Picterra

The GeoAI imperative for commodity sourcing

Derisking commodity supply chains through real-time, plot-level GeoAI

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The most material risk in commodity sourcing today is the risk that cannot be seen. This paper argues that derisking modern commodity supply chains requires monitoring three pillars in continuous, plot-level detail: yield risk shaped by climate volatility; regulatory compliance, which now determines whether goods can move across borders; and sustainability practices that protect the long-term resilience of the supply base. The same architecture underpins how finance is beginning to de-risk investment in restoration and nature-positive projects. What follows sets out what that architecture must do and why most existing tooling falls short.

01

The reality of commodity sourcing

Decisions under deep uncertainty

of the world's cocoa comes from

1 2 3 4 **5–6**

million

smallholder households

40%

underestimation in Ghana

Supply chain leaders in commodity-dependent industries are not simply managing procurement. They are making high-stakes decisions under persistent, structural uncertainty, and recent years have made that uncertainty impossible to ignore. Between 2023 and 2024, ICE cocoa futures rose more than fivefold, peaking near $12,000/tonne in December 2024 before retracing to roughly $4,000/tonne by late 2025. Côte d'Ivoire port arrivals for Oct 2023–Jun 2024 fell ~30% year-over-year to an eight-year low, and Ghana's 2023/24 harvest came in roughly 50% below its initial forecast, a 22-year low. These moves were driven by weather, disease, and structural crop decline, not by a shortage of dashboards.

Unlike traditional sourcing environments, commodities introduce constraints that are uniquely hard to manage:

- Decisions are made far in advance. Procurement strategies are often defined months, sometimes years, before resources are harvested or delivered.
- Supply is geographically distributed and opaque. Roughly 90% of the world's cocoa comes from an estimated 5–6 million smallholder households, most of whose farming plots are 1–3 hectares; official planted-area figures have been shown to be underestimated by up to 40% in Ghana.
- Conditions are dynamic and volatile. Weather, climate, land use, and geopolitics continuously reshape supply. Over the past decade, Côte d'Ivoire and Ghana have averaged ~40 additional days per year with maximum temperatures exceeding 90°F, which is above cocoa's optimal range.
- Quality is heterogeneous and hard to assess remotely. Securing the right mix of premium and standard lots is not only a pricing question; it is a visibility question.

The result is a fundamental tension: critical decisions must be made early, while the underlying reality remains only partially observable.

02

The visibility gap

Over the past decade, organizations have invested heavily in tools intended to close that gap: ERP and data platforms, reporting systems, satellite imagery, and AI-driven analytics. These have materially improved the situation. But investment has not translated into end-to-end visibility

McKinsey & Company

McKinsey's 2024 Global Supply Chain Leader Survey:

90%

of respondents encountered supply chain challenges during the year

14%

of respondents reported a good view of Tier-3 suppliers

43%

believed they had sufficient resilience measures in place.

Deloitte.

Deloitte's 2025 Global CPO Survey:

65%

of procurement leaders reported limited or no visibility beyond their Tier 1

64%

of respondents cited "greater supply-chain visibility" as the second-most used risk mitigation strategy.

Gartner

Gartner's 2024 Procurement Risk Survey:

High

threat to procurement's future success was identified as supply disruption

29%

of supply chain organizations have built the capabilities needed to deliver on future performance.

In other words, investment has produced partial improvement, not resolution. Most supply chain leaders still operate with incomplete coverage, delayed information, inconsistent insights across regions, and a limited ability to validate assumptions. The gap is less a tool gap than a structural mismatch between the problem and the architectures being applied to it.

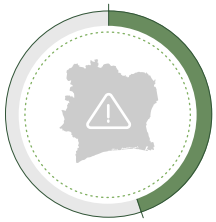
03

Why the problem is under-specified

Commodity sourcing is typically framed as a data availability problem or a forecasting problem. It is both, but it is also something else, and that something else is usually treated as secondary when it should be treated as primary:

Continuously understanding what exists on the ground, across vast geographies, under changing conditions, with incomplete information.

Three intrinsic challenges follow.



Côte d'Ivoire	**43%**
Local systems	20+
Latest update	Unsure
Risks	Undefined
Forest loss	**37%**

Ghana	**20%**
Local systems	20+
Latest update	Unsure
Risks	Undefined
Forest loss	**13%**

A. Scale mismatch

Sourcing is global, but most monitoring systems operate locally or regionally. A chocolate manufacturer sourcing cocoa from Côte d'Ivoire (~45% of the world supply), Ghana (~20%), Ecuador, Indonesia, and Cameroon cannot rely on a patchwork of country-level instruments that produce different answers at different cadences and resolutions.

B. Temporal mismatch

Decisions span multi-year horizons; data is often static, outdated, or episodic. Sentinel-2 provides 10–20 m optical imagery with a ~5-day revisit; Planet's PlanetScope constellation captures near-daily 3 m imagery across the land surface. The raw cadence exists. Converting it into continuously up-to-date, decision-grade intelligence at a global scale is the harder problem, and the one most architectures quietly skip.

C. Knowledge gap

What matters most is often what is not yet known: undiscovered supply sources, unreported changes, and emerging risks. Recent mapping finds cocoa cultivation is an underlying driver of more than 37% of forest loss in protected areas in Côte d'Ivoire and more than 13% in Ghana; roughly 40% of Côte d'Ivoire's cocoa crop is grown inside supposedly protected national parks and forests. These are material supply and compliance exposures that only surface when the full footprint is actually observed, not when a subset of registered farms is sampled.

04

What it actually takes to manage uncertainty

If the objective is to actively manage uncertainty, not merely report on it, a distinct set of design principles applies. None of these is a silver bullet; together they describe a viable architecture.

01 Continuous global observation, with change detection built in.

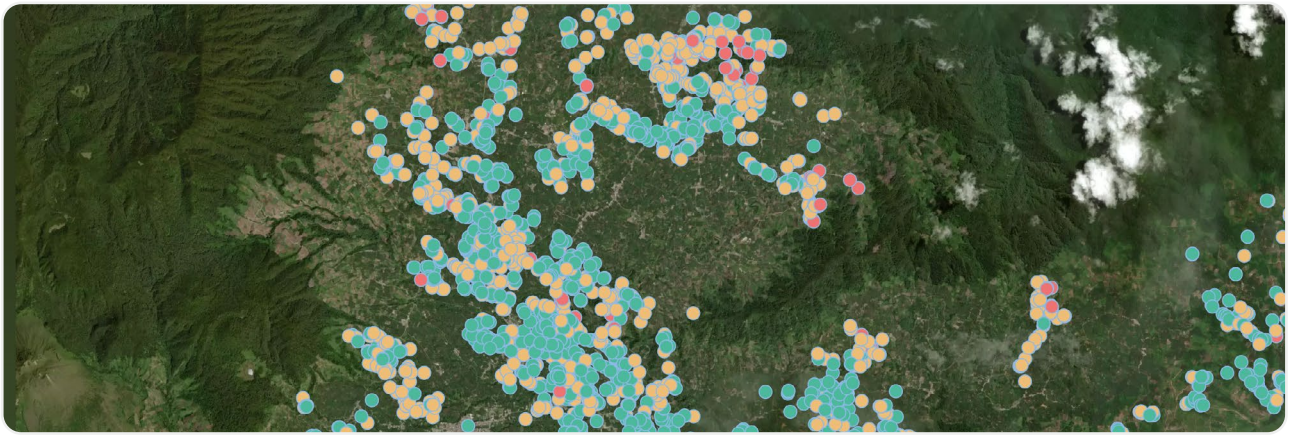
02 Ability to detect the unknown

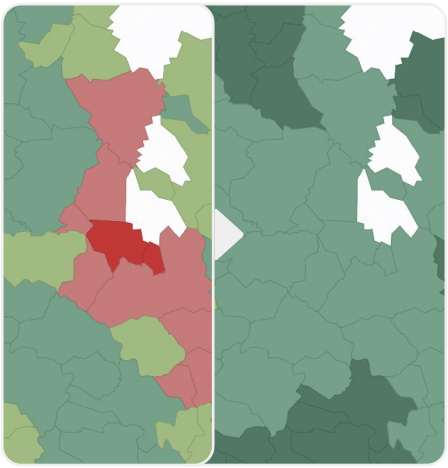
03 Consistency across contexts

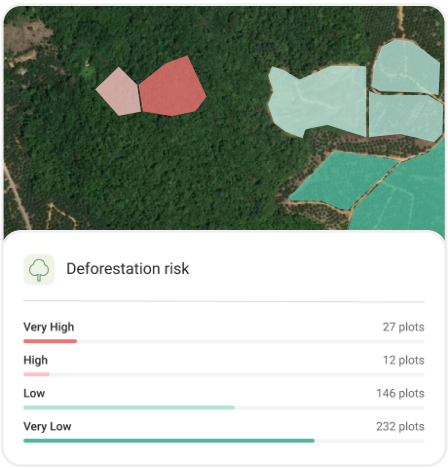
04 Contextual interpretation, not just observation

05 Scale by design, with plot-level granularity by default

06 Direct integration into decision systems







01

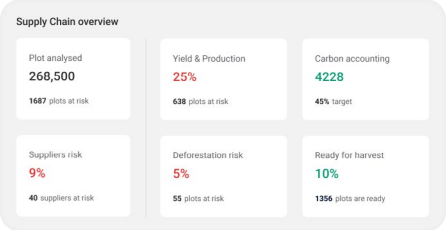
Continuous global observation, with change detection built in

Observe supply-relevant environments across all regions, update that understanding at the cadence of the underlying reality, and flag deviations the moment they occur, not after the fact. The standing observation system and the change-detection layer are not two systems. They are the same system.

02

Ability to detect the unknown

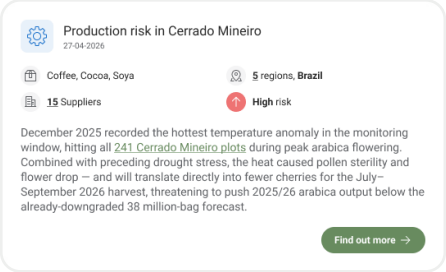
Go beyond tracking the assets you already know about. Map the fields surrounding a registered farm or processing site. Watch for activity at the periphery: dirt roads opening into forest, makeshift clearings, smallholder plots not yet on any supplier register. These physical transformations of the land are early signals of impact on nature and usually precede the impact itself. A new road in a forest is, with high probability, followed by tree clearing within months. The compliance framework for this kind of monitoring is the EUDR, which requires operators placing cocoa, coffee, palm, soy, rubber, cattle, or wood on the EU market to submit precise geolocation data and to prove that production did not occur on land deforested after 31 December 2020. But the operational reason is broader: by the time deforestation appears on a country-level dashboard, the supply chain is already exposed.



03

Consistency across contexts

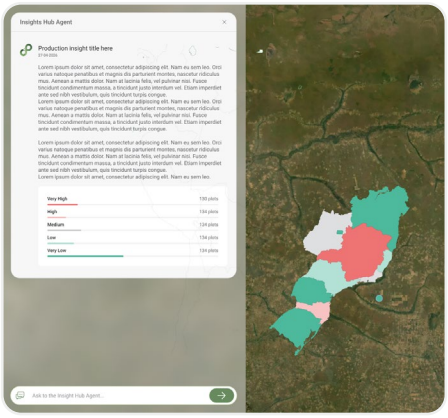
Produce comparable interpretations across geographies, commodities, and environmental conditions, rather than a different answer for each country team.



04

Contextual interpretation, not just observation

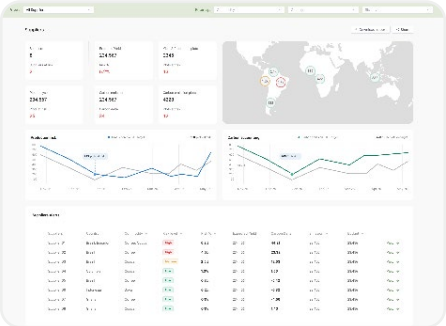
Pixels become decisions only when joined to weather, climate, market, and policy context.



05

Scale by design, with plot-level granularity by default

Global scope is not a feature to add later. It is an architectural premise. The right system starts from a global scale and resolves down to the individual plot, rather than starting from a single region and scaling outward. The point is not to scale a system. The point is to match a supply chain as it actually exists, without resorting to averaged or aggregated approximations.



06

Direct integration into decision systems

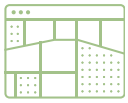
Insights must flow into procurement, forecasting, and risk workflows. They should not sit in a standalone viewer.

05

A gap between requirements and reality

Measured against these principles, a consistent pattern emerges:

Many systems provide visibility,
but not coverage.



Many provide data,
but not discovery.

Many provide data,
but not actionable information.

Many provide analysis,
but not consistency.

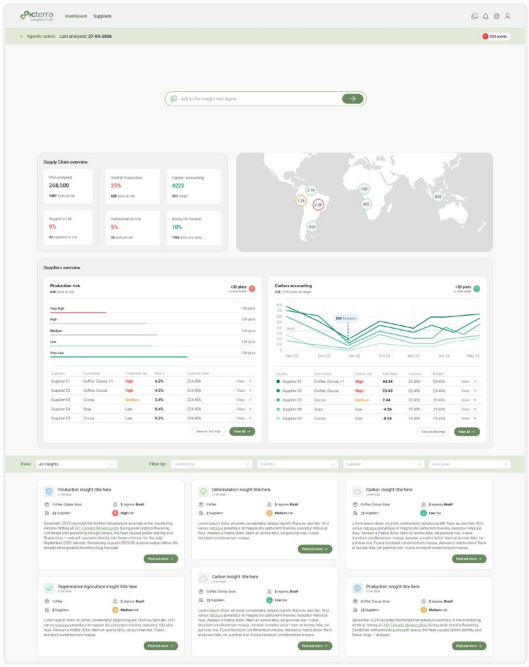
Many provide insight,
but not integration into the workflows that prompt business-critical action.

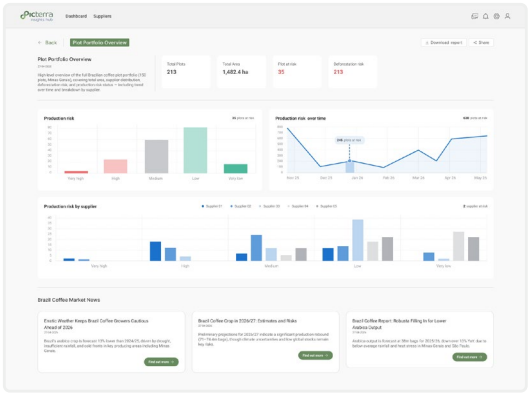
This is why, despite significant technological investment, supply chain uncertainty in commodity sourcing remains persistently under-managed. Not because the problem is intractable, but because, in many organizations, it is still being approached with the wrong architectural assumptions.

06

How Picterra closes the gap

We have spent the past ten years building exactly this architecture. We call it Insights Hub.





Plot-level monitoring at a global scale

Our own plot delineation models across soft commodities, built on continuous satellite observation, advanced machine learning, and curated partner data.

Decision-grade analytical workflows

Including production risk forecasting; deforestation and land-conversion analysis aligned with FAO WHISP methodology and EUDR requirements; Scope 3 carbon accounting at the Land Management Unit level; regenerative agriculture verification; biodiversity impact assessment; and biomass and yield monitoring at plot level.

Agentic reasoning across the supply base

A layer that surfaces what matters on a regular cadence, with built-in explainability and every insight traceable back to the underlying data.

Built to detect the unknown.

Comparable across contexts. Contextually integrated. Plot-level by default. Embedded in the systems where decisions actually get made.

If you are working through the visibility gap inside your own organization, we would welcome the conversation.

Find out more at

picterra.ai