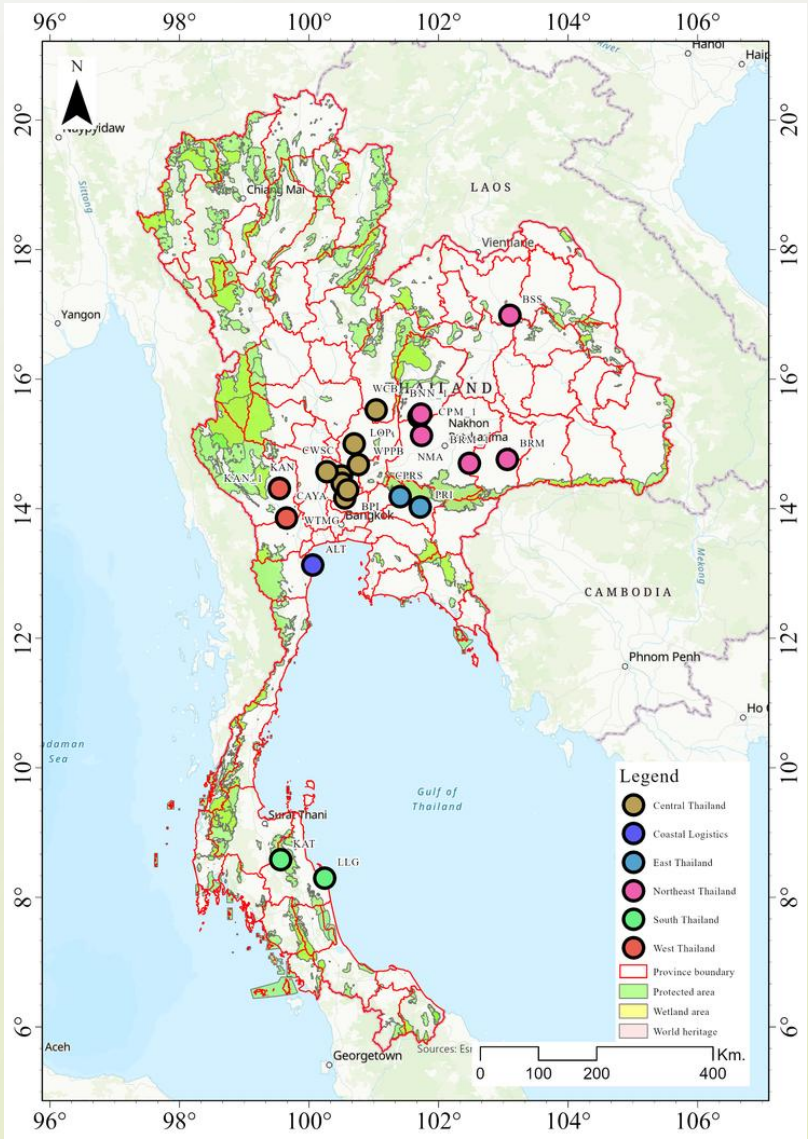
- Biodiversity Risk Screening
- Spatial Risk Maps
- Priority Site Matrix
- Risk & Dependency Assessment
- Management Recommendations

Expected Outcomes

Identify high-risk and biodiversity-sensitive sites, prioritize management actions, and strengthen long-term biodiversity risk management.

SCOPE OF ASSESSMENT

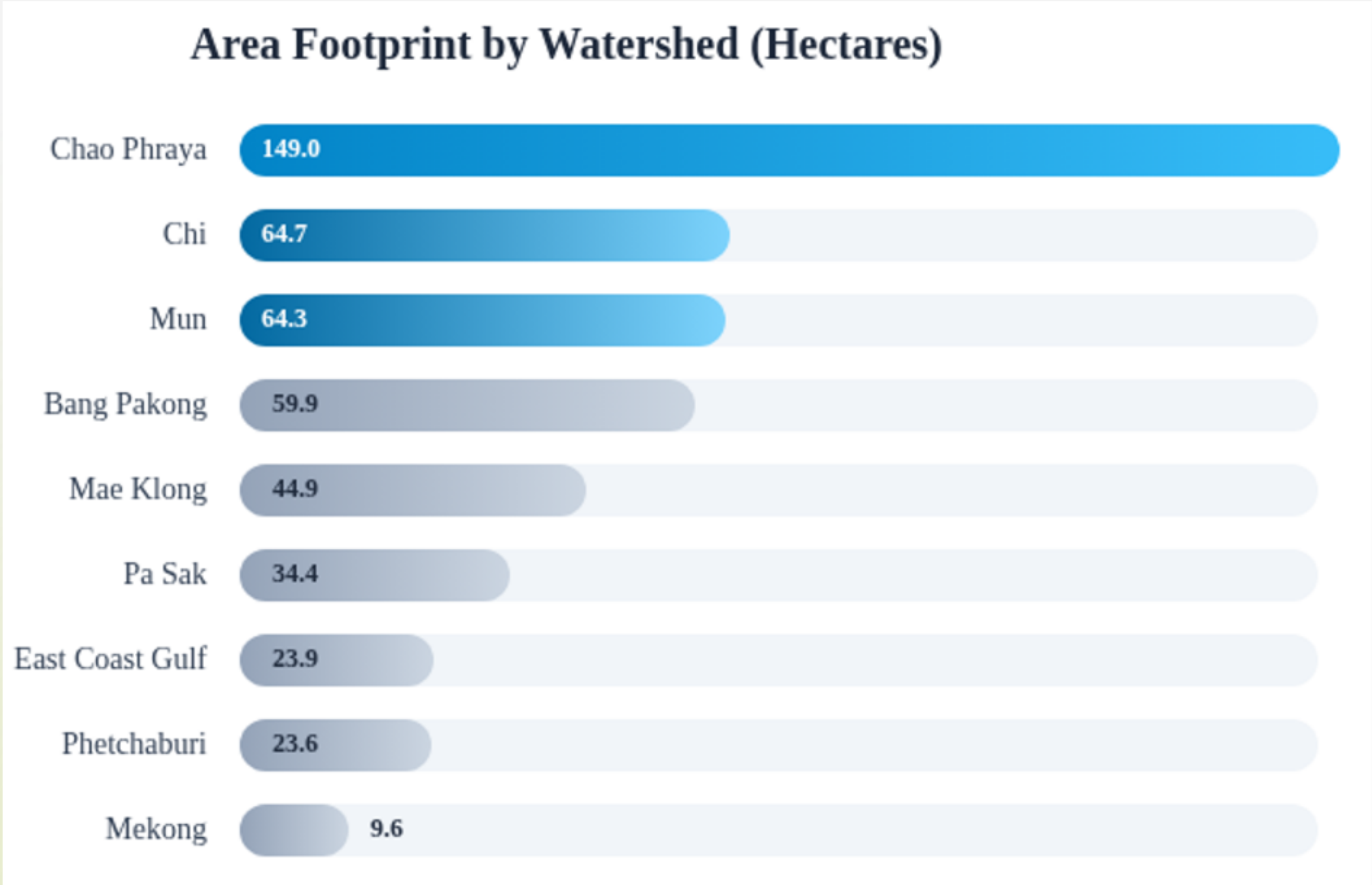
Power generation
assets (21 sites and Oil
terminal project)



No.	BCPG's Sites	Business Activities	Location	Watershed	Area (Hectares)
1	BPI	Solar Farm	Phra Nakhon Si Ayutthaya, Thailand	Chao Phraya	83.1372
2	BPH_1	Solar Farm	Phra Nakhon Si Ayutthaya, Thailand	Chao Phraya	42.514
3	CAYA	Solar Farm	Phra Nakhon Si Ayutthaya, Thailand	Chao Phraya	2.8288
4	CBPI	Solar Farm	Phra Nakhon Si Ayutthaya, Thailand	Chao Phraya	11.0564
5	CWSC	Solar Farm	Ang Thong, Thailand	Chao Phraya	9.4604
6	LOP	Solar Farm	Lopburi, Thailand	Pa Sak	21.7604
7	WCB	Solar Farm	Phetchabun, Thailand	Pa Sak	3.6092
8	WPPB	Solar Farm	Saraburi, Thailand	Pa Sak	9.0612
9	BNN_1	Solar Farm	Chaiyaphum, Thailand	Chi	40.858
10	CPM_1	Solar Farm	Chaiyaphum, Thailand	Chi	23.8864
11	BRM	Solar Farm	Buri Ram, Thailand	Mun	22.0188
12	BRM_1	Solar Farm	Buri Ram, Thailand	Mun	18.6848
13	NMA	Solar Farm	Nakhon Ratchasima, Thailand	Mun	23.6124
14	BSS	Solar Farm	Udon Thani, Thailand	Mekong	9.6
15	KAN	Solar Farm	Kanchanaburi, Thailand	Mae Klong	19.1808
16	KAN_1	Solar Farm	Kanchanaburi, Thailand	Mae Klong	19.102
17	WTMG	Solar Farm	Kanchanaburi, Thailand	Mae Klong	6.6304
18	CPRS	Solar Farm	Prachin Buri, Thailand	Bang Pakong	11.5492
19	PRI	Solar Farm	Prachin Buri, Thailand	Bang Pakong	48.3704
20	ALT	Oil Terminal and Storage Services	Phetchaburi, Thailand	Phetchaburi	23.5671
21	KAT	Solar Farm	Nakhon Si Thammarat, Thailand	Peninsula	1.8276
22	LLG	Wind Farm	Nakhon Si Thammarat, Thailand	Peninsula	22.0321

OPERATIONAL FOOTPRINT & WATERSHED DISTRIBUTION

Scope of Assessment: Distribution of BCPG's 22 operational sites across Thailand's major river basins.



474.3

Total Hectares

22 Sites

9 Watersheds

High Exposure Zone

Over 31% of the operational footprint is concentrated in the Chao Phraya basin, highlighting a critical area for both water stress and flood risk assessments.

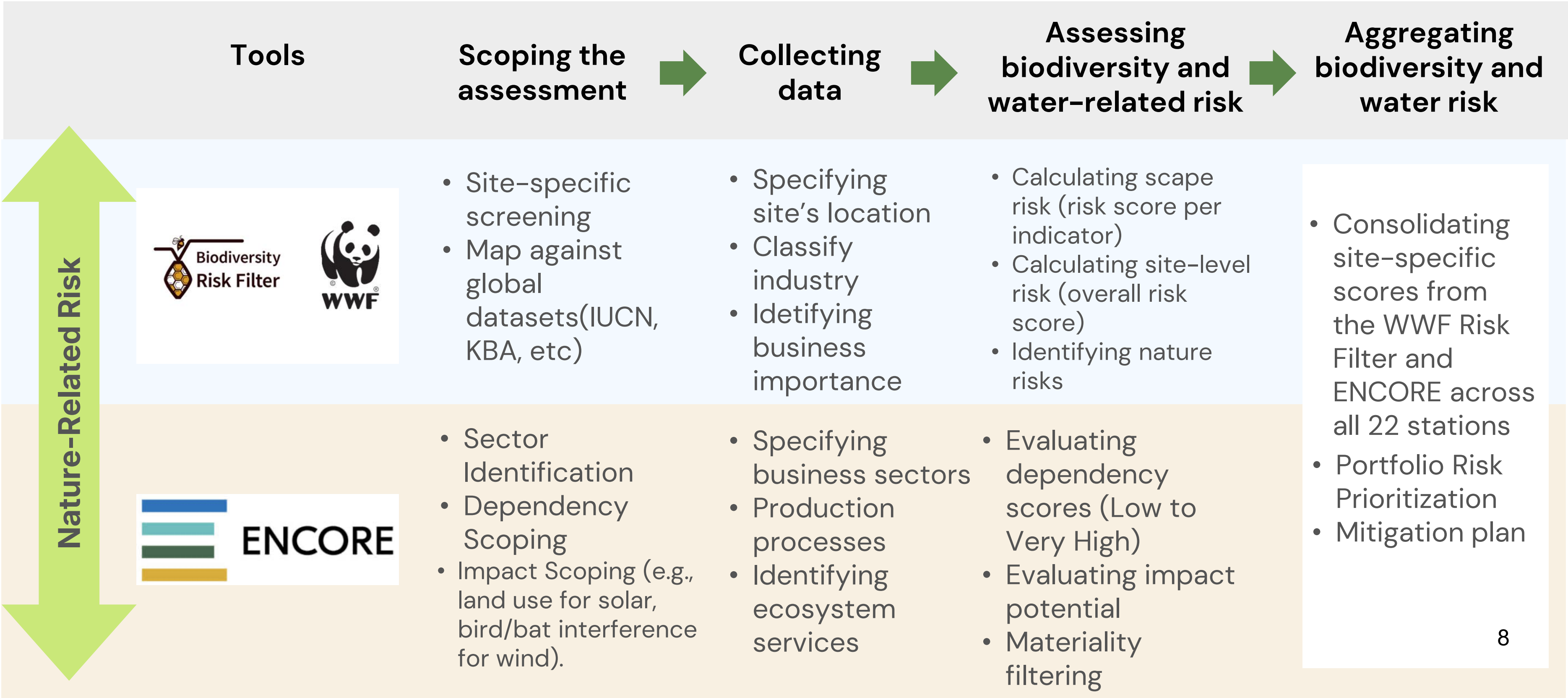
Northeastern Footprint

The Chi and Mun basins account for a combined 129 hectares, areas typically susceptible to seasonal drought risks impacting operational water dependency.

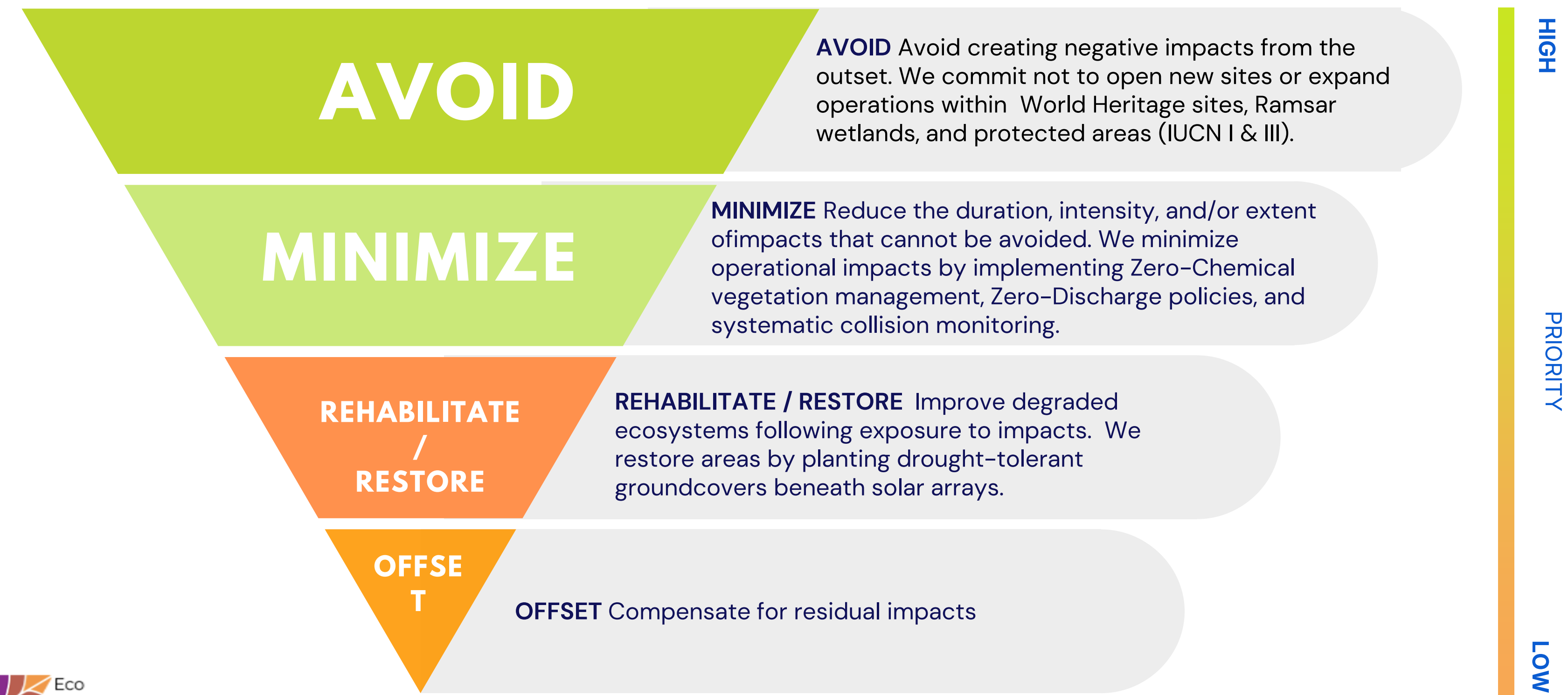
Biodiversity Risk Assessment Process



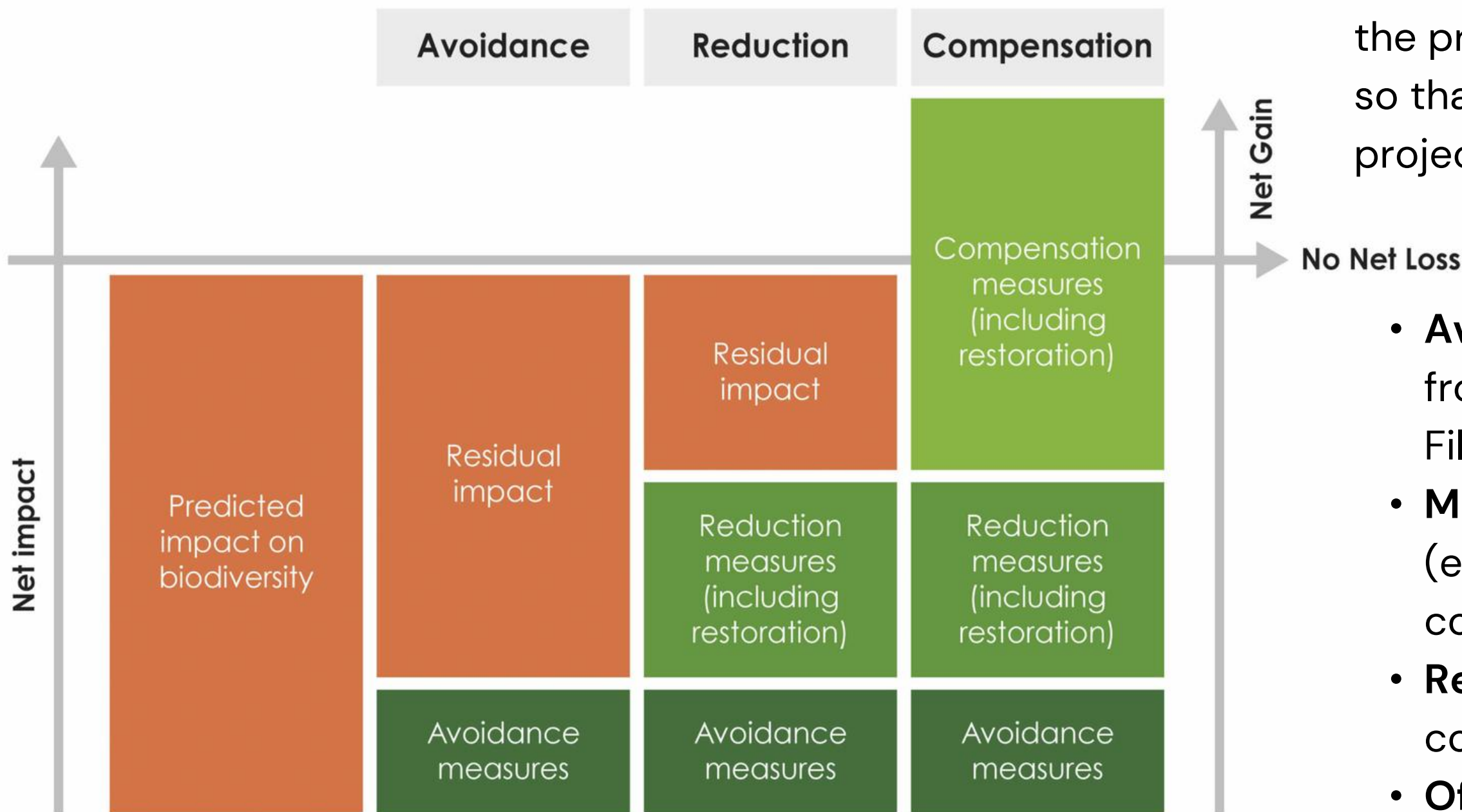
Methodology and Framework



Biodiversity Risk Mitigation Hierarchy



No Net Loss/ Net Gain



• **No Net Loss:** that any biodiversity losses caused by the project are fully balanced by mitigation measures, so that overall biodiversity value is no worse after the project than before.

- **Avoid:** Locate solar panels or wind turbines away from high-risk areas identified by your WWF Risk Filter (e.g., nesting grounds or wetlands).
- **Minimize:** If you must build, reduce the footprint (e.g., using "agrivoltaics" to allow farming/nature to coexist under solar panels).
- **Restore:** Rehabilitate areas disturbed during construction once the project is operational.
- **Offset:** As a last resort, if some nature is lost, BCPG must protect or restore an equivalent area elsewhere to achieve a "Net" balance.

Assessment Results



GIS Spatial analysis

Exploring Natural Capital Opportunities, Risks and Exposure



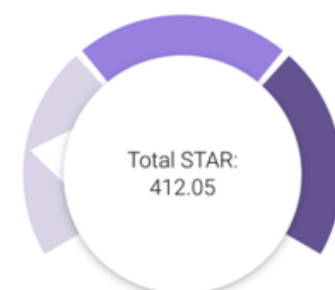
Potential to reduce species' extinction risk

'STAR units' reflect the potential contribution of your portfolio toward reducing global extinction risk. This highlights the extent of opportunities for reducing global extinctions within your portfolio, which can be achieved by reducing impacts on species.

Your portfolio score is below average for the number of mines and represents 0.41% of the total sector score.

How is the average calculated?

The average is determined by calculating the average mine value at global level and relating this to the size of the input portfolio. For example, if the average mine's STAR score is 20 and there are 10 mines in the portfolio, the average would be 200. Results are listed as roughly equal to average if they are within 5% of the average value.



Mining threats: 14.44 STAR
Other threats: 397.60 STAR

- High
- Medium
- Low

Ecological integrity risk

'Ecological integrity risk' reflects the potential impact of your portfolio on the integrity of selected habitats. This highlights extent of opportunities to increase the overall intactness of ecological communities within your portfolio, which can be achieved through appropriate biodiversity management and restoration.

Your portfolio score is below average for the number of mines and represents 0.36% of the total sector score.

What do the ecoregion alignment categories mean?

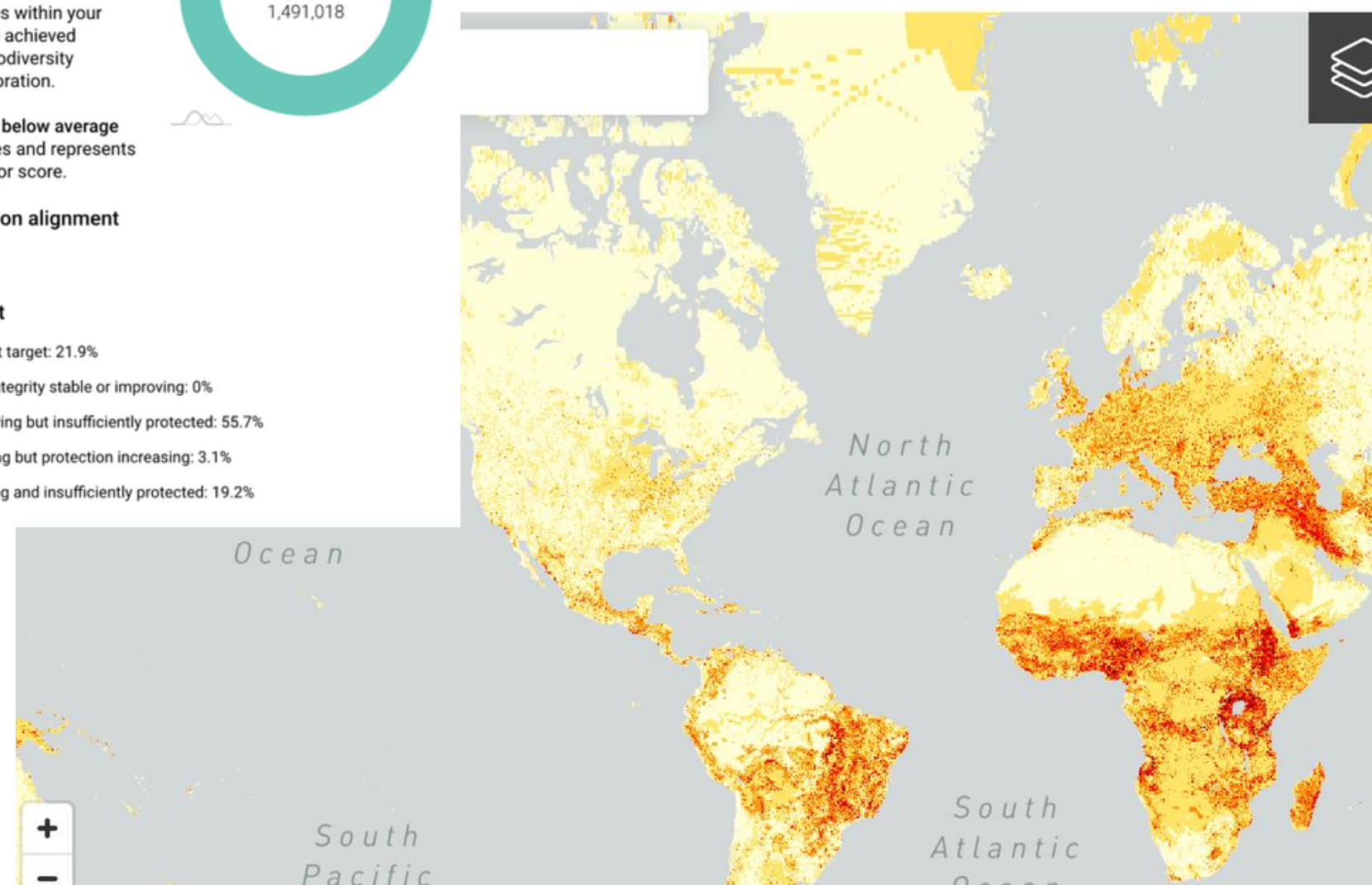
[View details](#)

Ecoregion alignment

- (A) On track to meet target: 21.9%
- (B) Protected and integrity stable or improving: 0%
- (C) Stable or improving but insufficiently protected: 55.7%
- (D) Integrity declining but protection increasing: 3.1%
- (E) Integrity declining and insufficiently protected: 19.2%



This assessment aligns with global sustainability frameworks, including the TNFD (LEAP Approach), GRI 101: Biodiversity (2024), and S&P Global CSA guidelines.



Data layers

Click each layer to display the spatial data and explore location-specific risks. Each data layer is accompanied by a description, and this [briefing note](#) summarises the methodology and data sources behind them.

Combined hotspots of natural capital depletion

Overlapping hotspots of depletion of stocks of natural capital assets (atmosphere, water, soil and sediments, biodiversity) in terrestrial environments. Hotspots correspond to the top 20% values of depletion, where human activities will be associated with higher risks of ecosystem service loss or degradation.

- 4 hotspots
- 3 hotspots
- 2 hotspots
- 1 hotspot

Dependencies

Assessing which Ecosystem Services the business relies upon to function continuously.

Solar Farms (20 sites): Require water resources (surface/groundwater) for panel cleaning and rely on surrounding ecosystems for flood protection.

Wind Farm (LLG): Depends on climate regulation and atmospheric stability to maintain a consistent wind flow.

Oil Terminal (ALT): Relies on coastal protection (e.g., natural barriers, mangroves) to shield infrastructure from erosion and severe storms.

Material Potential Pressures (Impacts)

Assessing how business activities generate Impact Drivers that affect nature.

Solar Farms (Ecosystem Use): Land clearing and large-scale footprint conversion may lead to habitat loss and fragmentation.

Wind Farm (Sensory Pollution): Noise and visual impacts may affect local biodiversity, such as bird and bat migration routes.

Oil Terminal (Pollutants): Risks of oil spills, surface runoff, or chemical contamination discharging into marine ecosystems.

Assessment & Interpretation Matrix

ENCORE Rating	Score	Dependency Interpretation (Business Reliance)	Impact Interpretation (Environmental Pressure)
Very High	5	Severe Physical Risk: Immediate operational disruption or severe financial loss if ecosystem service fails.	Severe Transition Risk: Severe environmental damage leading to potential loss of 'License to Operate'.
High	4	Significant Risk: Noticeable impact on operating costs; requires sourcing expensive resource alternatives.	Significant Risk: Environmental pressure likely to trigger community pushback or ESG divestment.
Medium	3	Moderate Risk: Operations can continue but with reduced efficiency. Contingency plans required.	Moderate Risk: Localized environmental impacts. Strict mitigation measures and monitoring required.
Low	2	Low Risk: Minimal reliance on nature. Functions can be easily substituted by technology.	Low Risk: Operations comply with standards, causing minimal changes to the ecosystem.
Very Low / NA	1 or 0	Insignificant Risk: Business process has virtually no direct link to this ecosystem service.	Insignificant Impact: Clean operations with no meaningful resource depletion or pollution.

Nature-Related Dependencies and Impacts

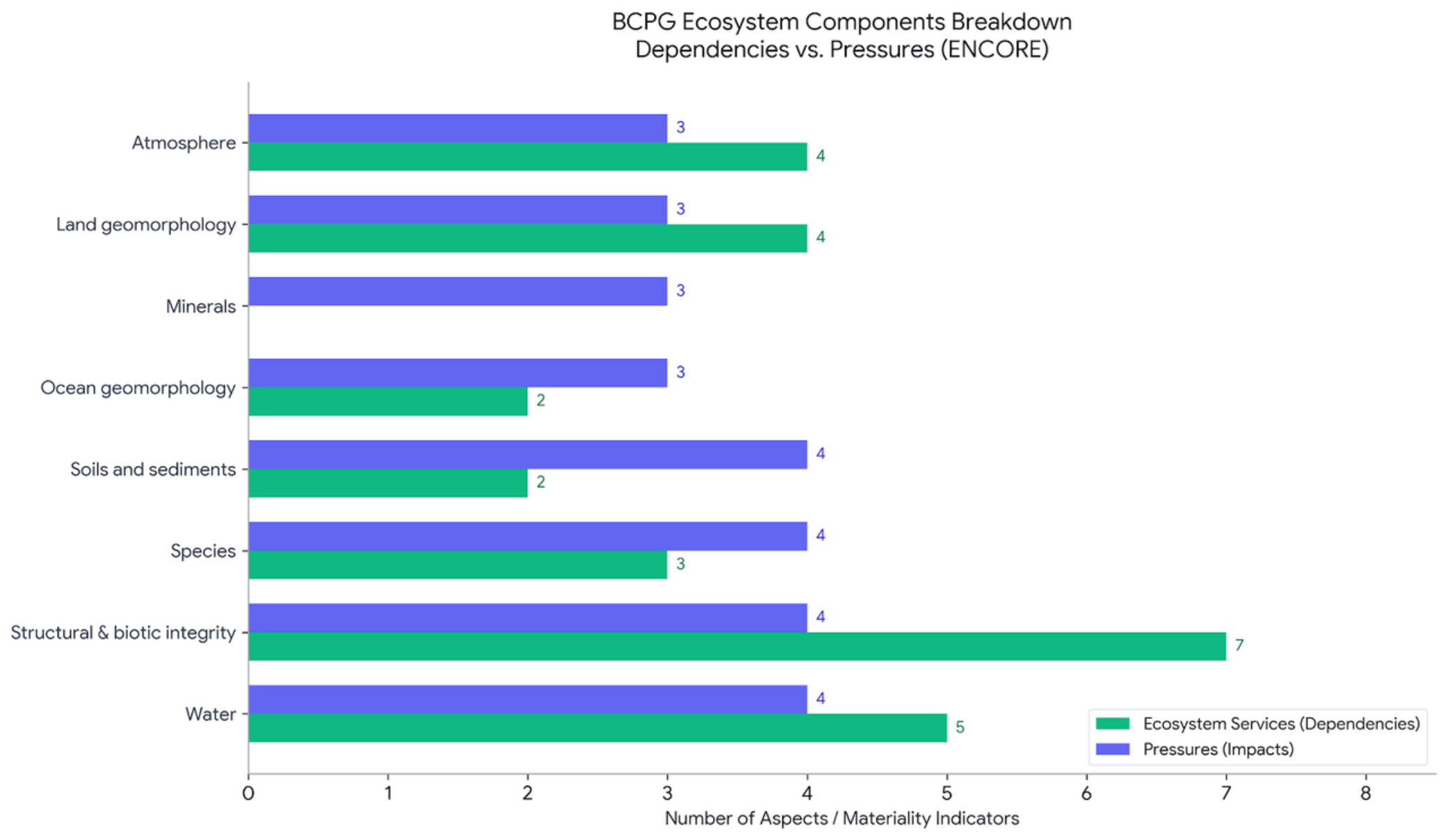
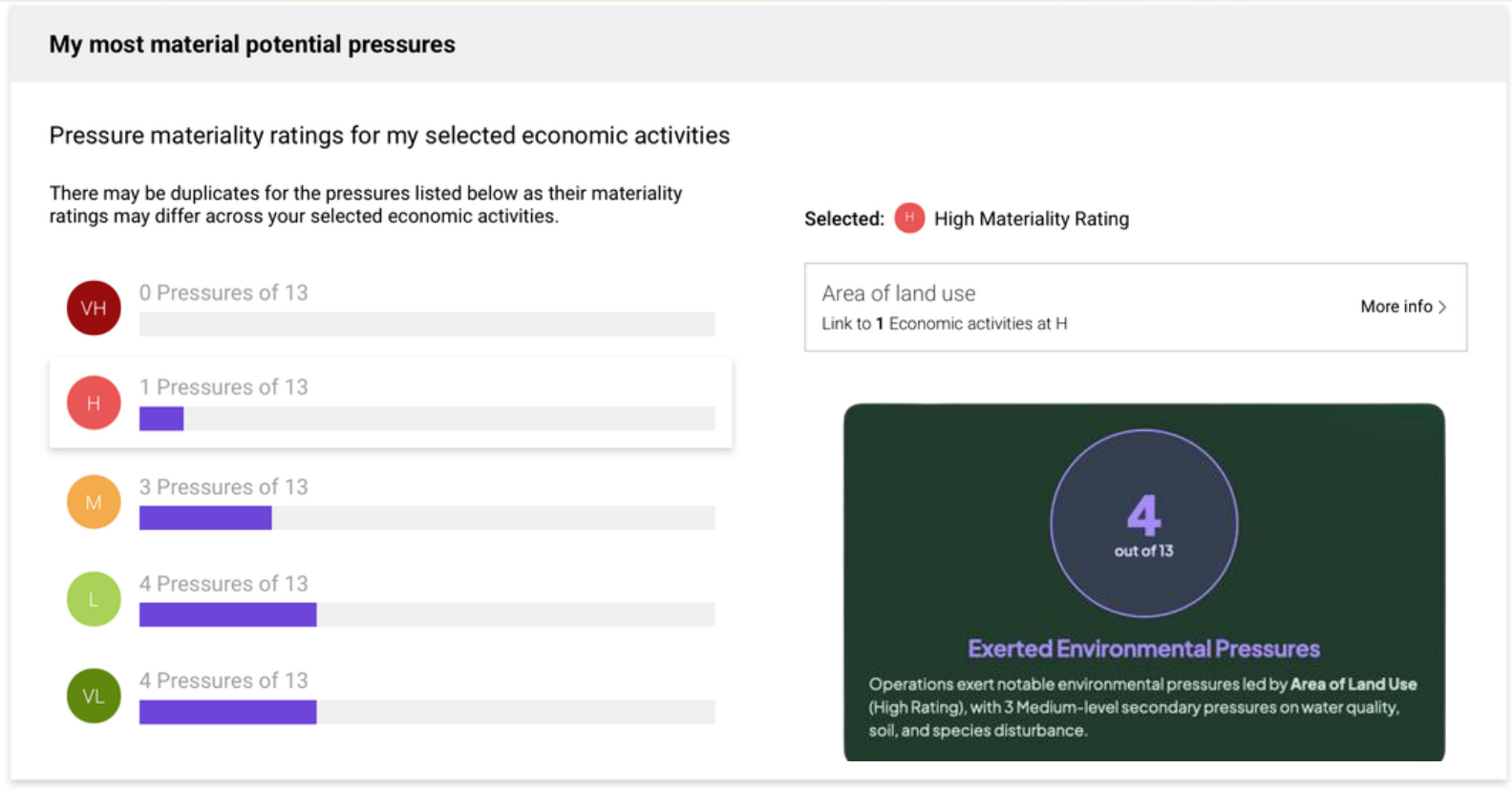
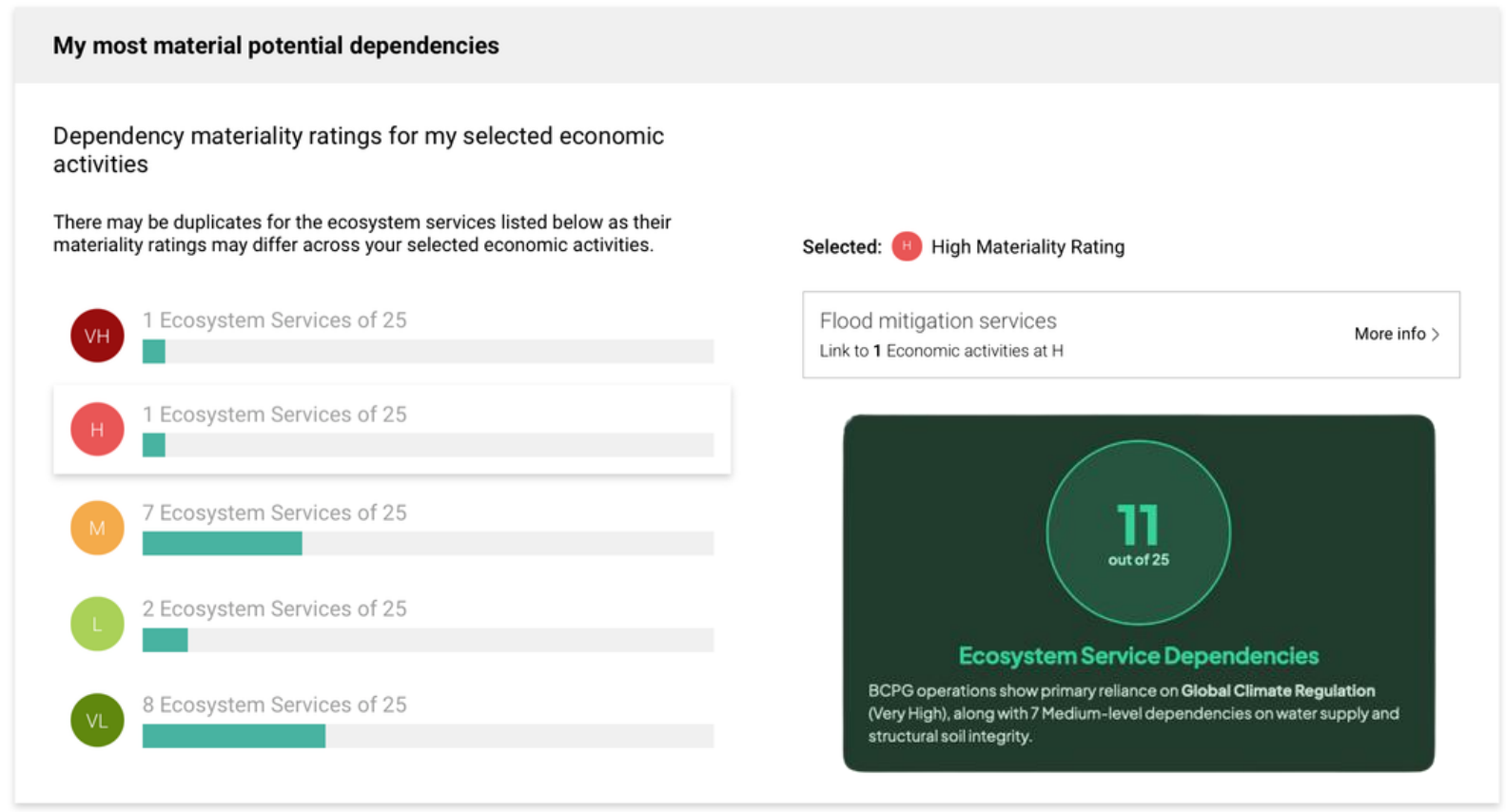
Quantitative Materiality Heatmap across BCPG Portfolio (Solar, Wind, ALT Terminal) based on ENCORE assessment.

Business	ENCORE Process	Dependencies (11 Services)											Impacts (4 Pressures)			
		Global Climate	Water Supply	Flood Mitigation	Storm Mitigation	Soil & Sediment	Water Flow	Local Climate	Rainfall Pattern	Air Filtration	Bio Control	Noise Atten.	Area of Land Use	Seabed Use	Disturbances/pollutants	GHG Emissions
Renewable energy	Solar	100	60	60	60	60	60	60	0	0	0	0	40	0	0	0
Renewable energy	Wind	5	0	4	3	3	3	3	0	0	0	3	4	0	3	0
Warehousing	ALT	0	0	0	2	3	1	2	0	0	0	0	2	0*	2	3

Note: The figures were generated by quantifying the ENCORE risk categories using five levels, and adding up the points for each category. The higher the number, the greater the level of impact.

- Scoring Formula: Materiality rating (5 to 0) × Number of operational sites
- * ALT Terminal's "Area of seabed use" is calibrated to 0 as the assessment boundary is restricted to onshore storage facilities, eliminating direct seabed disruption.

Ecosystem Components Breakdown



- Primary Double Materiality Hotspots: Structural & Biotic Integrity (7 dependencies, 4 pressures) and Water (5 dependencies, 4 pressures) represent BCPG’s highest exposure areas.
- High Environmental Pressures: Soils and sediments, Species, Structural & biotic integrity, and Water face the maximum level of pressures (4 aspects each).
- Zero Dependency Exception: Minerals exhibits zero operational dependencies while generating 3 pressures from physical asset presence/construction.

Summary of Nature-Related Dependencies and Impacts across the BCPG Portfolio

Solar Farm

Highest operational dependency on **Global Climate Regulation** (**Very high**). Impacts remain mostly localized, with a moderate reliance on continuous **water flow** and **soil retention** for site stability.

Wind Farm

Highest operational dependency on Global Climate Regulation (**Very high**). Significant physical footprint resulting in a High Impact on **Land Use** (**High**). Noticeable dependency on **flood mitigation services** to protect critical foundation infrastructure and access roads.

Oil Terminal

Moderate and minimal direct reliance on **natural ecosystems** (Moderate/Low/Very Low). The primary environmental focus remains on managing standard industrial pressures, such as **GHG emissions** and **local disturbances**.

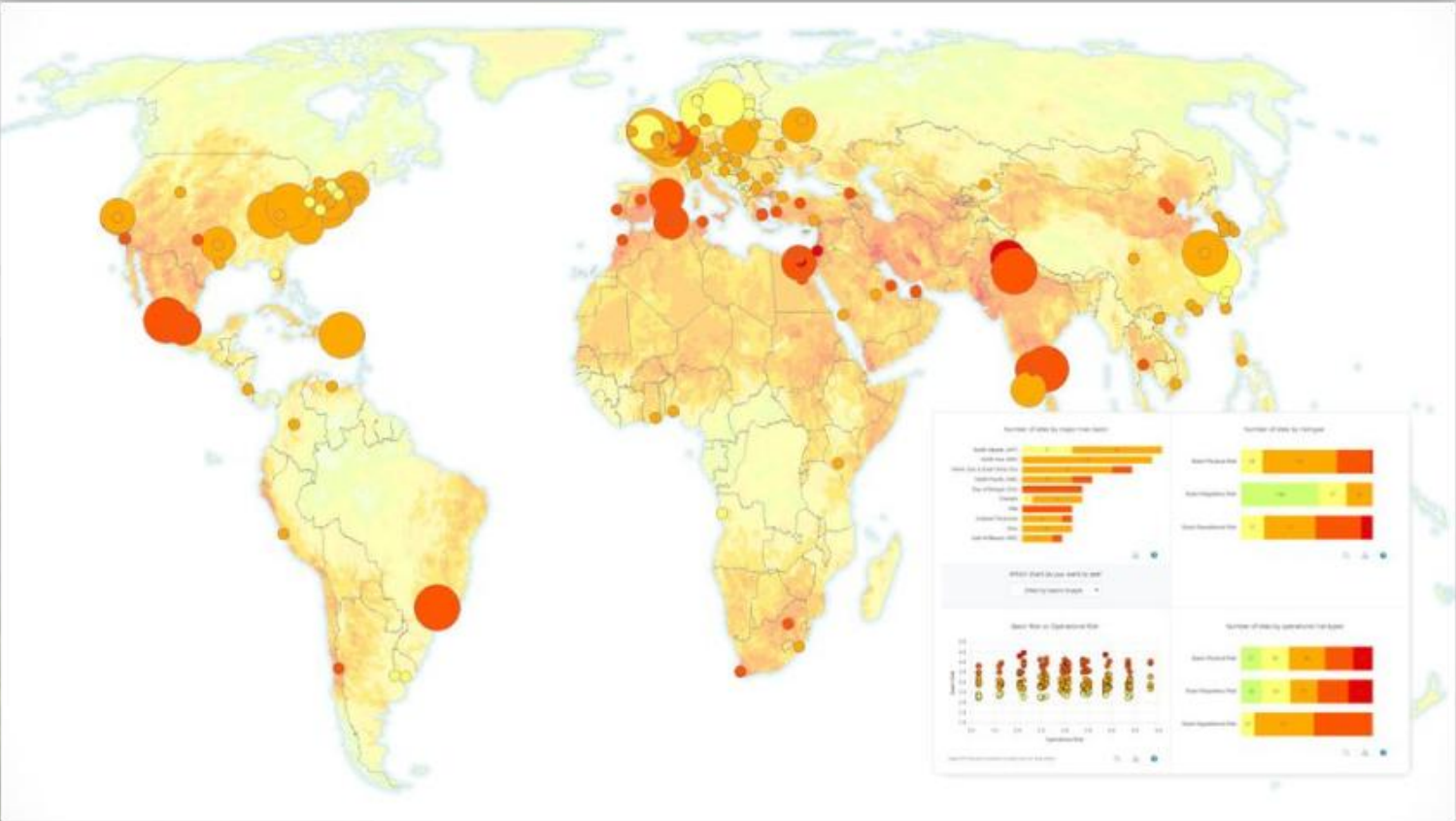
THE WWF RISK FILTER SUITE



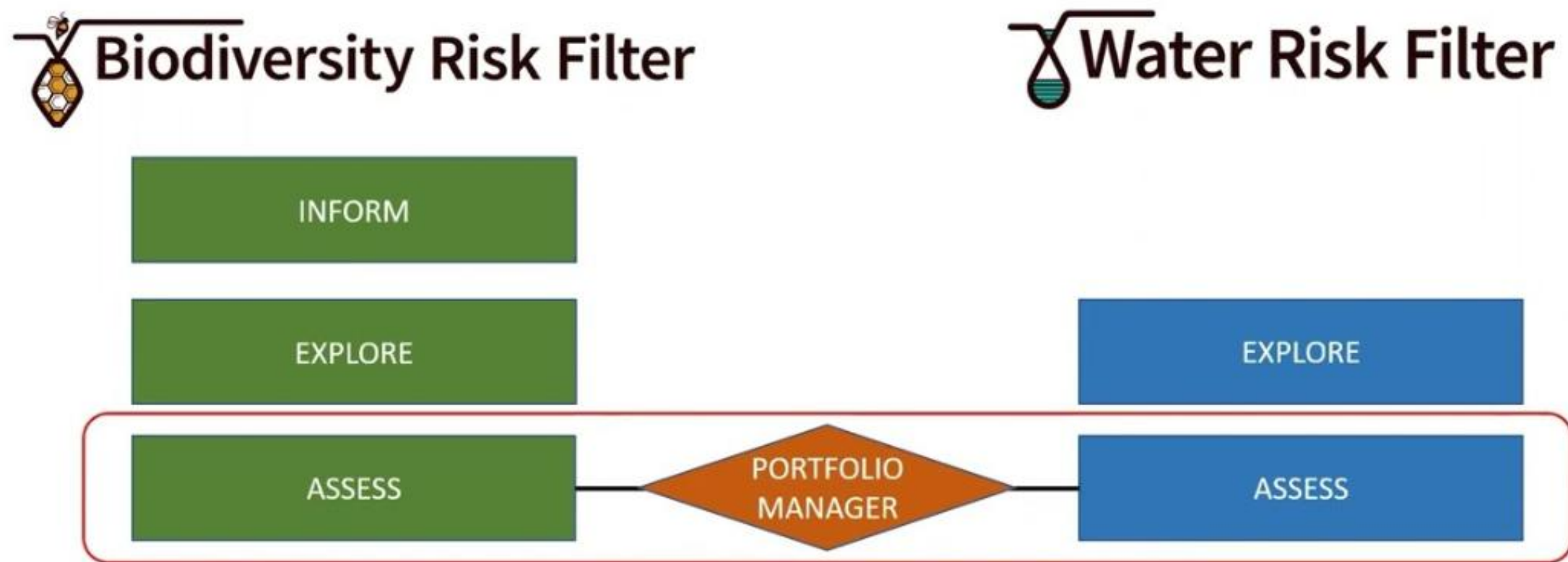
WWF Risk Filter Suite

Biodiversity Risk Filter

Water Risk Filter



WWF Risk Filter Suite
v3.0



Biodiversity Risk Filter
Water Risk Filter

Overview of implementation steps to run the WWF Risk Filter Suite

Step 0: Scoping the Assessment

The WWF Risk Filter Inform and Explore Modules help focus the scope of the assessment on priority industries and geographies, aligning with the recommendations of the TNFD and SBTN frameworks.

Step 0A: Identifying Industry Materiality

The Inform Module provides information about the level of dependencies on ecosystem services and impacts on biodiversity and water across major industry sectors.

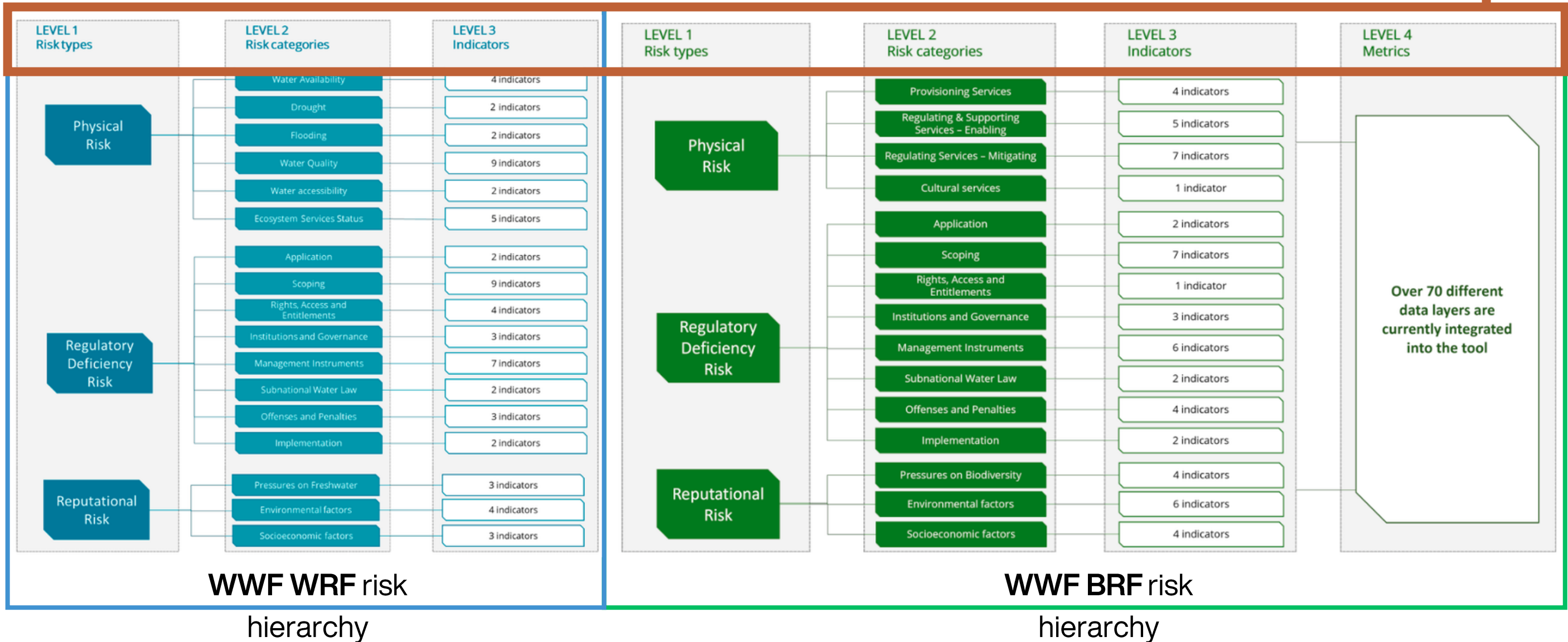
Step 0B: Exploring Landscape & Basin Risks

The Explore Module provides global maps showing risk levels based on a total of **58 biodiversity risk indicators** and **32 water risk indicators**.

Step 1: Collecting Location-specific Company and Supply Chain Data

After refining the scope of the assessment in Step 0, collect location-specific data on the portfolio's operational and supply chain sites. Essential input data (e.g., precise coordinates, industry activity) is required to run the Assess Modules.

RISK HIERARCHY & DEFINITIONS



LEVEL 1: This top level combines individual risk categories into three overarching classifications: Physical, Regulatory, and Reputational risks.

LEVEL 2: This level groups indicators into higher-level risk clusters directly relevant to companies and financial institutions. It encompasses 15 biodiversity risk categories and 17 water risk categories.

LEVEL 3: This level comprises spatial data reflecting the importance and local integrity of biodiversity and water aspects. The data is spatially aggregated into specific assessment units and translated into standardized risk scores across 58 biodiversity risk indicators and 32 water risk indicators.

LEVEL 4: Metrics comprises the raw global geospatial datasets that measure specific environmental, hydrological, and socioeconomic conditions at a given location. These underlying data layers feed directly into the indicators to evaluate location-specific operational vulnerabilities.

- **Physical Risks** arise from the business and its supply chain's dependence on natural conditions and ecosystems. The loss of ecosystem services can reduce productivity or increase input costs.
- **Regulatory Risks** stem from changes in national or local environmental policies and regulations, which can result in higher compliance costs or operational restrictions.
- **Reputational Risks** resulting from the organization's negative impacts on ecosystems and communities. This can damage the brand image, increase investor scrutiny, or diminish public trust.

RISK TYPES, RISK CATEGORIES, AND INDICATORS



Risk Type	Risk Category	Key	Indicator name
PHYSICAL	1. Provisioning Services	S1_1	Water Availability
		S1_2	Forest Productivity and Distance to Markets
		S1_3	Marine Fish Availability
		S1_4	Wild Flora & Fauna Availability
	2. Regulating & Supporting Services - Enabling	S2_1	Soil Condition
		S2_2	Water Quality
		S2_3	Air Quality
		S2_4	Ecosystem Condition (degraded)
		S2_5	Pollination
	3. Regulating Services - Mitigating	S3_1	Landslides
		S3_2	Wildfires
		S3_3	Disease
		S3_4	Herbicide Resistance
		S3_5	Extreme Heat
		S3_6	Tropical Cyclones
		S3_7	Flooding
	4. Cultural Services	S4_1	Natural & Cultural Resources
REGULATORY	5. Application	S5_1	Status of National Biodiversity Strategies and Action Plans (NBSAP)
		S5_2	Biodiversity Conservation Policy Statement in Law
	6. Scoping	S6_1	Definition of Biodiversity
		S6_2	Definition of Wild Fauna
		S6_3	Definition of Wild Flora
		S6_4	Definition of Protected Areas
		S6_5	Definition of Ecological Corridors and Networks
		S6_6	Definition of Invasive Alien species
		S6_7	Definition of a Threatened Species
	7. Rights, Access and Entitlements	S7_1	State's Duty to Protect and Conserve Biodiversity
	8. Institutions and Governance	S8_1	Biodiversity Management Authority
		S8_2	Coordination among National Government Authorities
		S8_3	Public Participation
	9. Management Instruments	S9_1	Monitoring of Biodiversity
		S9_2	Data Compilation and Sharing - National Level
		S9_3	Environmental Impact Assessments (EIA) and Strategic Environmental Assessments (SEA)
		S9_4	Offset Requirements
		S9_5	Protected Areas
		S9_6	Protected Species Management
	10. Subnational Water Law	S10_1	Requirement to Meet National Standards
		S10_2	Coordination Among Local and National Authorities
	11. Offenses and Penalties	S11_1	Pollution Crimes
		S11_2	Habitat Destruction
		S11_3	Violation of invasive species prohibitions
		S11_4	Violation of EIA requirements
	12. Implementation Risk	S12_1	Effective Policy Formulation
		S12_2	Respect for Institutions
REPUTATIONAL	13. Pressures on Biodiversity	S13_1	Land, Freshwater and Sea Use Change
		S13_2	Forest Canopy Loss
		S13_3	Invasives
		S13_4	Pollution
	14. Environmental Factors	S14_1	Protected/Conserved Areas
		S14_2	Key Biodiversity Areas
		S14_3	Wetlands of International Importance
		S14_4	Other Important Delineated Areas
		S14_5	Ecosystem Condition (Intact)
		S14_6	Range Rarity
	15. Socioeconomic Factors	S15_1	Indigenous Peoples & Local Communities
		S15_2	Resource Scarcity
		S15_3	Labor/Human Rights
		S15_4	Financial Inequality

Risk Type	Risk Category	Key	Indicator name
PHYSICAL	1. Water Availability	B1_1	Water Depletion
		B1_2	Baseline Water Stress
		B1_3	Freshwater Quantity Target
		B1_4	Groundwater
	2. Drought	B2_1	Meteorological Drought
		B2_2	Agricultural Drought
		B2_3	Hydrological Drought
	3. Flooding	B3_1	Flood Occurrence
		B3_2	Flood Hazard
	4. Water Quality	B4_1	Coastal Eutrophication Potential
		B4_2	Nitrate-Nitrite Concentration
		B4_3	Periphyton Growth Potential
		B4_4	Biological Oxygen Demand
		B4_5	Pathogens
		B4_6	Pesticides
		B4_7	Chemicals
		B4_8	Plastics
	5. Water Accessibility	B4_9	Salinity
		B5_1	Access to Basic Safe Drinking Water
	6. Ecosystem Services Status	B5_2	Access to Basic Sanitation
		B6_1	Forest Canopy Loss
		B6_2	Landslides
		B6_3	Invasive Species
		B6_4	Desertification
		B6_5	River Fragmentation
REGULATORY	7. Application	B7_1	Status of IWRM Water Policy
		B7_2	IWRM Policy Statement in Law
	8. Scoping	B8_1	Definition of Freshwater Resources
		B8_2	Definition of Groundwater
		B8_3	Definition of Wastewater
		B8_4	Definition of Environmental Water
		B8_5	Definition of Wetlands
		B8_6	Definition of Basin, Watershed, or Catchment
		B8_7	Definition of Riparian Zone
		B8_8	Definition of Potable Water
		B8_9	Definition of Water Pollution
	9. Rights, Access and Entitlements	B9_1	Constitutional Right to Clean and Healthy Environment
		B9_2	Access to Water Supply and Sanitation Infrastructure
		B9_3	Water Register
		B9_4	Infrastructure and Management
	10. Institutions and Governance	B10_1	Water Resource Authority
		B10_2	Coordination among National Government Authorities
		B10_3	Public Participation
	11. Management Instruments	B11_1	Monitoring Environmental Water Quality
		B11_2	Monitoring of Environmental Water Status
		B11_3	Water Catchment Management
		B11_4	Water Resource Management Plans
		B11_5	Enforceability of Water Resource Management Plans
		B11_6	Water-Related Disasters
		B11_7	Data Compilation and Sharing - National Level
	12. Subnational Water Law	B12_1	Requirement to Meet National Standards
		B12_2	Coordination Among Local and National Authorities
	13. Offenses and Penalties	B13_1	Violation of Clean Water Standards
		B13_2	Violation of Wastewater Standards
		B13_3	Harm to Wetlands
REPUTATIONAL	14. Implementation Risk	B14_1	Effective Policy Formulation
		B14_2	Respect for Institutions
	15. Pressures on Freshwater	B15_1	Freshwater Exploitation
		B15_2	Freshwater Habitat Degradation
		B15_3	Pollution
	16. Environmental Factors	B16_1	Freshwater Biodiversity
		B16_2	Wetlands of International Importance
		B16_3	Ecosystem Condition
		B16_4	Free Flowing Rivers
	17. Socioeconomic Factors	B17_1	Water Conflicts
		B17_2	Labour/Human Rights
		B17_3	Financial Inequality

WWF Biodiversity Risk Filter Assessment Results

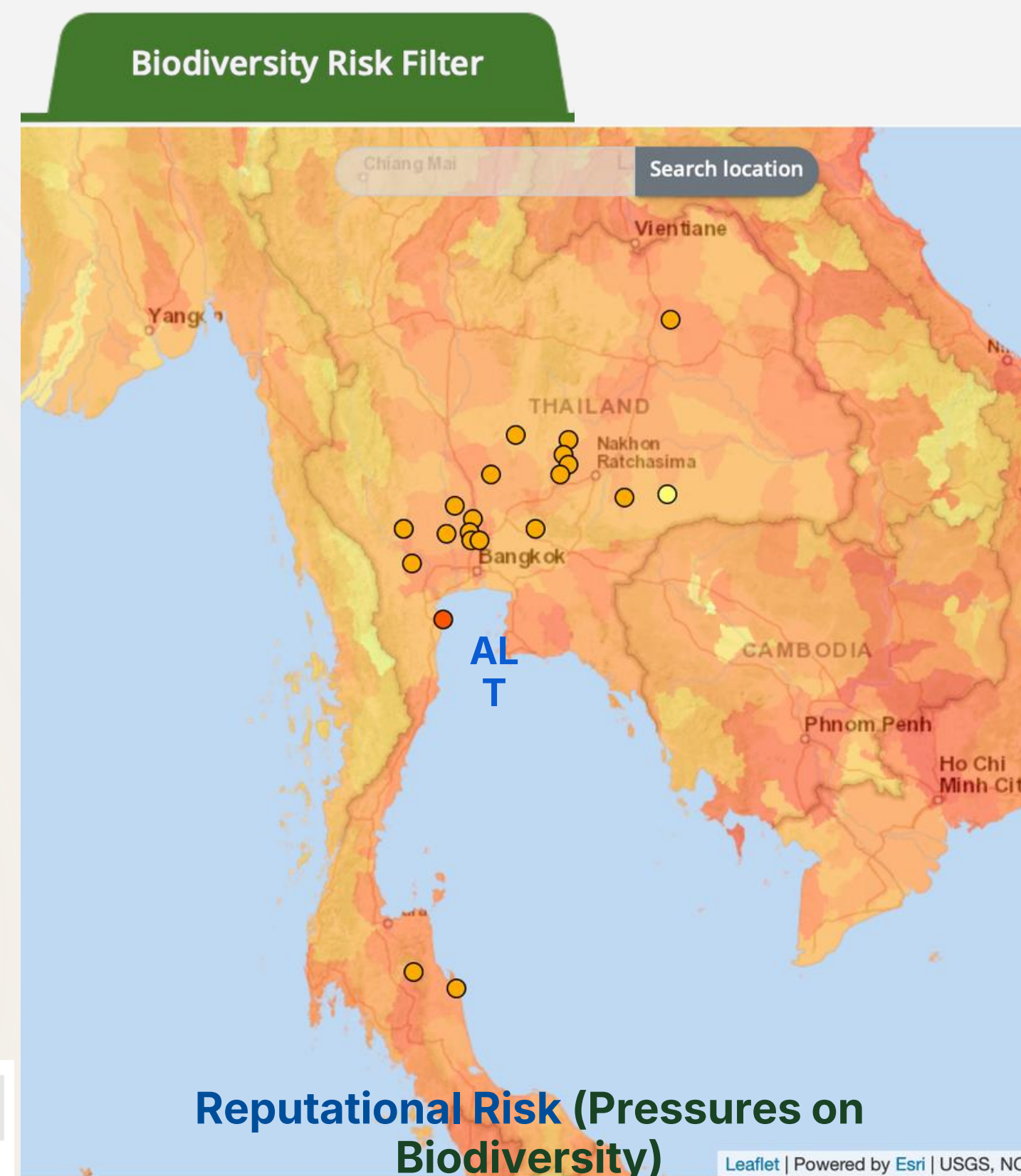
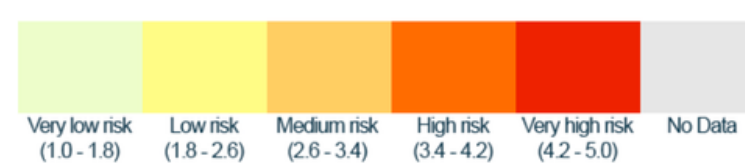
Data derived from the WWF Biodiversity Risk Filter (2026). Analyzing Physical, Regulatory, and Reputational exposures.

The WWF Biodiversity tool highlights the spatial relationship between project footprint and critical habitats.

Biodiversity Risk Portfolio Overview

- **Physical Risk** (**High** = 3.52)
Driven by degraded natural buffers. Central Region is the most vulnerable due to KBA (waterbird habitat) overlap and driven by hydrological extremes (flooding).
- **Regulatory Risk** (**High** = 3.50)
A systemic, portfolio-wide risk driven by Thailand's strict environmental regulations (scoring 5.0), not site-level violations.
- **Reputational Risk** (**Moderate** = 3.08)
Strong compliance with 0% encroachment on protected areas, but features severe localized spikes due to community and wetland sensitivities.

WWF Biodiversity Risk Filter levels



Location & Site Importance

22 of total assessed sites

Site Importance is categorized using two main criteria: Land Area (Footprint Size) for solar farms and Strategic/Risk Factors for other business types.

Site Name	Location (Province)	Business Type	Electricity Generation Capacity (MW)	Land Area (Hectares)
BPI	Phra Nakhon Si Ayutthaya	Solar Power	38	83.14
BPH_1	Phra Nakhon Si Ayutthaya	Solar Power	8	42.51
CAYA	Phra Nakhon Si Ayutthaya	Solar Power	2	2.83
CBPI	Phra Nakhon Si Ayutthaya	Solar Power	5	11.06
CWSC	Ang Thong	Solar Power	5	9.46
LOP	Lopburi	Solar Power	6	21.76
WCB	Phetchabun	Solar Power	1.75	3.61
WPPB	Saraburi	Solar Power	5	9.06
BNN_1	Chaiyaphum	Solar Power	16	40.86
CPM_1	Chaiyaphum	Solar Power	8	23.89
BRM	Buri Ram	Solar Power	8	22.02
BRM_1	Buri Ram	Solar Power	8	18.68
NMA	Nakhon Ratchasima	Solar Power	8	23.61
BSS	Udon Thani	Solar Power	5	9.6
KAN	Kanchanaburi	Solar Power	5	19.18
KAN_1	Kanchanaburi	Solar Power	5	19.1
WTMG	Kanchanaburi	Solar Power	3.94	6.63
CPRS	Prachin Buri	Solar Power	5	11.55
PRI	Prachin Buri	Solar Power	8	48.37
ALT	Phetchaburi	Tank Terminal	-	23.57
KAT	Nakhon Si Thammarat	Solar Power	1.2	1.83
LLG	Nakhon Si Thammarat	Wind Power	8.97	22.03

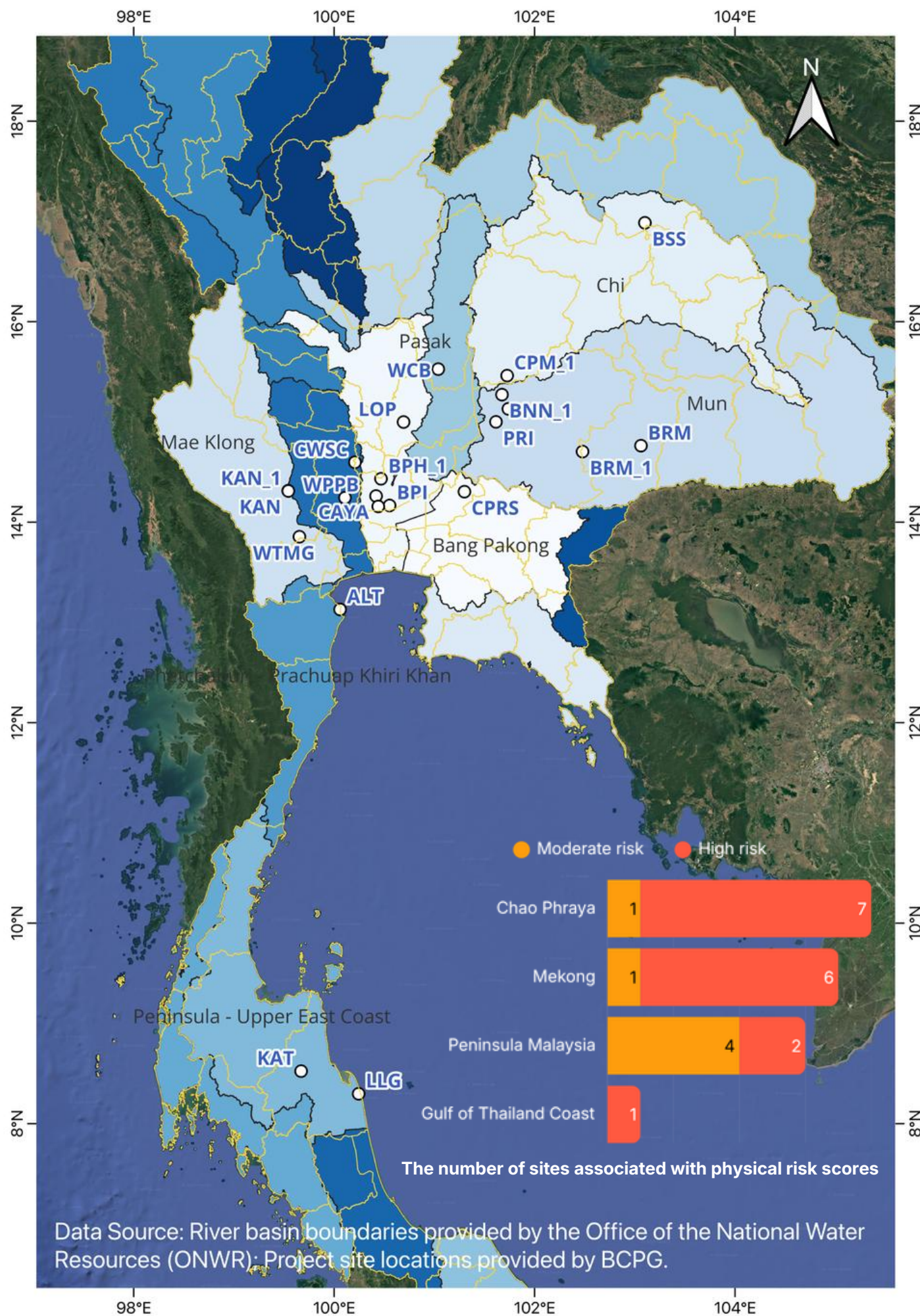
Scoping the assessment

22 of total assessed sites

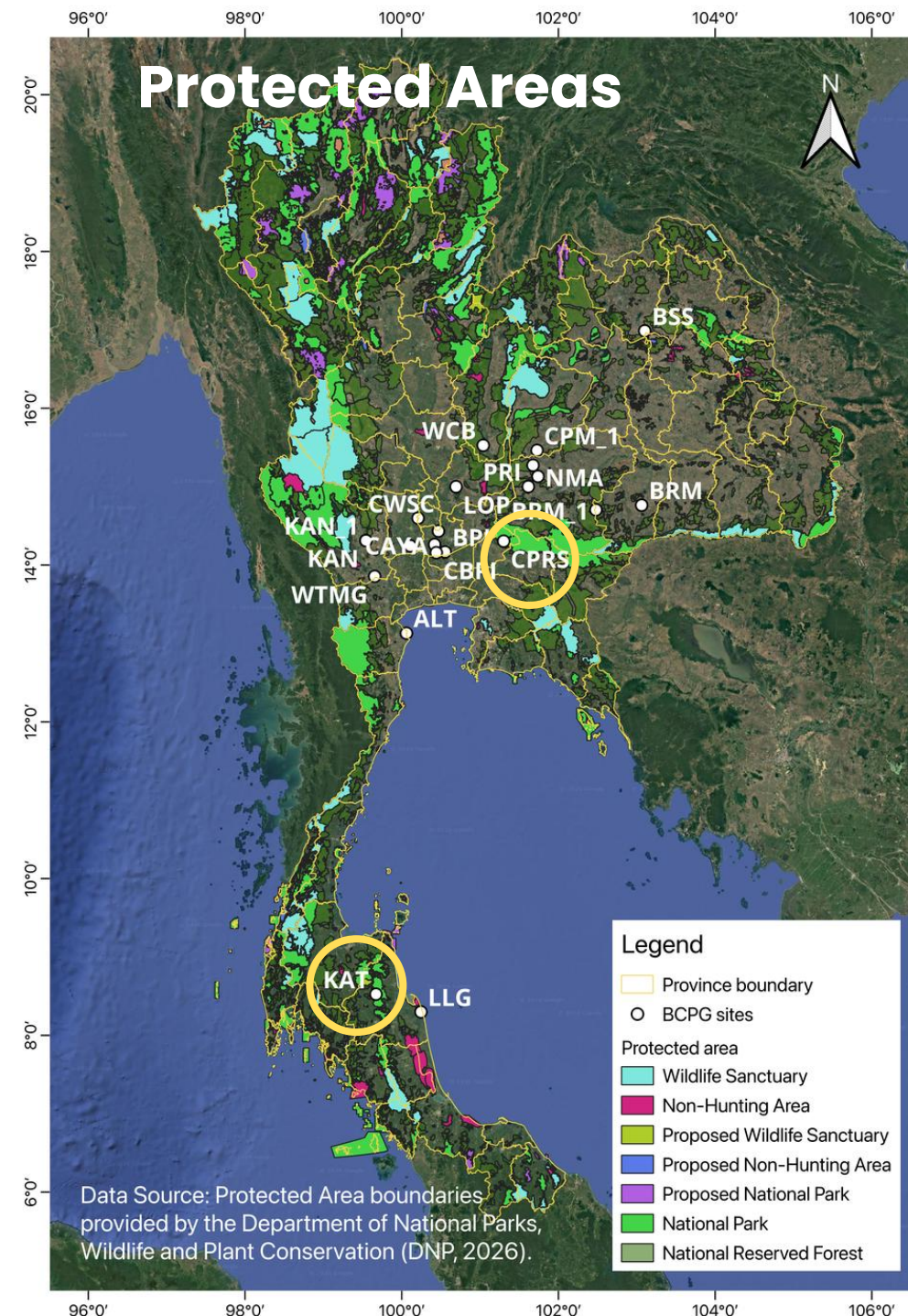
BCPG's sites and surrounding areas

GIS Spatial Analysis

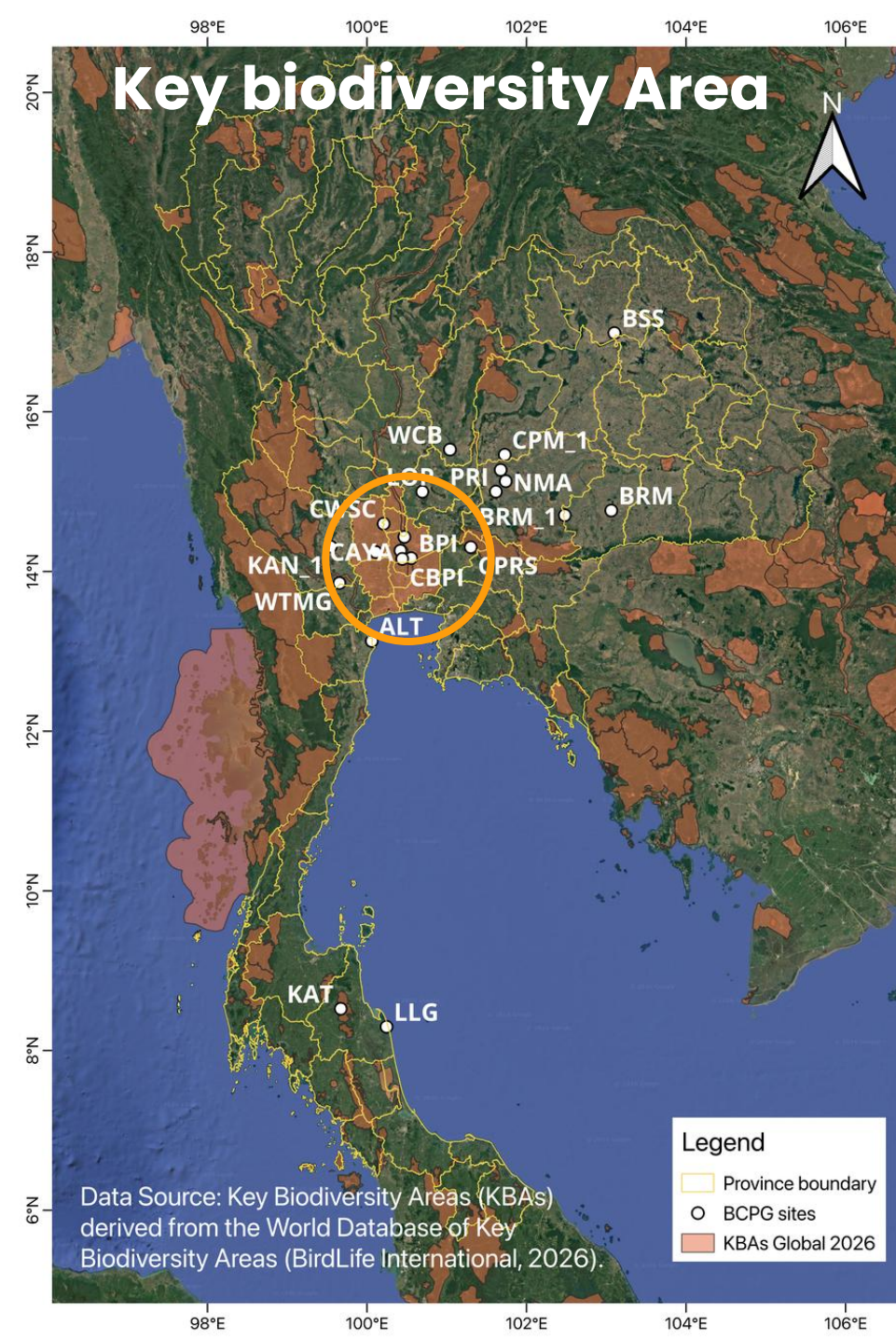
- Legally Protected Areas - **No**
- Key Biodiversity Areas (KBAs) - **Central sites**
- Threatened species according to the IUCN Red List (Thailand and Global) - **ALT, KAT, LLG, and CPRS**



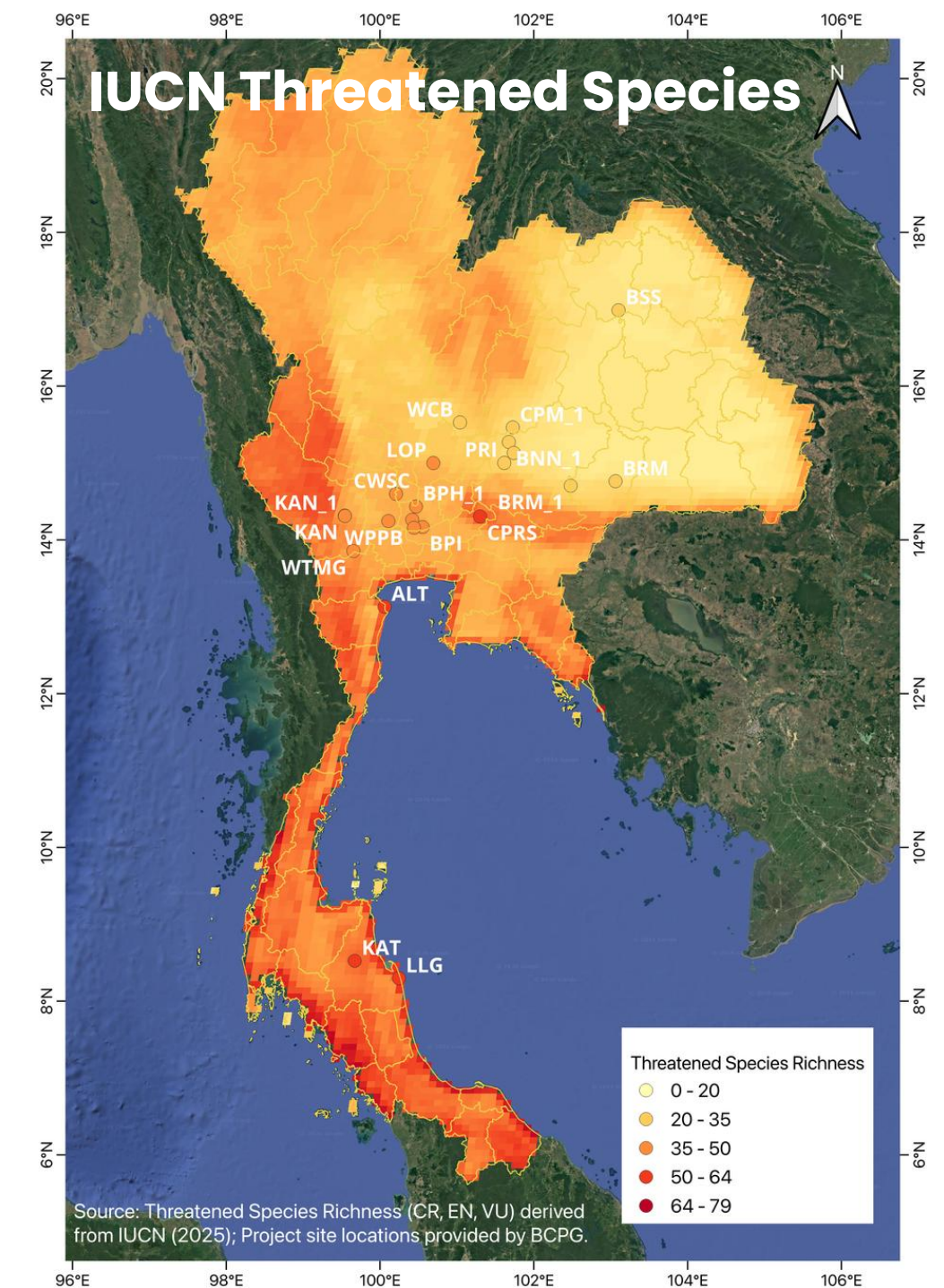
Assessing biodiversity-related risks



All project sites are located completely outside of legally protected areas. However, sites **CPRS** and **KAT** are situated in close proximity (less than 5 km) to conservation boundaries.



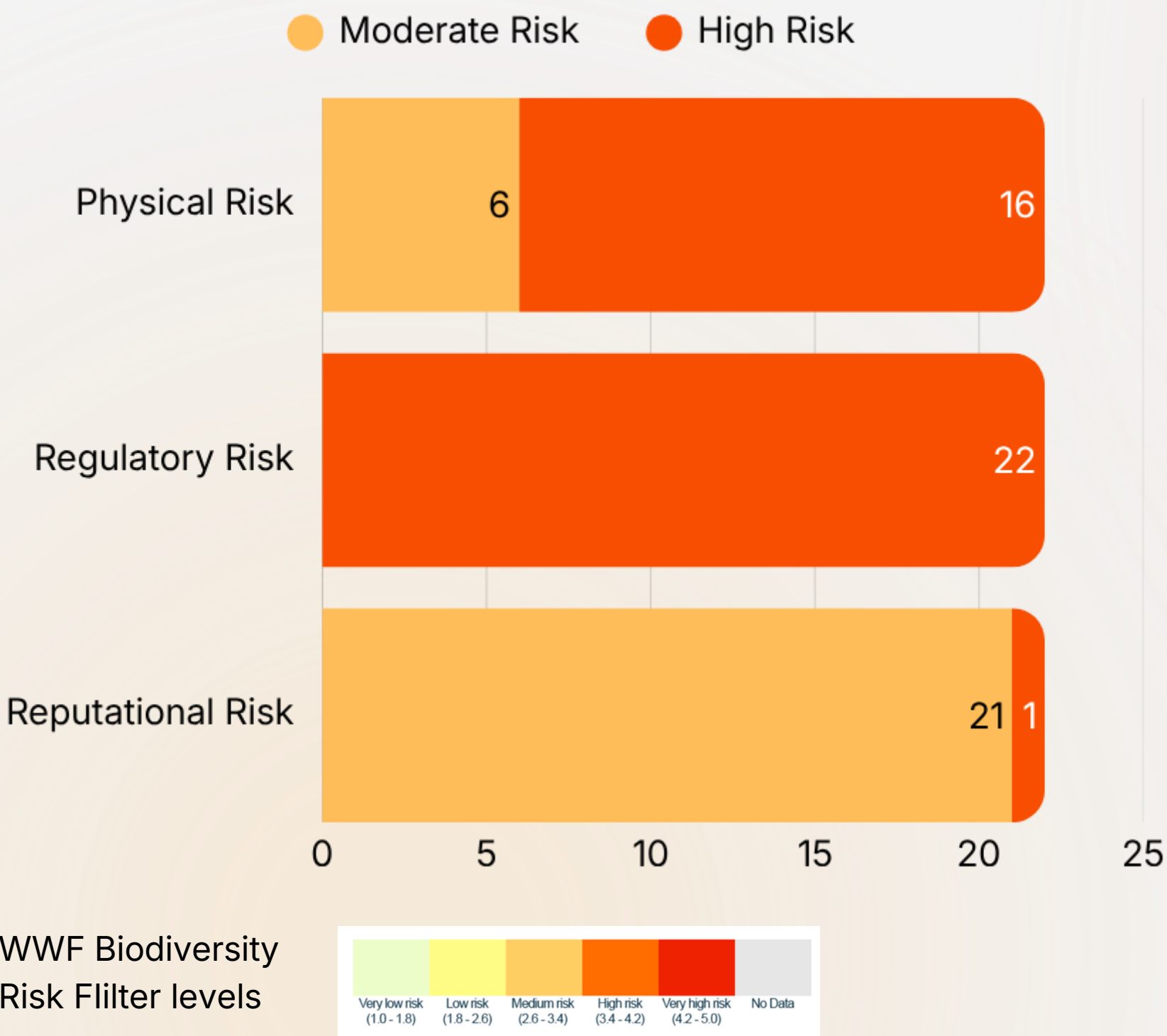
PRI, NMA, CPM_1, BRM_1, BRM, and BSS are located within Global KBAs, they require stringent biodiversity management aligned with IFC Performance Standard 6.



Sites **ALT, KAT, LLG, and CPRS** show the highest concentration of threatened species (50–64) among the portfolio and require site-specific mitigation.

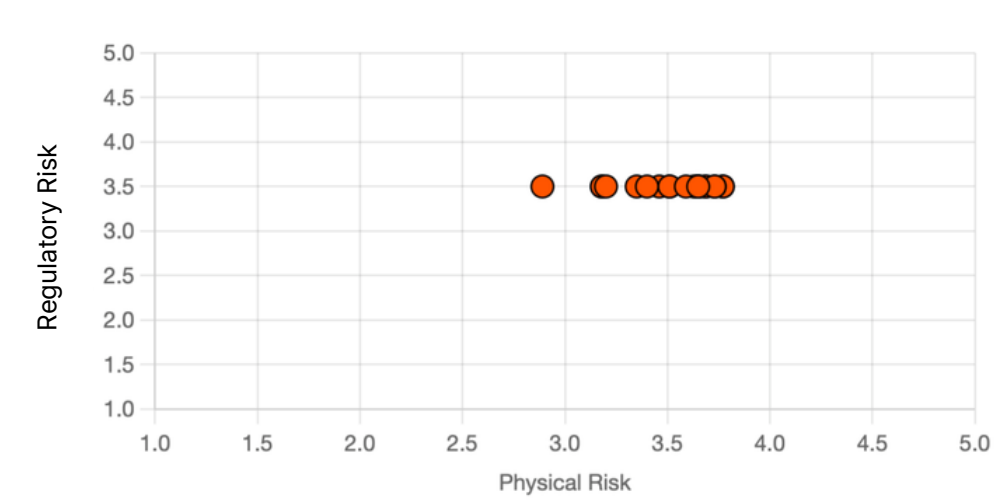
Biodiversity Risk Dashboard (1/4)

Number of Sites by Risk Type



- **Physical Risk** is significant: The majority of the portfolio faces elevated physical threats, with 16 sites at **High Risk** and 6 at **Moderate Risk**.
- **Regulatory Risk** is the top concern: All 22 sites are classified as **High Risk**. The breakdown shows this is driven largely by "Subnational Biodiversity Law," with all 22 sites flagged as Very High Risk.
- **Reputational Risk** is moderate: This area poses the least immediate threat, with 21 out of 22 sites at **Moderate Risk** and only 1 at **High Risk**.

Physical risk vs. Regulatory risk

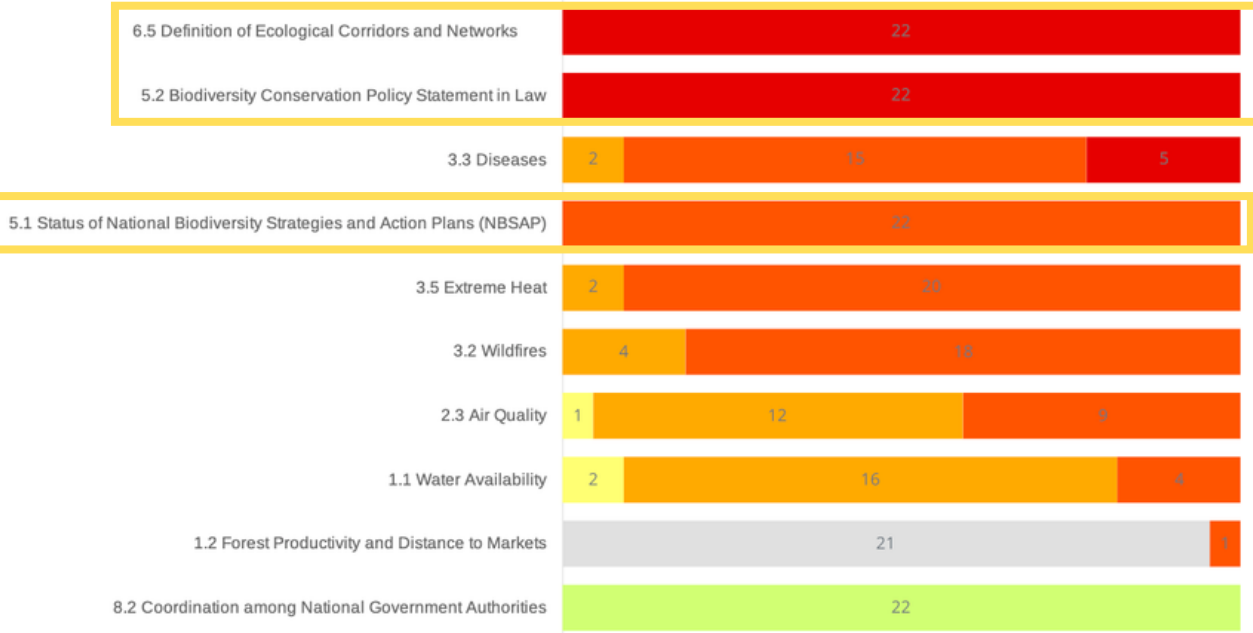


Note: Physical risk includes risk categories 1 through 4.
Regulatory risk comprises risk categories 5 through 12.
 Reputational risk comprises risk categories 13 through 15.

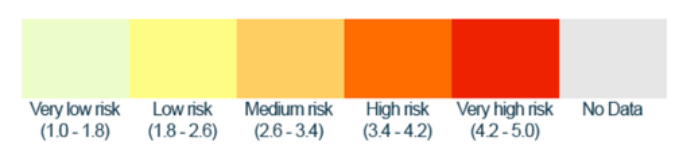
Number of sites by risk category

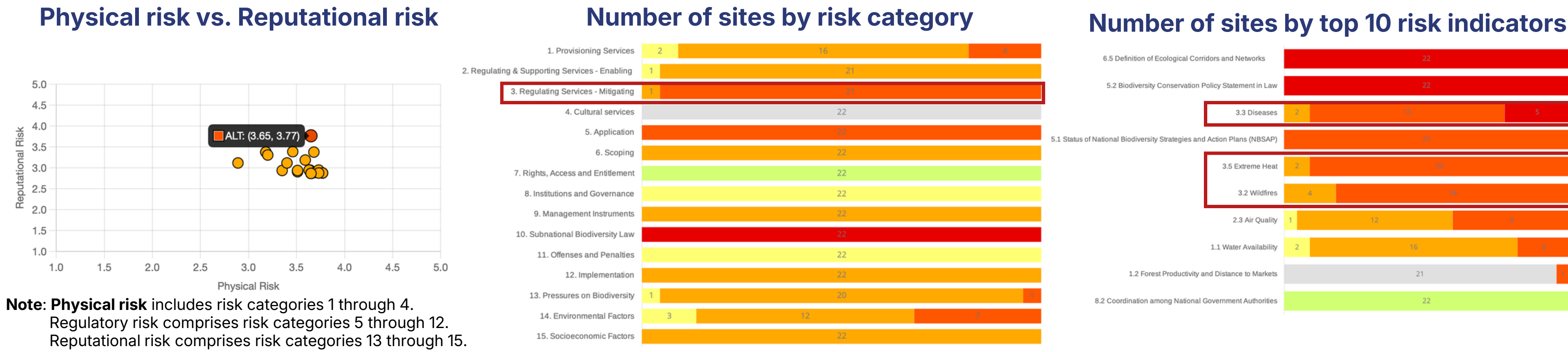


Number of sites by top 10 risk indicators



- The scatter plot reveals a uniform regulatory risk profile across all 22 sites, highlighting a systemic, portfolio-wide policy challenge.
- The greatest vulnerability lies in Subnational Biodiversity Law (Category 10) and Application (Category 5) , with all sites facing very high risk due to weak local environmental governance.
- This systemic risk is primarily driven by legal ambiguities, specifically the lack of clear definitions for ecological corridors and unfinalized national conservation action plans (NBSAP).
- These results indicate significant Policy Transition Risk, suggesting the company must proactively adopt internal environmental guidelines that exceed current local regulations.





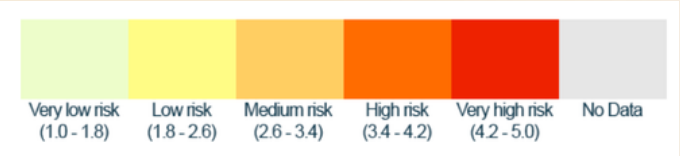
- The ALT site (3.65 Physical Risk) is identified as the most exposed to combined environmental and reputational threats.
- The greatest physical vulnerability lies in **Regulating Services - Mitigating (Category 3)** , where nearly all sites are operating at a high risk level.
- This elevated physical risk is primarily driven by acute climate variables and ecological stressors, specifically Diseases (3.3), Extreme Heat (3.5), Wildfires (3.2), Air Quality (2.3), and Water Availability (1.1).
- These findings indicate a pressing need to integrate climate resilience into site operations, prioritizing robust occupational health and safety (OHS) measures and environmental hazard mitigation.

Biodiversity Risk Dashboard (4/4)

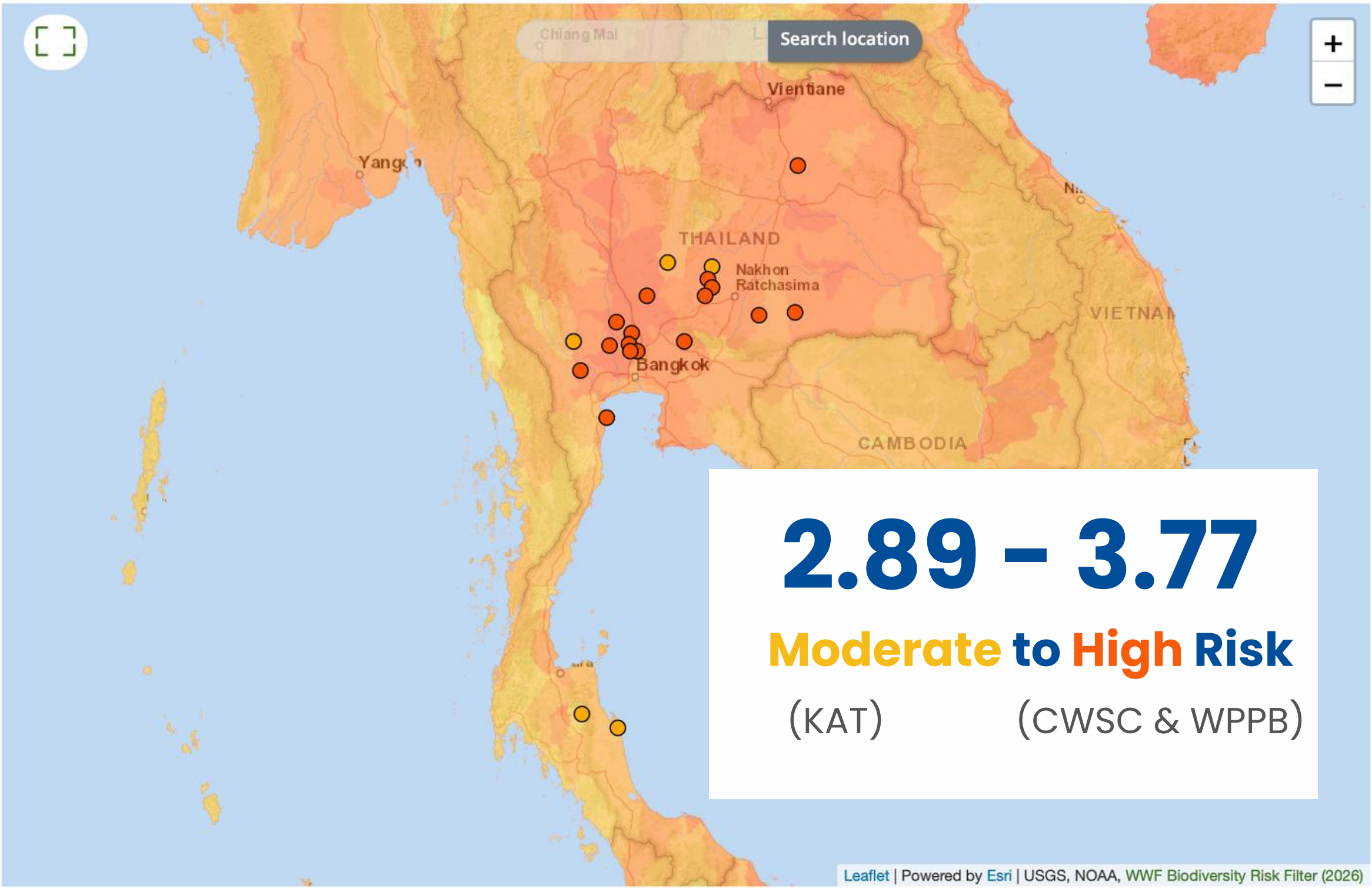
Biodiversity Risk Filter Scape Risk Results	Scape Physical Risk	1. Provisioning Services	2. Regulating & Supporting Services - Enabling	3. Regulating Services - Mitigating	4. Cultural Services	Scape Regulatory Deficiency Risk	5. Application	6. Scoping	7. Rights, Access and Entitlements	8. Institutions and Governance	9. Management Instruments	10. Subnational Water Law	11. Offenses and Penalties	12. Implementation Risk	Scape Reputational Risk	13. Pressures on Biodiversity	14. Environmental Factors	15. Socioeconomic Factors
Site Name	SPH	SRC1	SRC2	SRC3	SRC4	SRG	SRC5	SRC6	SRC7	SRC8	SRC9	SRC10	SRC11	SRC12	SRP	SRC13	SRC14	SRC15
BPI	3.64	3.30	3.40	3.88	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.95	3.03	2.88	2.88
BPH_1	3.73	3.45	3.40	4.00	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.95	3.03	2.88	2.88
CAYA	3.73	3.45	3.37	4.00	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.88	2.86	2.88	2.88
CBPI	3.63	3.30	3.39	3.88	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.95	3.03	2.88	2.88
CWSC	3.77	3.55	3.39	4.00	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.88	2.74	2.88	2.88
LOP	3.69	3.15	3.39	4.00	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.89	2.91	2.88	2.88
WCB	3.40	3.30	3.01	3.50	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	3.12	2.66	3.38	2.88
WPPB	3.77	3.55	3.39	4.00	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.88	2.74	2.88	2.88
BNN_1	3.65	3.30	2.93	4.00	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.87	2.86	2.50	2.88
CPM_1	3.35	3.20	2.88	3.50	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.94	2.66	3.00	2.88
BRM	3.51	3.15	2.89	3.88	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.94	2.49	3.00	2.88
BRM_1	3.65	3.30	2.93	4.00	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.87	2.86	2.50	2.88
NMA	3.65	3.30	2.93	4.00	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.87	2.86	2.50	2.88
BSS	3.51	3.15	3.00	3.88	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	2.91	2.95	2.88	2.88
KAN	3.18	2.80	2.86	3.50	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	3.38	2.75	3.88	2.88
KAN_1	3.18	2.80	2.86	3.50	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	3.38	2.75	3.88	2.88
WTMG	3.46	2.80	3.04	3.88	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	3.39	3.03	3.75	2.88
CPRS	3.68	3.30	3.40	3.97	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	3.38	2.78	3.88	2.88
PRI	3.59	3.15	3.31	3.88	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	3.19	2.86	3.50	2.88
ALT	3.65	3.40	2.92	3.91	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	3.77	4.10	3.44	3.25
KAT	2.89	2.15	2.40	3.38	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	3.12	2.75	3.38	2.88
LLG	3.20	2.60	2.66	3.75	No impact/depende	3.50	4.00	3.00	1.00	2.00	3.00	5.00	2.00	3.00	3.31	2.66	3.75	2.88

- All sites score a critical 5.00 in Subnational Water Law (SRC10), confirming widespread regulatory vulnerability.
- High scores in SRC3 (Mitigating Services) highlight portfolio-wide exposure to physical climate threats.
- Site ALT requires immediate attention due to elevated Reputational Risk, specifically in pressures on biodiversity (SRC13 = 4.10).

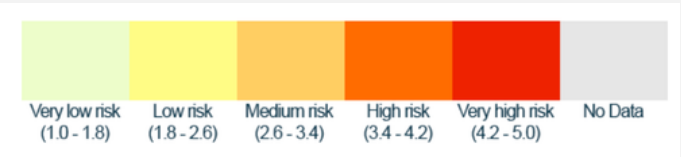
WWF Biodiversity
Risk Filter levels



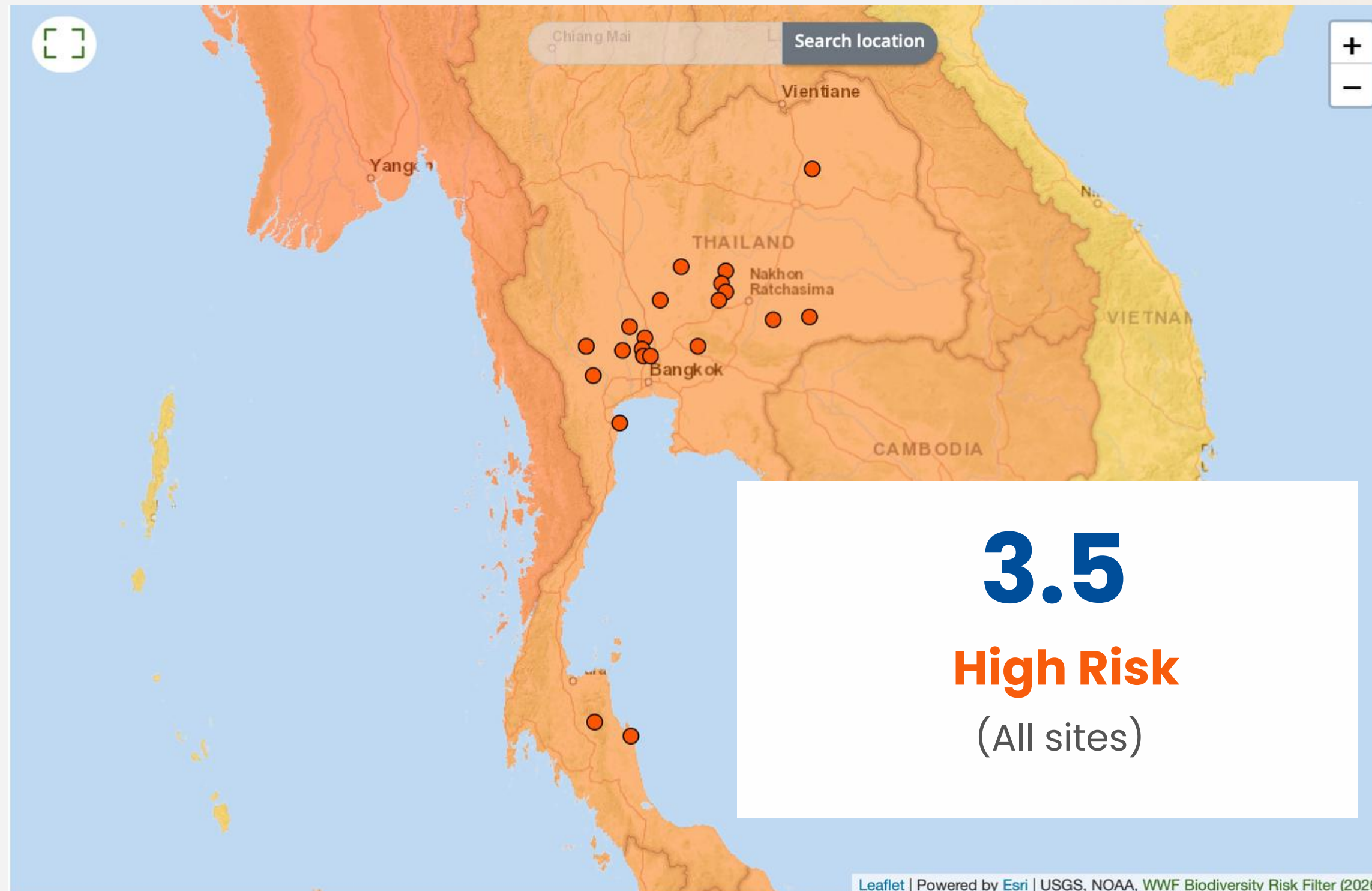
Physical Risk



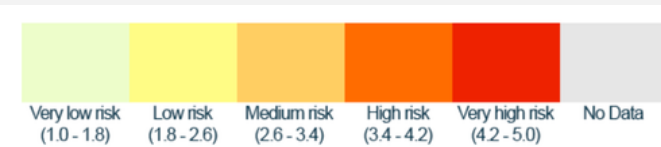
- The background heatmap indicates Moderate-High to High physical risk (orange zones) concentrated in the **Central** and **Northeastern** regions.
- Most projects face a high level of physical risk. This indicates that operations, value chains, or investments in these areas are highly vulnerable to natural changes or human-induced impacts.
- Only a select few projects, such as those in the western region and specific areas in the south fall into the moderate or lower risk categories.

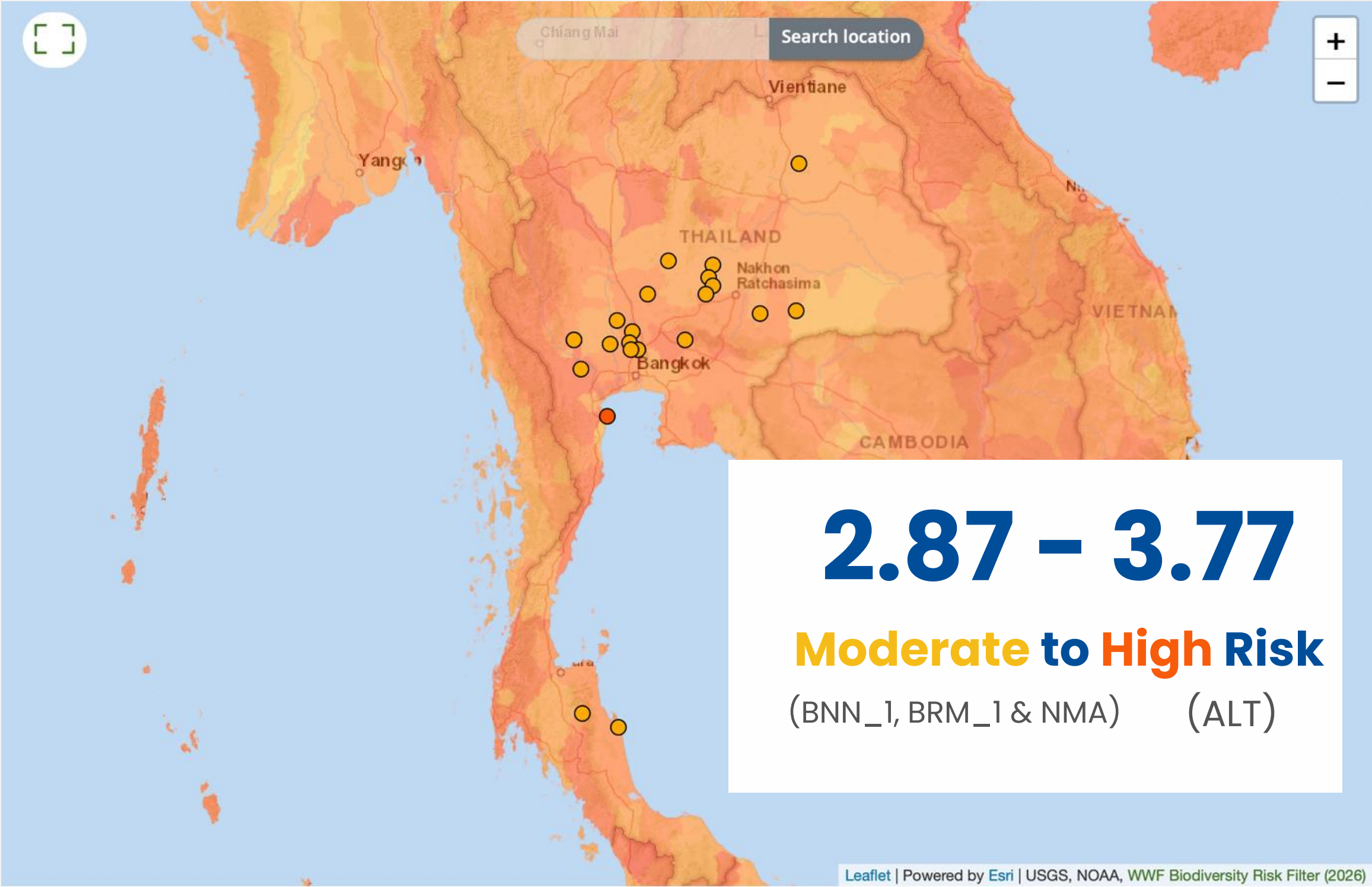


Regulatory Risk

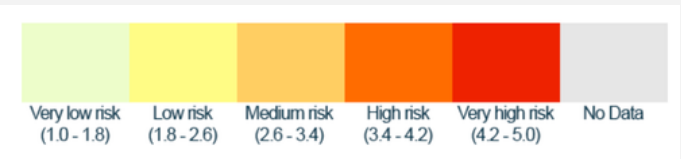


- All 22 sites share identical regulatory risk scores (3.50).
- This uniformity indicates that the risk is driven by national-level legal frameworks (e.g., National Biodiversity Policies, Subnational Biodiversity Laws) rather than site-specific operational factors.
- Despite geographic diversification, the entire portfolio is exposed to the same policy transition risks. A sudden shift in Thailand's environmental regulations would affect all sites simultaneously, necessitating a robust, centralized compliance strategy.



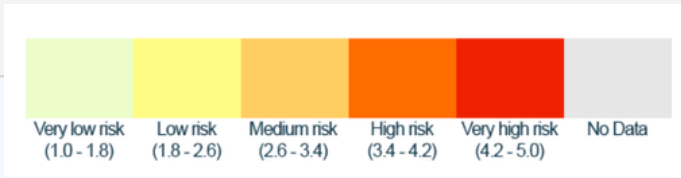


- Reputational risk is spatially explicit and highly dependent on local environmental conditions rather than blanket national policies.
- The ALT site is the most vulnerable location due to its proximity to sensitive coastal ecosystems.
- This regional heterogeneity indicates that the company must deploy targeted, site-specific engagement strategies for high-risk locations rather than relying on a single standardized corporate approach.



Summary of Physical and Reputational Risks across Major Scapes

WWF Biodiversity Risk Filter levels

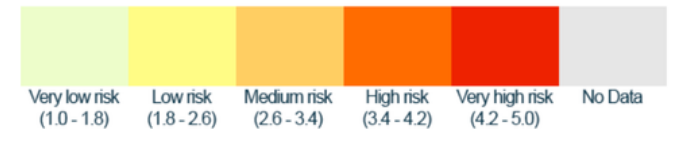


Chao Phraya Basin (Central Thailand)

Sub-basin (Scape)	Province	Site Name	Physical Risk (SPH)	Reputational Risk (SRP)	Key Drivers & Remarks
Chai Si	Ang Thong	CWSC	3.77	2.88	Top Physical: Flooding (4.12) Top Reputational: Key Biodiversity Areas (4.0)
Chai Si	Suphanburi	WPPB	3.77	2.88	Top Physical: Flooding (4.12) Top Reputational: Key Biodiversity Areas (4.0)
Chao Phraya	Phra Nakhon Si Ayudhya	BPH_1	3.73	2.95	Top Physical: Flooding (4.12) Top Reputational: Land Use Change (3.5)
Chao Phraya	Phra Nakhon Si Ayudhya	CAYA	3.73	2.88	Top Physical: Flooding (4.12) Top Reputational: Key Biodiversity Areas (4.0)
Delta	Phra Nakhon Si Ayudhya	CBPI	3.63	2.95	Top Physical: Flooding (4.12) Top Reputational: Key Biodiversity Areas (4.0)
Noi	Lopburi	LOP	3.69	2.89	Top Physical: Flooding (4.12) Top Reputational: Key Biodiversity Areas (3.5)
Noi	Phetchabun	WCB	3.4	3.12	Top Physical: Flooding (3.88) Top Reputational: Protected Areas (4.0)
Noi	Phra Nakhon Si Ayudhya	BPI	3.64	2.95	Top Physical: Flooding (4.12) Top Reputational: Key Biodiversity Areas (4.0) Large-scale footprint requires careful land use monitoring.

Summary of Physical and Reputational Risks across Major Scapes

WWF Biodiversity Risk Filter levels

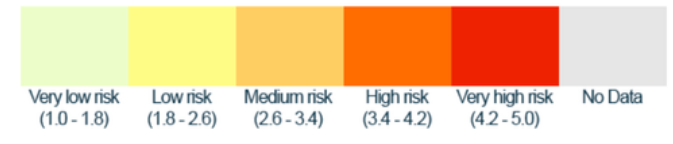


Mekong Basin (Northeastern Thailand)

Sub-basin (Scape)	Province	Site Name	Physical Risk (SPH)	Reputational Risk (SRP)	Key Drivers & Remarks
Nam Chi	Chaiyaphum	CPM_1	3.35	2.94	Top Physical: Flooding (3.88) Top Reputational: Land Use Change (3.25)
Nam Chi	Udon Thani	BSS	3.51	2.91	Top Physical: Disease (4.0) Top Reputational: Land Use Change (3.5)
Nam Mun	Buriram	BRM	3.51	2.94	Top Physical: Disease (4.0) Top Reputational: Protected Areas (3.0)
Nam Mun	Buriram	BRM_1	3.65	2.87	Top Physical: Disease (4.5) Top Reputational: Land Use Change (3.5)
Nam Mun	Nakhon Ratchasima	BNN_1	3.65	2.87	Top Physical: Disease (4.5) Top Reputational: Land Use Change (3.5)
Nam Mun	Nakhon Ratchasima	NMA	3.65	2.87	Top Physical: Disease (4.5) Top Reputational: Land Use Change (3.5)
Nam Mun	Nakhon Ratchasima	PRI	3.59	3.19	Top Physical: Disease (4.5) Top Reputational: Protected Areas (4.0)

Summary of Physical and Reputational Risks across Major Scapes

WWF Biodiversity Risk Filter levels

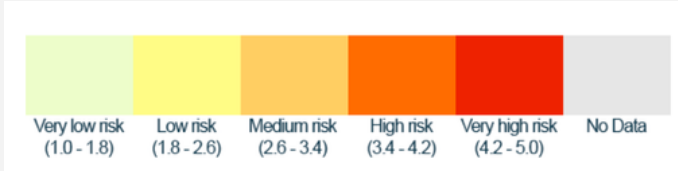


Gulf of Thailand Coast Basin (Eastern Thailand)					
Sub-basin (Scape)	Province	Site Name	Physical Risk (SPH)	Reputational Risk (SRP)	Key Drivers & Remarks
Sa Keo	Prachin Buri	CPRS	3.68	3.38	Top Physical: Disease (4.5) Top Reputational: Protected Areas (4.0) Proximity to protected areas elevates conservation scrutiny.
Peninsula Malaysia Basin (Western & Southern Thailand)					
East Coast 3	Nakhon Si Thammarat	LLG	3.2	3.31	Top Physical: Disease (4.0) Top Reputational: Protected Areas (4.0)
East Coast 7	Phetchaburi	ALT	3.65	3.77	Top Physical: Disease (4.0) Top Reputational: Wetlands of International Importance (4.5) Highest reputational risk in the portfolio due to proximity to critical wetlands.
Mae Khlong	Kanchanaburi	KAN	3.18	3.38	Top Physical: Flooding (3.75) Top Reputational: Protected Areas (4.0)
Mae Khlong	Kanchanaburi	KAN_1	3.18	3.38	Top Physical: Flooding (3.75) Top Reputational: Protected Areas (4.0)
Mae Khlong	Kanchanaburi	WTMG	3.46	3.39	Top Physical: Flooding (3.75) Top Reputational: Protected Areas (4.0)
Me Luang	Nakhon Si Thammarat	KAT	2.89	3.12	Top Physical: Flooding (3.75) Top Reputational: Protected Areas (4.0)

Summary of Physical and Reputational Risks across regional



WWF Biodiversity Risk Filter levels

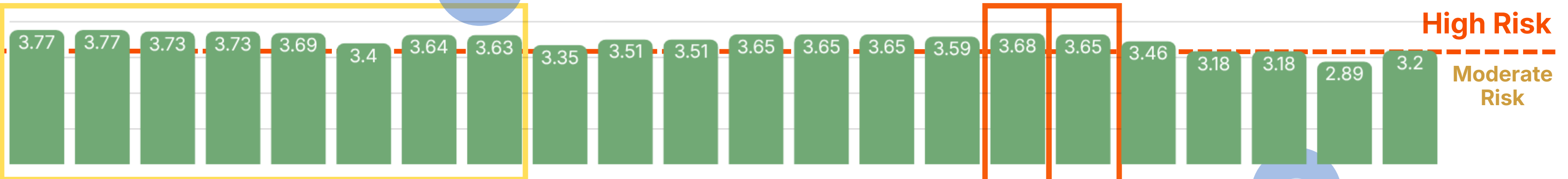


Regional	No. of Sites	Specific Sites	Average Physical Risk	Average Reputational Risk	Risk Profiles
Central	8	BPH_1, CWSC, CBPI, CAYA, WPPB, LOP, WCB & BPI	3.67	2.94	Surrounding ecosystems face severe baseline forest fragmentation, soil degradation, and intensive agricultural land-use pressures (Highest Physical Risk) .
Gulf of Thailand	1	ALT (Terminal)	3.65	3.77	Critical outlier due to terminal storage operations near coastal and marine habitats. Demands maximum stakeholder engagement and transparency (Highest Reputational Risk) .
Eastern	2	PRI, CPRS	3.64	3.29	Elevated baseline pressures; faces a dual challenge with relatively high risk scores across both physical and social dimensions.
Northeastern	6	BNN_1, BRM, BRM_1, NMA, CPM_1 & BSS	3.55	2.9	Moderate-to-high ecological pressure from landscape changes, while maintaining a stable and low-exposure public reputation profile.
Western	3	WTMG, KAN & KAN_1	3.27	3.38	Located in Kanchanaburi, closely adjacent to strictly protected national forest boundaries with a dense presence of endemic and range-rare biodiversity (Highly Sensitive Geography) .
Southern	2	KAT, LLG (Wind farm)	3.05	3.22	Exhibits the most robust natural ecosystem integrity, resulting in the lowest overall physical risk profile across the portfolio.

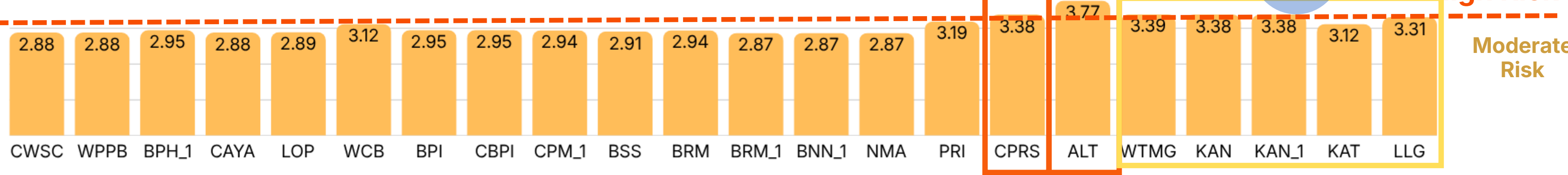
Spatial Biodiversity Risk Prioritization



Physical risks



Reputational risks



Central

North-eastern and Eastern

GOT

Western

Southern

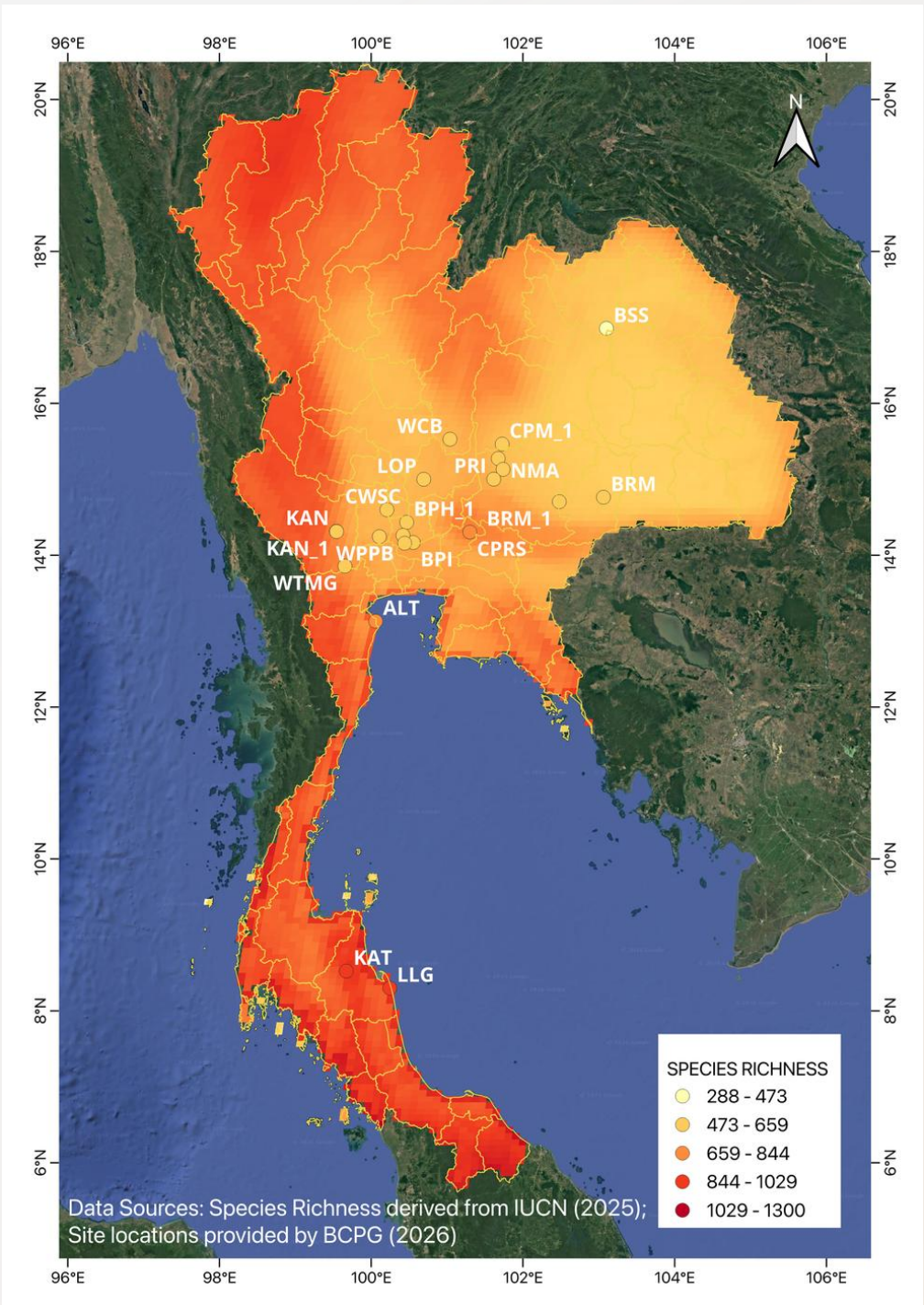
- 1** The **ALT (Phetchaburi)** and **CPRS (Prachin Buri)** sites exhibit critical risk scores primarily driven by their proximity to globally recognized biodiversity hotspots. ALT is located adjacent to the **Pak Thale coastal wetlands**, a crucial stopover site on the East Asian-Australasian Flyway. Its role as a sanctuary for critically endangered migratory birds—such as the Spoon-billed Sandpiper—creates extremely high reputational sensitivity. Meanwhile, CPRS is situated near the **Dong Phrayayen-Khao Yai Forest Complex**, a UNESCO World Heritage site. This proximity makes the site highly vulnerable to ecological edge effects, potential human-wildlife interactions, and intense scrutiny from conservation bodies.
- 2** In the **Chao Phraya Basin**, sites such as CWSC, WPPB, and BPH_1 face high physical risks (>3.60) driven by seasonal flood dynamics. Because these low-lying floodplains overlap with Key Biodiversity Areas (KBAs) for waterbirds, the critical threat extends beyond operational flooding to potential contaminant runoff during high-water events. To protect downstream ecosystems, these sites must enforce strict, closed-system water management protocols.
- 3** Sites in **Kanchanaburi** and **Nakhon Si Thammarat** exhibit highly elevated reputational exposure despite having manageable physical risks. Their direct proximity to major protected forest complexes and vital ecological corridors makes operations extremely sensitive to public and conservationist scrutiny. Consequently, any future expansions will require rigorous spatial impact assessments to mitigate ecological edge effects and proactively manage stakeholder relations.

Biodiversity Risk Screening

Spatial Analysis

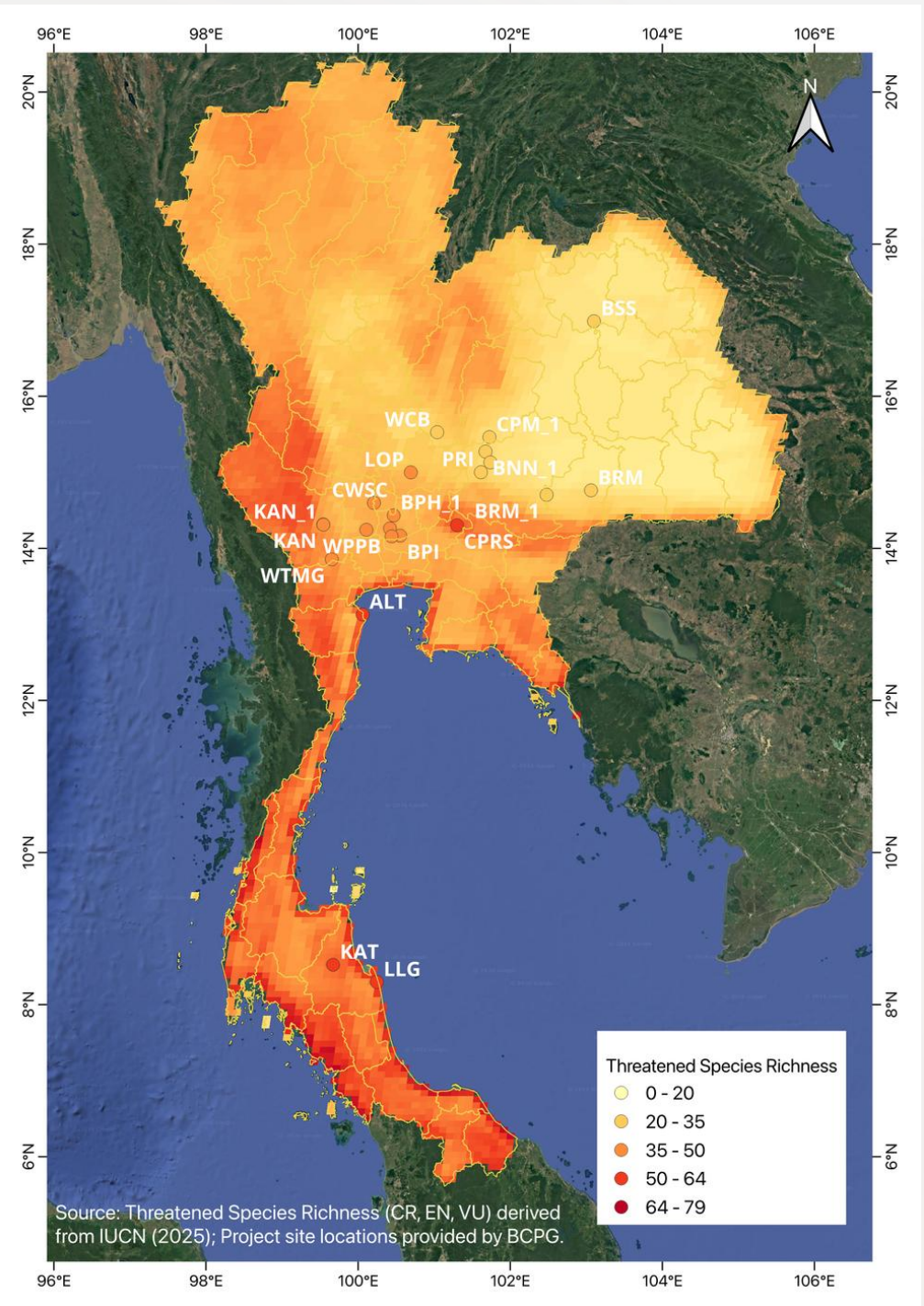


Species Richness



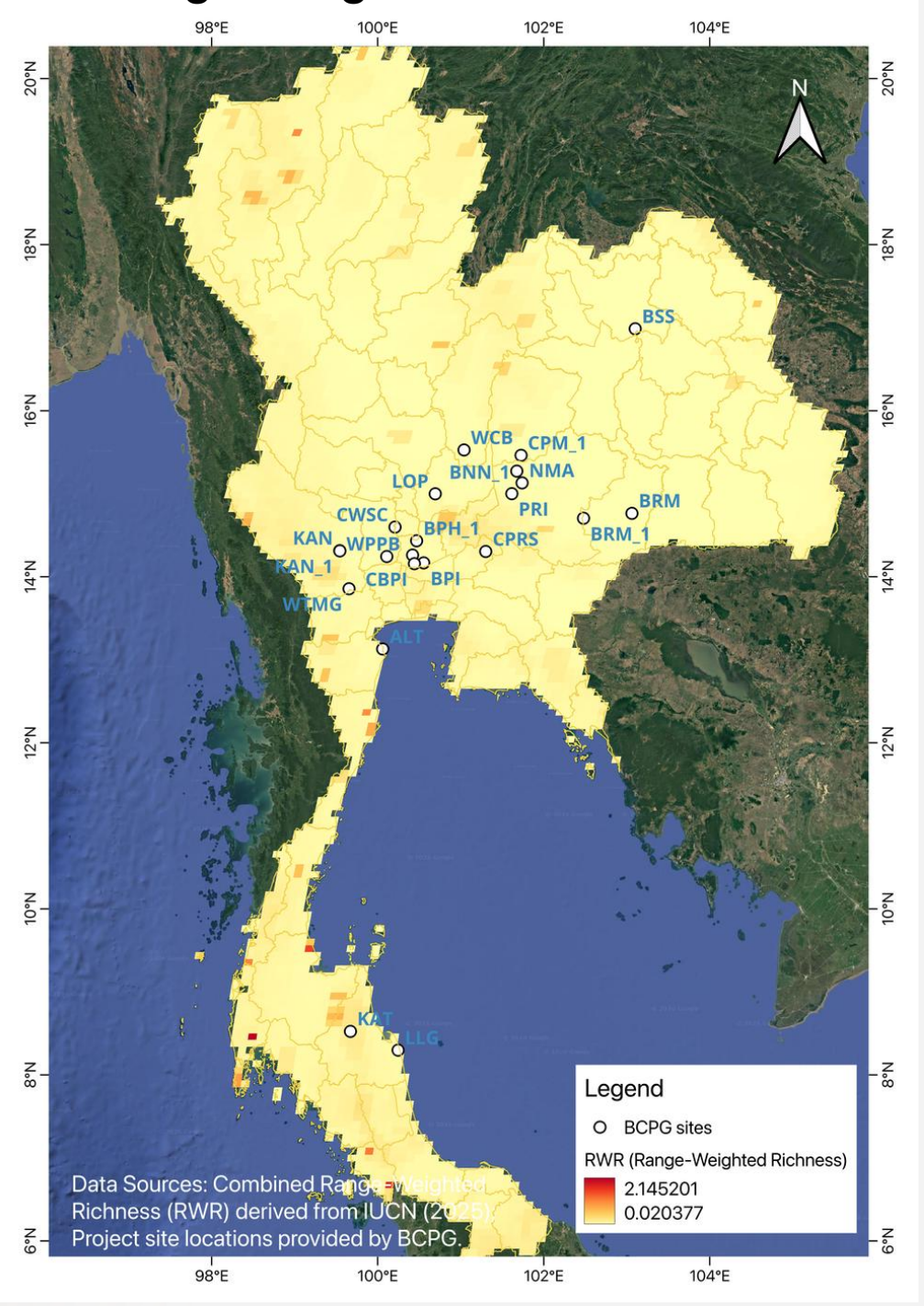
The combined density of terrestrial vertebrates (mammals, birds, amphibians, and reptiles). The Southern (**KAT**, **LLG**) sites are directly within the "Red Zone" (844–1,300 species), indicating highly complex and biodiverse operational environments.

Threatened Species Richness



As the most critical risk indicator, this map isolates threatened species (CR, EN, VU). Deep red zones confirm severe operational vulnerabilities, highlighting that **LLG**, **KAT**, **ALT**, and **CPRS** face a critical risk of disturbing endangered wildlife habitats.

Range-Weighted Richness - RWR



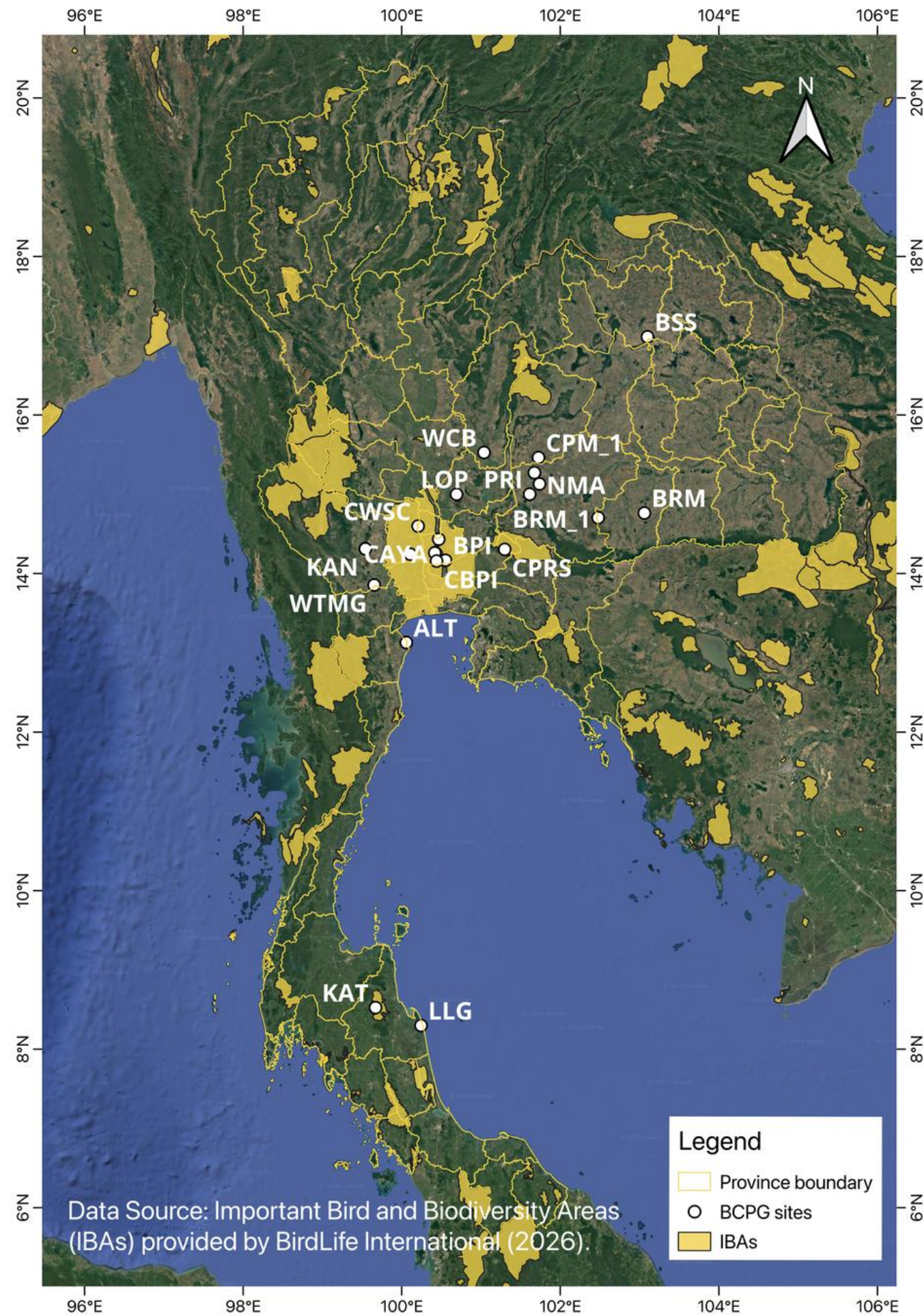
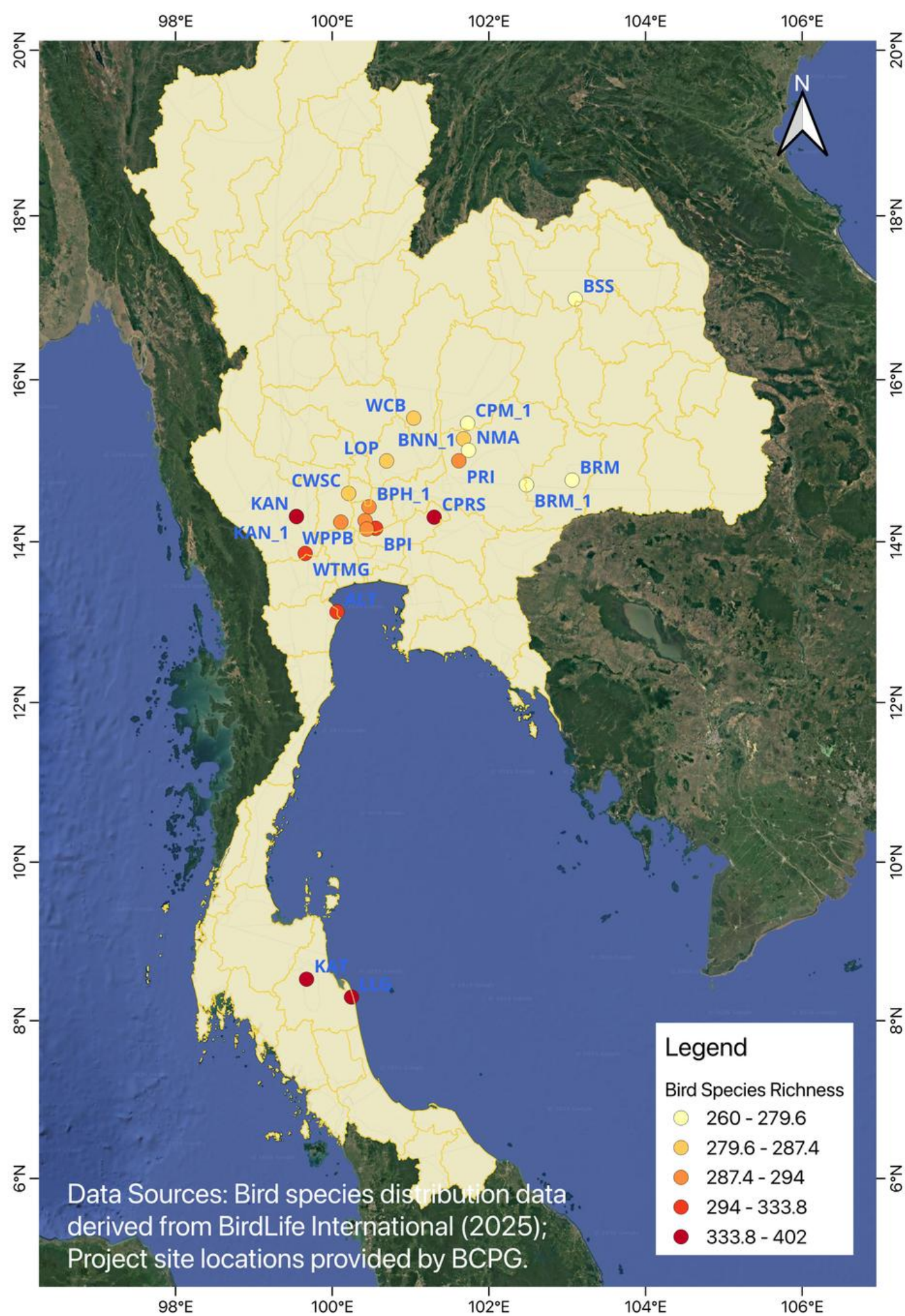
This map highlights endemic and range-restricted species. Although the high-density red areas are smaller, this metric is crucial for identifying localized vulnerabilities and pinpointing high ecological sensitivity within the **Western forest complexes** and **KAT**, which demand careful spatial management.

Spatial Evidence

IBA & Bird Richness Action Priorities

Overlaying 22 project sites with BirdLife International's Bird Richness and IBA (Important Bird Area) maps reveals that critical locations—specifically **ALT, CPRS, the Central Basin, and the Western/Southern clusters (WTMG, KAN, KAN_1, LLG, KAT)**—operate adjacent to highly sensitive avian habitats. This spatial evidence validates the immediate necessity for targeted mitigation and active monitoring.

- The **BPI site** is most vulnerable to the "Lake Effect" because of its massive scale—the largest operational area at 83 hectares—and its proximity to wetlands (KBAs). This collision risk reaches its peak during the migratory bird season (typically September to April), necessitating heightened surveillance during these months.
- Located in a high bird-species-richness zone and near critical ecological corridors, the **LLG** wind farm poses a direct collision risk to avian and bat populations. Conducting comprehensive Avian & Bat PCFM at this site is imperative to transparently monitor and mitigate turbine impacts.



Avian Biodiversity Risk Assessment Across Project Sites (1/3)

Chao Phraya Basin (Central Thailand)			Threatened categories			
Province	Site Name	Total Bird Species	CR Critical Endangered	EN Endangered	VU Vulnerable	NT Near Threatened
Ang Thong	CWSC	275	2	4	14	22
Suphanburi	WPPB	286	2	4	14	21
Phra Nakhon Si Ayudhya	BPH_1	280	2	3	14	22
Phra Nakhon Si Ayudhya	CAYA	285	2	3	14	22
Phra Nakhon Si Ayudhya	CBPI	286	2	3	14	21
Lopburi Approx. 35 km from Pasak Jolasid Dam Non-Hunting Area	LOP	274	2	3	14	21
Phetchabun Approx. 28 km from Sap Langka Wildlife Sanctuary	WCB	278	2	3	14	19

Note: Desktop screening based on Species Distribution Maps from BirdLife International (2026), the official Red List Authority for the IUCN. Vulnerability categorization (CR, EN, VU, NT) referenced from the latest IUCN Red List assessments.

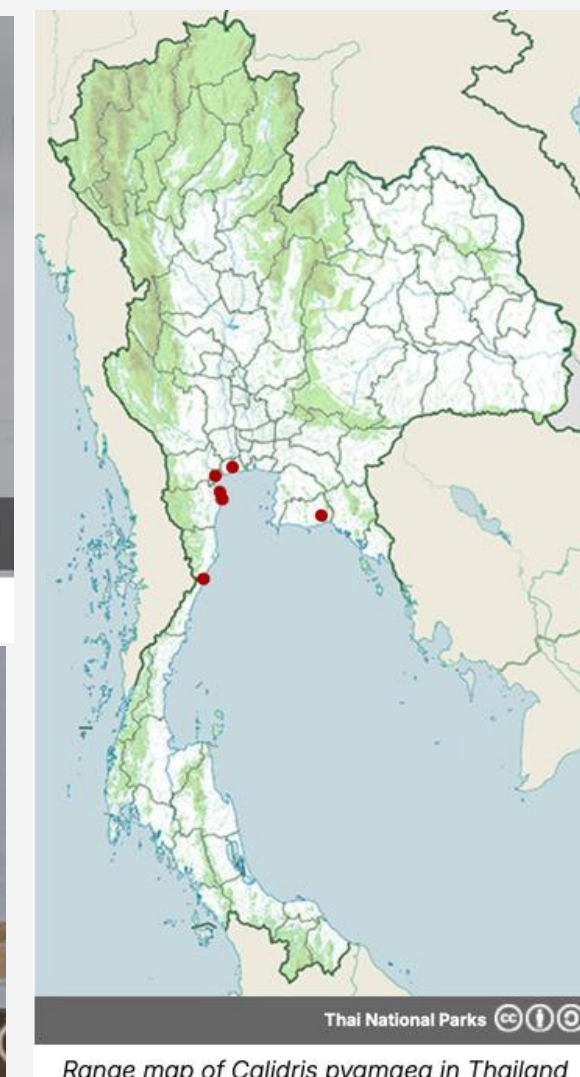


Note
***Aythya baeri* (Central Region):**
While Central Thailand was historically a significant wintering ground for the globally Critically Endangered Baer's Pochard, current sightings are exceptionally rare. The species appears in the screening results because of its broad historical distribution. As the project site lacks large, undisturbed wetland ecosystems, the probability of this species utilizing the area is considered **negligible**.

Source: © Bird Conservation Society of Thailand (BCST)

Avian Biodiversity Risk Assessment Across Project Sites (2/3)

Gulf of Thailand Coast Basin (Eastern Thailand)			Threatened categories			
Province	Site Name	Total Bird Species	CR Critical Endangered	EN Endangered	VU Vulnerable	NT Near Threatened
Prachin Buri Approx. 2.5 km from Khao Yai National Park	CPRS	354	2	4	15	24
Peninsula Malaysia Basin (Western & Southern Thailand)						
Kanchanaburi Approx. 23 km from Salakpra Wildlife Sanctuary	KAN	327	2	5	13	22
Kanchanaburi Approx. 23 km from Salakpra Wildlife Sanctuary	KAN_1	327	2	5	13	22
Kanchanaburi Approx. 25 km from Somdet Phra Srinagarindra Park Non-Hunting Area	WTMG	321	2	5	15	21
Nakhon Si Thammarat Less than 1 km from Khao Luang National Park	KAT	392	1	5	16	56
Nakhon Si Thammarat Approx. 10 km from Laem Talumphuk Non-Hunting Area	LLG	341	0	5	15	51
Phetchaburi	ALT	308	2	6	15	24



Source: © Bird Conservation Society of Thailand (BCST)

- These two CR species (*Emberiza aureola*, *Aythya baeri*) are consistently found across most sites, except for the **ALT** site (*Emberiza aureola*, *Calidris pygmaea*).

Avian Biodiversity Risk Assessment Across Project Sites (3/3)

Mekong Basin (Northeastern Thailand)			Threatened categories			
Province	Site Name	Total Bird Species	CR Critical Endangered	EN Endangered	VU Vulnerable	NT Near Threatened
Chaiyaphum Udon Thani Approx. 1.8 km from Lam Pao Non-Hunting Area	CPM_1	265	2	3	14	19
	BSS	257	2	3	15	16
Buriram (10 - 14 km from the reservoir)	BRM	250	2	3	14	16
Buriram Approx. 38 km from Thap Lan National Park	BRM_1	258	2	3	14	16
Nakhon Ratchasima	BNN_1	272	2	3	14	20
Nakhon Ratchasima	NMA	269	2	3	14	20
Nakhon Ratchasima	PRI	280	2	3	14	19

Note: Desktop screening based on Species Distribution Maps from BirdLife International (2026), the official Red List Authority for the IUCN. Vulnerability categorization (CR, EN, VU, NT) referenced from the latest IUCN Red List assessments.

- Similarly, these two globally Critically Endangered (CR) species (*Emberiza aureola* and *Aythya baeri*) are also present across the project sites located in the Northeastern region.



Source: © Bird Conservation Society of Thailand (BCST)

Disclaimer

The species lists and associated numbers in this section come from a preliminary desktop screening using global spatial databases (e.g., IUCN Red List, BirdLife International). These figures represent potential occurrences based on broad geographic ranges and migratory flyway polygons, not field-verified species richness. Consequently, the initial dataset contains spatial anomalies (e.g., including strictly coastal or marine species in inland project sites). These ecological mismatches are systematically screened out through a habitat suitability assessment. Therefore, the species count provided herein should not be interpreted as the definitive number of species currently inhabiting the project area, which must be subsequently verified through baseline field surveys.

Conclusion

The portfolio biodiversity and water risk assessment, utilizing global standard tools (ENCORE and WWF Risk Filter), highlights key strategic management directions for the organization. To further validate these findings and establish precise baselines, the Integrated Biodiversity Assessment Tool (IBAT) is highly recommended for targeted deep-dive analysis on the identified critical sites.

Nature-Related Dependencies & Impacts

- Our renewable energy projects demonstrate high materiality in ecosystem dependencies, particularly regarding Global Climate regulation and Flood Mitigation services.
- The primary impacts stem from land-use change, necessitating careful and stringent management of operational spatial boundaries.

Critical Vulnerabilities & Immediate Actions

- **Dual Threats in the Chao Phraya Basin:** These sites face critical flooding risks (average score 4.19) coupled with the highest level of strict subnational water regulations (score 5.00). The organization must urgently upgrade drainage infrastructure and implement strict measures to ensure that any wastewater discharge fully complies with regulatory standards.

Conclusion

Critical Vulnerabilities & Immediate Actions

- **Critical Habitats & Ecological Corridors:** Sites such as **ALT**, **LLG**, **KAT**, and **CPRS** operate directly adjacent to globally recognized protected areas and critical wetlands (registering severe physical risk scores up to 4.5). The organization must strictly avoid operational expansion into established ecological buffer zones. Furthermore, it is imperative to enforce rigorous surveillance measures, specifically infrastructure-tailored Post-Construction Fatality Monitoring (PCFM). Incorporating advanced statistical adjustments for carcass persistence and searcher efficiency will ensure the empirical accuracy of the mortality data. It is strongly recommended to prioritize these specific high-risk sites for upcoming IBAT analysis to map exact proximities to endangered species and accurately quantify the STAR metric.
- **Solar "Lake Effect" Vulnerability (Priority: BPI):** Given the extensive polygon area of large-scale solar operations like **BPI**—which scores a 4.0 for proximity to Key Biodiversity Areas (KBAs)—there is a heightened risk of avian collisions driven by the "Lake Effect," where migratory waterbirds mistake reflective solar arrays for open water bodies. Immediate mitigation must include integrating visual deterrents across panel boundaries and conducting targeted ecological monitoring during peak migratory seasons to minimize impacts on local wetland fauna.

References

- WWF Risk Filter Suite (Water & Biodiversity) WWF. (2026). WWF Risk Filter Suite: Biodiversity Risk Filter and Water Risk Filter. World Wide Fund for Nature (WWF). Available at: <https://riskfilter.org/> (Note: Used for assessing basin-level physical, regulatory, and reputational risks.)
- ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure) UNEP-WCMC, UNEP FI, & NCFA. (2024). ENCORE. United Nations Environment Programme World Conservation Monitoring Centre, UNEP Finance Initiative, and Natural Capital Finance Alliance. Available at: <https://encore.naturalcapital.finance/> (Note: Used for evaluating the dependency and impacts of specific economic sectors on ecosystem services.)
- IBAT (Integrated Biodiversity Assessment Tool) IBAT Alliance. (2024). Integrated Biodiversity Assessment Tool. BirdLife International, Conservation International, IUCN, and UNEP-WCMC. Available at: <https://www.ibat-alliance.org/> (Note: The primary platform utilized for proximity analysis and generating standardized ESG/TNFD metrics.)
- The IUCN Red List of Threatened Species IUCN. (2025). The IUCN Red List of Threatened Species. International Union for Conservation of Nature. Available at: <https://www.iucnredlist.org/> (Note: Source for the Threatened Species Richness and STAR metric data.)
- WDPA (World Database on Protected Areas) UNEP-WCMC & IUCN. (2024). Protected Planet: The World Database on Protected Areas (WDPA). Available at: <https://www.protectedplanet.net/> (Note: Source for identifying national and international strict conservation boundaries.)
- WDB-KBA (World Database of Key Biodiversity Areas) BirdLife International. (2024). The World Database of Key Biodiversity Areas. Hosted by the KBA Partnership. Available at: <https://www.keybiodiversityareas.org/> (Note: Source for identifying ecologically sensitive corridors and Important Bird and Biodiversity Areas (IBAs).)
- BirdLife International. (2026). World Database of Key Biodiversity Areas. Developed by the KBA Partnership: BirdLife International, International Union for Conservation of Nature, American Bird Conservancy, Amphibian Survival Alliance, Conservation International, Critical Ecosystem Partnership Fund, Global Environment Facility, Re:wild, NatureServe, Rainforest Trust, Royal Society for the Protection of Birds, World Wildlife Fund and Wildlife Conservation Society. Available at: <http://www.keybiodiversityareas.org>
- Royal Forest Department (RFD). (2026). Spatial Data of National Reserved Forests in Thailand. Bangkok: Ministry of Natural Resources and Environment.
- Office of the National Water Resources (ONWR). (2026). Spatial Data of River Basins and Sub-basins in Thailand. Bangkok: Office of the Prime Minister.
- IUCN. (2026). The IUCN Red List of Threatened Species. Version 2026. Spatial Data: Terrestrial Mammals. Available at: <https://www.iucnredlist.org>