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The transition from disclosure-led ESG to observed ESG

How satellite ESG analytics and regulation are reshaping environmental ESG data

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Executive Summary

Environmental, Social and Governance (ESG) scoring is entering a period of structural transition. Over the past decade, frameworks developed by organisations such as FTSE Russell, MSCI, Morningstar Sustainalytics and others have brought consistency and comparability to the assessment of environmental performance, enabling ESG to become embedded within capital allocation and risk management processes.

However, the context in which these frameworks operate is changing. ESG ratings are no longer simply analytical outputs: under the EU ESG Ratings Regulation, due to come into force in July 2026, they are becoming part of regulated financial infrastructure, subject to authorisation, supervision, and increasing scrutiny. This shift places new emphasis on transparency, methodological rigour, and the evidentiary basis of ratings.[1]

At the same time, new technical capabilities have emerged. Advances in satellite Earth Observation now allow environmental conditions to be observed, measured and monitored directly through scalable satellite ESG analytics. In this context, satellites form the foundational measurement infrastructure, providing independent and continuously updated observations of the physical world.

When combined with cloud-native processing platforms, automated analytics, machine learning and AI, these large volumes of satellite data can be transformed into structured, scalable and increasingly cost-efficient environmental intelligence and ESG observation data that can be injected into enterprise workflows and models.

The result is what can be described as an 'observation layer' — a source of independently derived, asset-level environmental signals supporting asset-level ESG monitoring, capable of complementing and strengthening existing ESG methodologies. Beyond improving transparency and evidentiary quality, this observation layer creates the potential for more dynamic environmental intelligence, enabling organisations to move from periodic ESG assessment towards continuously updated environmental insight and more informed risk analysis.

This paper argues that environmental ESG is evolving from a system currently dominated by disclosures, estimations and proxy methodologies towards one increasingly supported by observed measured evidence. This evolution is not only technologically enabled but increasingly aligned with regulatory expectations.

KEY THEMES

- The EU ESG Ratings Regulation (July 2026) raises the evidentiary bar for every provider in the market
- Satellite Earth Observation creates a third-party, continuously updated 'observation layer' at asset level
- Cloud-native processing and Artificial Intelligence (AI) operationalise raw satellite data into enterprise-grade ESG intelligence
- Observed ESG does not replace existing frameworks — it strengthens their evidentiary foundation
- Providers integrating observation layers gain structural advantages in credibility, defensibility and competitive differentiation

[1] EU Regulation (EU) 2024/3005 on the transparency and integrity of ESG rating activities.

1 The Structural Limitations of Current Environmental ESG Scoring

Modern environmental ESG scoring has been designed to address a fundamental challenge: how to evaluate environmental performance across diverse entities using incomplete and heterogeneous data. The prevailing solution has been pragmatic — combine corporate disclosures with standardised methodologies and fill remaining gaps with modelled estimates.

This approach has delivered scale, but it has also introduced structural limitations that are becoming more material in a regulated environment.

The first limitation is temporal. ESG data is typically reported periodically, often annually, creating an inherent lag between environmental change and its representation in ratings. The second is epistemological — a significant proportion of environmental indicators are inferred through proxies rather than directly measured. The third is reliance on self-reported information, which introduces variability in quality, scope, and interpretation.

As ESG ratings move under regulatory oversight, these limitations take on new significance. Under emerging ESG ratings regulation frameworks in the EU, an ESG rating is explicitly defined as a structured score or opinion based on a defined methodology assessing environmental risk, impact, or performance. This formalisation places greater weight on the quality and traceability of underlying data inputs. [1, 4, 5]

The result is a growing tension between what is reported and what can be evidenced. [4, 5]

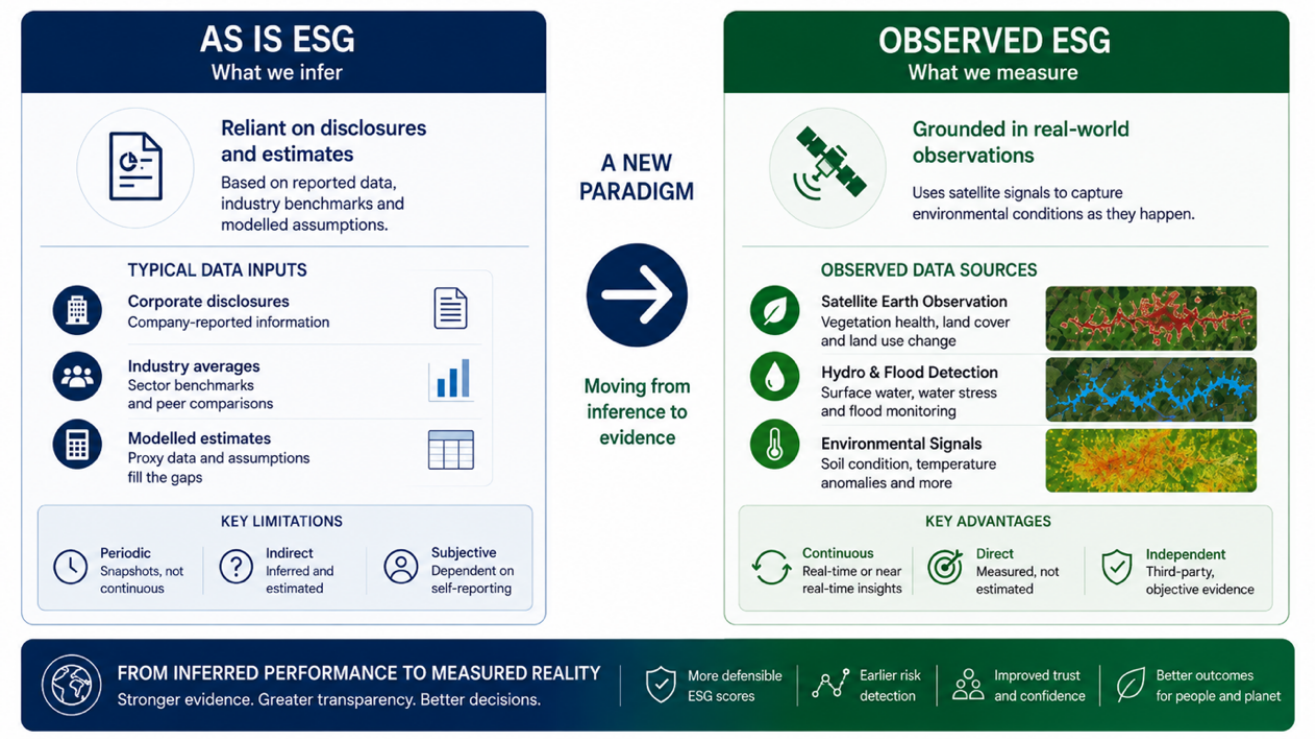

FIGURE 1 **The ESG Paradigm Shift — From Inferred to Observed**
Moving from inference to evidence: disclosure-led vs observed ESG

[1] EU Regulation (EU) 2024/3005 on the transparency and integrity of ESG rating activities.
[4] European Commission. Corporate Sustainability Reporting Directive (CSRD).
[5] EFRAG. European Sustainability Reporting Standards (ESRS).

2 The Emergence of Observed ESG

The observation layer represents a shift in how environmental data enters ESG analysis. Rather than relying on reported or inferred metrics, it introduces signals derived from direct measurement.

While a range of measured data sources are emerging — including IoT networks, industrial telemetry and ground-based sensing — satellite Earth Observation is uniquely positioned to provide globally consistent ESG observation data and independently verifiable environmental intelligence at scale, enabling continuous monitoring across geographically dispersed assets and supply chains.

Satellite Earth Observation now enables the monitoring of vegetation dynamics, water presence, land use change, and surface conditions across large geographies and at increasingly frequent intervals. When processed using cloud-native platforms, advanced algorithms, machine learning and AI, these data streams can be transformed into consistent, structured indicators suitable for integration into ESG workflows.

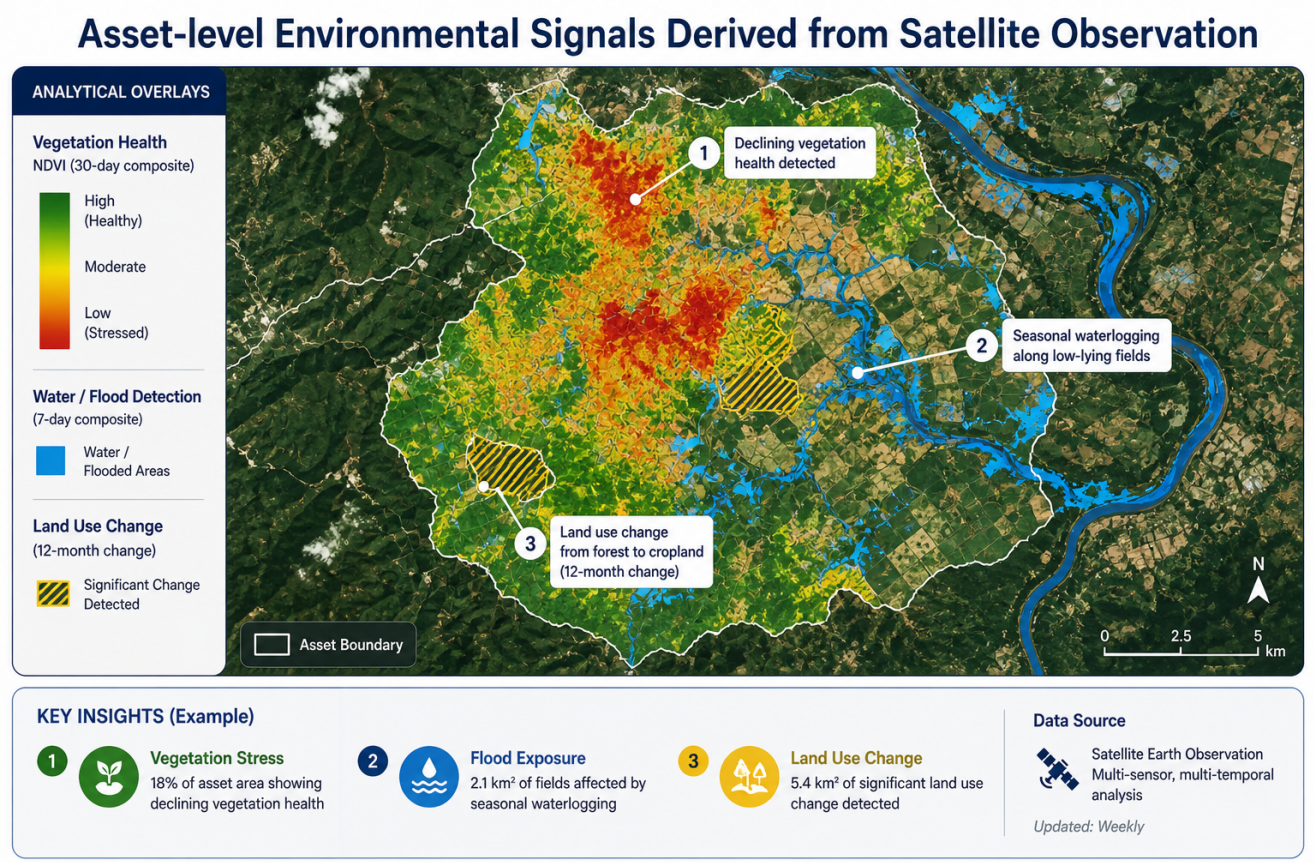

FIGURE 2 **Asset-Level Environmental ESG Signals Derived from Satellite Observation**
Illustrations of asset-level environmental ESG signals that can be observed

What distinguishes this layer is not simply its technical sophistication, but its independence. It provides third-party, spatially explicit, and continuously updated insight into environmental conditions supporting near real-time ESG monitoring. In doing so, it reduces reliance on proxies and introduces a new evidentiary dimension. Observed environmental signals also create the potential to strengthen the linkage between environmental actions and measurable environmental outcomes over time.

While observed ESG data does not establish deterministic causation in isolation, it can materially strengthen evidence of environmental influence when interpreted alongside contextual information such as operational activity, weather conditions, historical baselines and scientific models.

Importantly, the observation layer does not replace existing ESG methodologies and models. Instead, it provides a mechanism to validate, challenge, and refine existing ESG methodologies using observable sustainability data, strengthening the analytical foundation on which ratings are built.

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3 From Scores to Signals: What Changes in Practice

The integration of observed data alters ESG not at the level of structure, but at the level of interpretation.

A conventional environmental assessment may classify a company's land use as 'managed' or its water risk as 'moderate', based on disclosed practices and sectoral benchmarks. These classifications are inherently static, reflecting a synthesis of available information at a given point in time.

When observed signals are introduced, this static view becomes dynamic. Vegetation indices derived from satellite imagery may indicate a gradual decline in ecosystem health. Satellite-based water detection may reveal recurring flooding patterns. Land use analysis may identify inconsistencies between reported and observed practices.

The effect is not necessarily to invalidate the original score, but to reframe it. Environmental performance becomes measurable sustainability rather than a static classification. Risk becomes something that evolves, rather than something that is periodically assessed.

In this sense, ESG begins to shift from a periodic classification framework towards a dynamic environmental intelligence capability — capable of supporting not only retrospective assessment, but also ongoing situational awareness and evolving environmental risk interpretation.

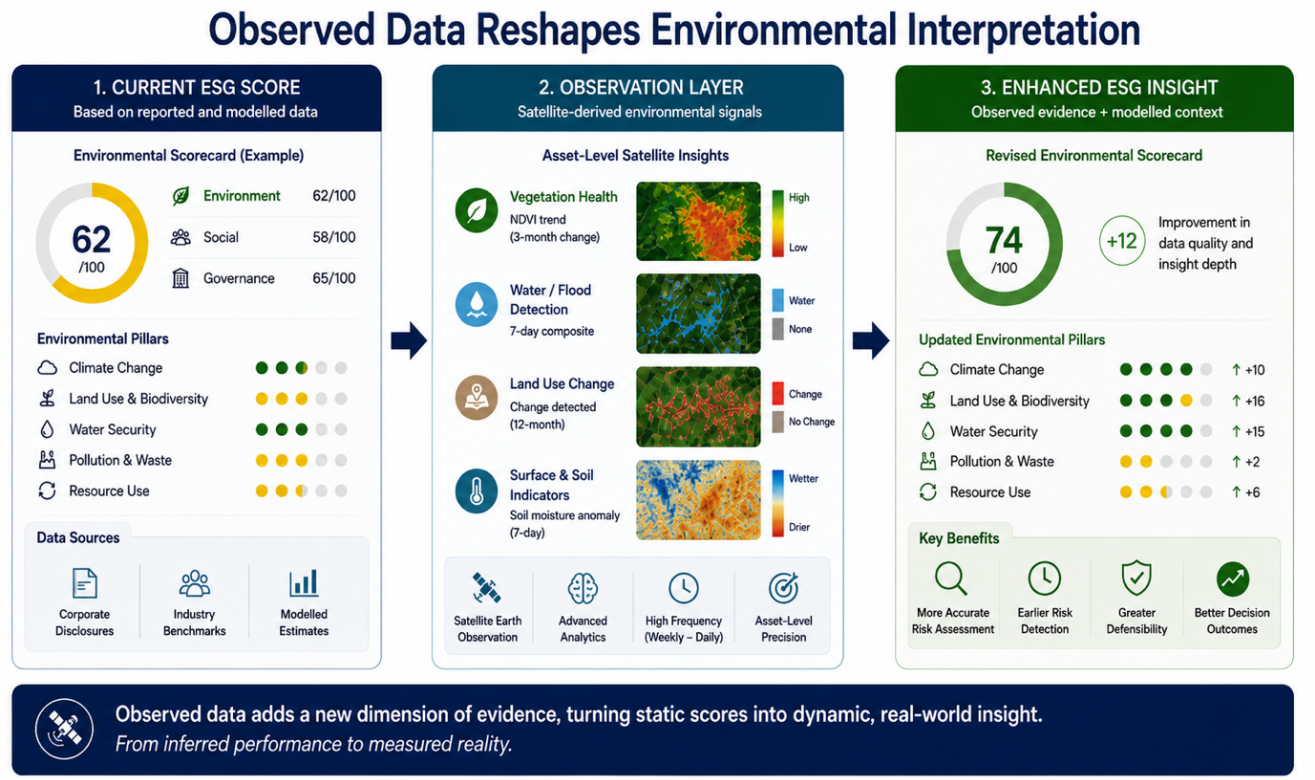

FIGURE 3 **Observed Data Reshapes Environmental ESG Intelligence**
How the observation layer transforms static ESG scores into dynamic insight

4 ESG Ratings Regulation: From Transparency to Evidence

The introduction of the EU ESG Ratings Regulation that comes into effect in July 2026 and the Code of Conduct for ESG Ratings and Data Providers represents a significant inflection point for the industry. Together, they establish a clear direction of travel: ESG ratings must become more transparent, more robust, and more accountable. [1, 3]

Transparency is a central requirement. Providers must disclose not only their outputs, but the methodologies and data sources that underpin them. Where estimations or industry averages are used in the absence of actual data, this must be made explicit. This requirement does not prohibit the use of proxies, but it does expose their presence. [1]

This creates a structural incentive. As reliance on estimation becomes more visible, the adoption of direct, observed data sources becomes increasingly attractive.

The regulation also introduces the concept of methodological accountability. ESG ratings must be explainable, consistent, and defensible under supervision by authorities such as the European Securities and Markets Authority. This shifts ESG from a largely interpretative discipline towards one that must withstand regulatory scrutiny. [1, 2]

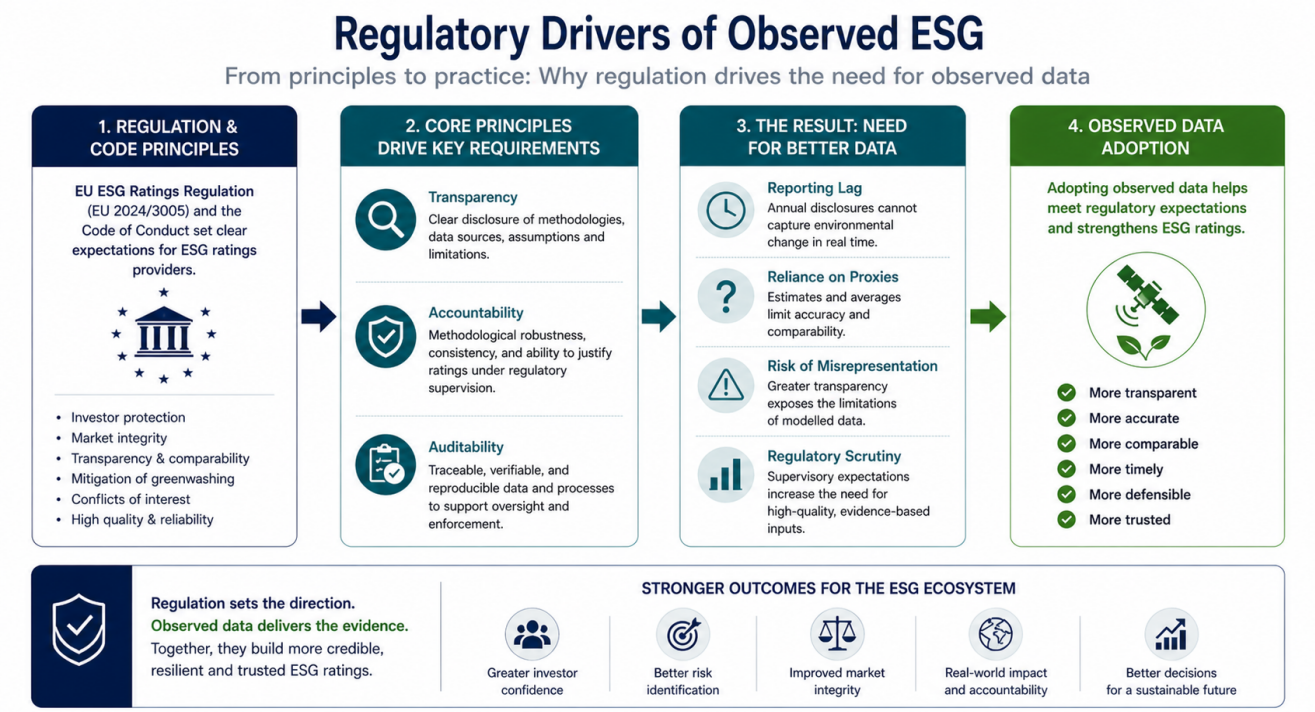

FIGURE 4 **Regulatory Drivers of Observed ESG**
Regulation is driving the need for observed environmental data

In parallel, there is a strong emphasis on mitigating greenwashing through independently verifiable ESG observation data. This extends beyond corporate disclosures to the ratings themselves. ESG assessments must be supported by robust and verifiable evidence, reducing the risk of misrepresentation. [2, 3]

The regulation further addresses conflicts of interest, encouraging separation between rating activities and other commercial functions. This reinforces the importance of independent satellite-derived ESG data sources, particularly those not reliant on client-provided information. [2, 3]

Finally, there is an implicit requirement for auditability. As ESG ratings fall within a supervisory perimeter, the ability to trace, reproduce, and validate underlying data becomes critical. [1]

Taken together, these developments point towards a common conclusion: while the regulation does not explicitly mandate the use of observed data, it systematically favours it. [1, 2, 3]

> *While the regulation does not explicitly mandate the use of observed data, it systematically favours it — exposing estimation, rewarding independence, and requiring auditability.*

[1] EU Regulation (EU) 2024/3005 on the transparency and integrity of ESG rating activities.
[2] IOSCO. ESG Ratings and Data Products Providers: Final Report.
[3] ICMA / IRSG. Code of Conduct for ESG Ratings and Data Products Providers.

5 AI, Climate Risk Analytics and the Infrastructure of Observed ESG

The emergence of the observation layer is closely linked to advances in machine learning, AI and cloud computing, but it is important to distinguish between measurement and interpretation.

The underlying environmental observations originate from satellite sensors and associated systems for Earth Observation. These technologies provide the direct measurement layer, capturing signals related to vegetation condition, water presence, land use dynamics, surface temperature, and other environmental indicators relevant to physical risk intelligence.

Enabling the interpretation of measurements derived from satellite infrastructure requires far more than analytical capability alone. Satellite data is immense, complex, fragmented, and continuously expanding across multiple sensors, resolutions and temporal frequencies. Cloud-native processing infrastructure therefore forms the operational backbone required to ingest, process, harmonise and distribute these data streams at scale, enabling near real-time ESG monitoring and the integration of environmental intelligence into enterprise workflows.

Within this cloud architecture, validated and trusted algorithms and machine learning AI techniques perform the essential task of interpretation. They identify patterns, detect anomalies, classify environmental change, and convert raw observations into indicators relevant to ESG assessment. Crucially, these processes can be automated and repeated consistently across large portfolios of geographically dispersed assets.

Beyond retrospective analysis, continuously updated observational datasets also create the foundation for predictive environmental intelligence. Trend analysis, anomaly detection, environmental change trajectories and early-warning indicators can support forward-looking climate risk analytics and more proactive operational decision-making.

What increasingly differentiates providers in this emerging market is therefore not access to satellite imagery alone, but the ability to operationalise environmental intelligence at enterprise scale. This requires validated analytical workflows, scalable AI interpretation and repeatable delivery into operational business environments capable of supporting large-scale commercial and regulatory use.

The value of observed ESG therefore extends beyond regulatory compliance and reporting alone. Continuously updated environmental intelligence has the potential to support operational optimisation, infrastructure resilience, climate adaptation planning, supply-chain oversight, asset stewardship and enterprise risk management. In this context, observed ESG becomes not simply a compliance mechanism, but an operational decision-support capability.

Early operational deployments are beginning to demonstrate how observed ESG analytics can support measurable operational and environmental outcomes across sectors including utilities, infrastructure and global supply chains. These implementations provide an important proof point that scalable environmental intelligence is becoming commercially viable as part of mainstream enterprise and ESG data infrastructure.

Importantly, the introduction of observed data does not move ESG scoring from modelling to non-modelling. Rather, it changes the evidentiary foundation upon which those models operate — moving from models grounded primarily in disclosures and proxies towards models increasingly constrained and validated by continuously updated measurements of real-world conditions.

Observed measurement provides the empirical grounding; advanced algorithms, machine learning, AI and cloud infrastructure provide the means to interpret, operationalise and cost-effectively scale that information into usable ESG intelligence.

6 Strategic Implications for ESG Ratings Providers and Asset Owners

The integration of observed data has implications that extend beyond methodology into strategy.

For ESG ratings providers, it enhances the defensibility of their outputs. Ratings supported by independently verifiable data are better positioned to withstand both regulatory scrutiny and market challenge.

For asset owners and financial institutions, it enables earlier identification of climate and environmental risk through continuously updated physical risk intelligence and environmental observation data. Observed signals can reveal emerging issues before they are disclosed or priced into markets, offering a potential information advantage.

Importantly, observed ESG data is most valuable when interpreted within broader environmental context. Regional climate conditions, historical baselines, seasonal variability and external environmental pressures can all influence observed outcomes. As such, the role of observed ESG is not simply to measure environmental state, but to provide richer empirical context through which environmental performance and risk can be interpreted more accurately and consistently.

At a broader level, it introduces a new axis of competition. As ESG methodologies converge, differentiation is likely to be driven increasingly by the quality, provenance, ESG transparency and timeliness of underlying data. Providers that successfully integrate observation layers may therefore establish a structural advantage in credibility and trust.

Conclusion

The evolution of ESG is being shaped by two converging forces: technological capability and regulatory expectation.

Advances in satellite Earth Observation, cloud processing, processing algorithms, machine learning and AI have made it possible to measure environmental conditions directly and continuously. At the same time, regulatory frameworks such as the EU ESG Ratings Regulation and disclosure initiatives like the Taskforce on Nature-related Financial Disclosures and the Corporate Sustainability Reporting Directive are raising expectations around transparency, accountability, and evidence. [1, 4, 6]

The result is a gradual but definitive shift from disclosure-led ESG towards observed ESG supported by satellite ESG analytics and measurable sustainability data.

This is not a rejection of existing frameworks, but an evolution of them. ESG ratings will increasingly be judged not only by how they are constructed, but by the strength of the evidence that underpins them.

In that context, the observation layer is not simply an enhancement. It is a mechanism through which ESG can meet the demands now being placed upon it by regulators, by markets, and by the realities of the physical world it seeks to describe.

> *The question is no longer whether ESG can be observed, but which organisations can most effectively translate environmental observation into trusted, enterprise-grade ESG insight and decision-support capability.*

ABOUT D-CAT

D-CAT provides enterprise-grade observed ESG analytics, combining satellite Earth Observation with cloud-native processing, validated algorithms and AI to produce continuously updated environmental intelligence at asset level. Our platform integrates into existing ESG workflows, supporting both ratings methodology and institutional risk management. Early deployments across utilities, infrastructure and global supply chains demonstrate that scalable environmental intelligence is commercially viable as part of mainstream ESG data infrastructure.

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[1] EU Regulation (EU) 2024/3005 on the transparency and integrity of ESG rating activities.
[4] European Commission. Corporate Sustainability Reporting Directive (CSRD).
[6] IFRS Foundation / ISSB. IFRS S1 and IFRS S2 Sustainability Disclosure Standards.

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