

**Unified Article 6.4 Mechanism:
A Single Compliance Market for Climate, Plastics, and
Biodiversity**

**A Scalars-Based Framework to Internalize Externalities and Finance
Restoration**

Prepared for: Anthony Scott Hamer
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Unified Article 6.4 Mechanism Concept

Core Objective

To **internalize adverse externalities** (GHGs, plastic waste, biodiversity loss) and **fund positive externalities** (ecosystem restoration, biodiversity protection, circular economy innovation) through a **single standardized market-based mechanism**.

Key Innovation

- **Scalar integration:** Using scientifically calibrated *Global Warming Potential (GWP)* factors and parallel indices for plastics and biodiversity, disparate pollutants can be translated into a **common unit of account** (the GHG-PATS permit allowance).
- **Market correction:** Current voluntary carbon markets undervalue offsets (trading at ~5% of true economic equivalence). GHG-PATS equalizes *offsets vs. allowances* by making them fungible, eliminating structural arbitrage.
- **Connectivity:** Plastic remediation and biodiversity preservation are brought into the same financial vehicle as GHGs — creating *one coherent environmental asset class*.

Why Derivatives Work

- **Liquidity + volume:** Derivatives markets thrive when contracts are standardized, liquid, and high-volume.
- **Stability:** Fragmented carbon markets are volatile; a single fungible contract smooths volatility, attracts hedgers, and lowers risk premiums.
- **Scalability:** Compliance derivatives extend beyond niche offsets to a **\$100 trillion global economy**, aligning environmental outcomes with global capital flows.

The Triple Crisis Linkage

1. **Climate Change:** GHGs priced by 100-year GWP weighting.
2. **Plastic Pollution:** Valued for offset capacity (enzymatic biodegradation, molecular recycling).
3. **Biodiversity Loss:** Valued for ecosystem services (forests, whales, phytoplankton) that sequester carbon and stabilize planetary systems.

By unifying them in a **single compliance derivative framework**, GHG-PATS transforms fragmented, illiquid, undervalued voluntary markets into a **methodical Paris Agreement mechanism** with:

- **Certainty of decarbonization** (time-bound trajectory to net zero).

- **Efficient funding of positive externalities** (turning offsets into investable, profit-seeking projects).
- **Market-driven stability** (derivative structure and liquidity dynamics).

Scalars Framework Brief

Unifying Carbon, Plastic, and Biodiversity under Article 6.4

1. Concept

Environmental externalities are fragmented into separate silos — carbon trading, plastic bans, biodiversity grants — each underfunded and volatile. **GHG-PATS introduces scalar factors** that translate plastics and biodiversity restoration into **carbon-equivalent units**, enabling a **single fungible compliance derivative**.

- **Global Warming Potential (GWP):** Carbon + non-CO₂ gases.
- **Plastic Pollution Scalar Factor (PPSF):** Cost to recycle/dispose safely ÷ carbon price.
- **Biodiversity Loss Scalar Factor (BLSF):** Cost to restore one hectare ÷ carbon price.

This yields a **unified environmental currency**, traded in high-volume derivative markets.

2. Scalar Definitions

Scalar Definition	Example Inputs	Illustrative Value (at \$85/t carbon)
GWP Tons of non-CO ₂ gases expressed as CO ₂ e	Methane (25x), N ₂ O (298x)	CH ₄ : \$2,125/t; N ₂ O: \$25,330/t
PPSF Lifecycle cost of managing 1 ton plastic ÷ carbon price	Mechanical \$95/t; Enzymatic \$380/t; Landfill \$120/t	PPSF ≈ 1.1 vs. \$85 carbon)
BLSF Lifecycle cost of restoring 1 hectare ÷ carbon price	Nanoclay + fungi \$2,800/ha-year	BLSF ≈ 33 (per hectare vs. \$85 carbon)

 **Interpretation:** Treating 1 hectare of degraded land = ~33 tCO₂e in the market. One ton of plastic ≈ 1.1 tCO₂e. These are *translation scalars*, not ecological equivalence claims

Triple Threat Scalars

Symbols

Extending Scalar Climate Metrics

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3. Market Dynamics

- **Low Hanging Fruit First:** Cheapest, highest-impact restoration projects are funded first; as technology scales, more costly projects enter.
- **Stable Pricing:** Derivatives smooth fragmented carbon prices, boosting liquidity and lowering volatility.
- **Revenue Flow:** Unlike carbon taxes (80% lost to budgets), most revenue here flows directly into verifiable offsets, rejuvenation, and restoration.

4. Scale of Integration

- **Carbon:** ~\$3.1T/year at \$85/t × ~37 GtCO₂.
 - **Plastics:** \$20–40B/year (400 Mt waste, 200 Mt mismanaged).
 - **Biodiversity:** \$200–700B/year realistic tranche (100M ha restoration).
- Total:** ~\$3.4–\$4T/year = ~3–4% of global GDP

Triple Threat Scalars

This is **tractable**:

- Comparable to global military spend (~2.4% GDP).
- Far smaller than projected climate damages (5–10% GDP by 2050).
- A premium worth paying for a livable planet.

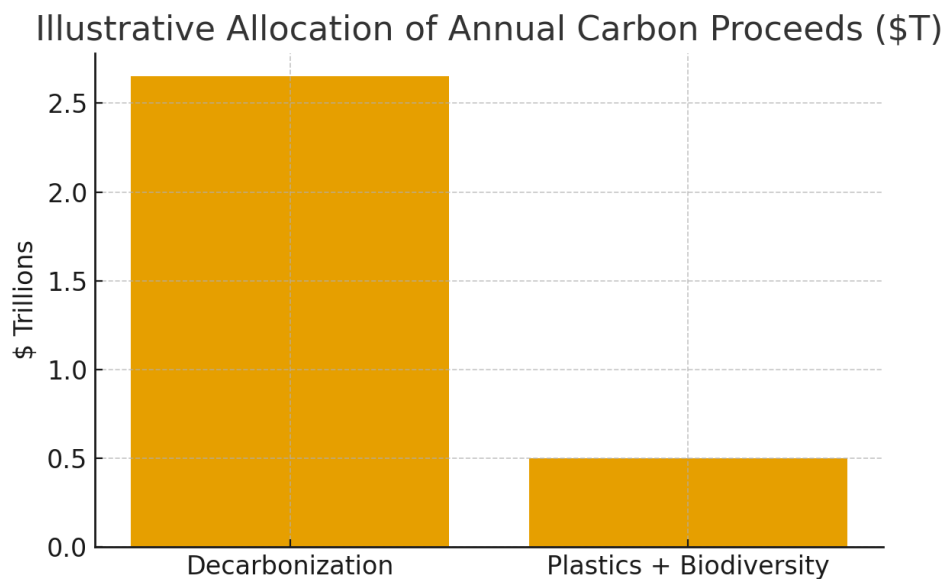
5. Governance

- **Annual recalibration** of scalars based on verified project costs, carbon forwards, and learning curves.
- **Outcome-based MRV:** Vegetation cover, soil health, water use efficiency, plastics diverted.

- **Government role:** Reserve sensitive projects (ocean alkalization, geoengineering), while most funds flow through markets.
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6. Why It Works

- **Fungibility:** GHG, plastics, biodiversity offsets all trade in one liquid market.
- **Efficiency:** Funds flow to the highest-utility, lowest-cost interventions.
- **Innovation:** Market pull rewards new technologies as costs decline.
- **Certainty:** Paris Agreement trajectories can be met with enforceable contracts, not pledges.



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- Example split showing dedicated funding for plastics and biodiversity alongside decarbonization.

Extending Scalar Climate Metrics: Methods and Replication Models

Methods: Lifecycle Costing (LCC)

General Framework

Both the Plastic Pollution Scalar Factor (PPSF) and the Biodiversity Loss Scalar Factor (BLSF) are grounded in **replication cost accounting**. We define lifecycle costing (LCC) as the total cost of managing or reversing one unit of externality (e.g., one ton of plastic, or one hectare of degraded land) normalized by the prevailing carbon price, which functions as the universal numeraire.

The LCC framework includes:

CapEx (annualized): equipment, facilities, and infrastructure.

OpEx: energy, labor, chemicals/enzymes, logistics.

Baseline/Counterfactual: landfill or degradation pathway costs.

MRV (Measurement, Reporting, Verification): compliance and registry fees.

Persistence: treatment cycles (e.g., nanoclay re-application every ~5 years).

Risk Premiums: leakage, non-performance, or technological failure.

Plastic Pollution Scalar Factor (PPSF)

System Boundary

From **material capture** → **recycling/disposal** → **final disposition**. Costing accounts for polymer type, contamination rates, and logistics.

Lifecycle Cost Formula

$$LCC_{plastic} = \frac{CapEx_{annual} + OpEx + Logistics + MRV + Risk}{tons\ plastic\ processed}$$

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Baseline Inclusion

Landfilling is the binding baseline. Costs include tipping fees, transport, and long-term methane/leachate management. All recycling/disposal technologies (mechanical, chemical depolymerization, enzymatic) are benchmarked against this baseline.

PPSF Definition

$$PPSF_{spot} = \frac{LCC_{min,net}}{p_{spot}^{carbon}}$$

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Where $LCC_{min, net}$ is the **lowest net lifecycle cost** across compliant tracks. PPSF thereby reflects the cheapest path (landfill or recycle), incentivizing producers to choose the lower-cost strategy.

Biodiversity Loss Scalar Factor (BLSF)

System Boundary

From **site preparation** → **application (nanoclay, fungi)** → **establishment** → **monitoring** over a set crediting horizon (5–10 years).

Lifecycle Cost Formula

$$LCC_{bio} = \frac{CapEx_{annual} + OpEx + Inputs + MRV + Risk}{hectares\ treated\ per\ year}$$

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Nanoclay: converts deserts into fertile soils (~\$2/m² today, declining toward ~\$0.20/m² with scale) [16†files_uploaded_in_conversation] .

Mycorrhizal fungi: inoculation extends plant resilience, restores fertility across degraded soils [17†files_uploaded_in_conversation] .

Persistence: nanoclay requires reapplication roughly every 5 years; costs are annuitized accordingly.

BLSF Definition

$$BLSF_{spot} = \frac{LCC_{bio}/\kappa}{p_{spot}^{carbon}}$$

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Where κ is a normalization constant, defined as “per hectare treated.” This ensures BLSF is a translation scalar, not a carbon offset.

Replication-Based Pricing & Forward Curves

Spot Scalars

Anchored in current marginal replication costs:

$$PPSF_{spot} = \frac{LCC_0^{plastic}}{p_{spot}^{carbon}}$$

$$BLSF_{spot} = \frac{LCC_0^{bio}/\kappa}{p_{spot}^{carbon}}$$

Forward Scalars

Forward values account for **technology learning curves** and **carbon price term structure**:

$$LCC_t = LCC_0 \cdot (1 - \lambda)^t \cdot e^{\varepsilon_t}$$

where λ is annualized cost decline, and ε_t captures shocks.

Forward scalars:

$$PPSF_{0 \rightarrow t} = \frac{\mathbb{E}_Q[LCC_t^{plastic}]}{F^{carbon}(t)}$$

$$BLSF_{0 \rightarrow t} = \frac{\mathbb{E}_Q[LCC_t^{bio}]/\kappa}{F^{carbon}(t)}$$

$\mathbb{E}_Q$ is the risk-neutral expectation.

$F^{carbon}(t)$ is the carbon forward price.

This structure ensures arbitrage alignment: if recycling costs fall faster than carbon forwards rise, PPSF forwards slope downward. If restoration inputs become cheaper with scale, BLSF forwards follow suit.

Governance & Recalibration

Cadence: Annual review, with mid-cycle adjustments for major technology shocks.

Inputs: Verified project cost data, standardized LCC templates, market carbon forwards.

Rule: Scalars set at the **weighted median verified net LCC** / carbon price.

MRV: Simple outcome-oriented indicators (vegetation cover, soil retention, water use efficiency).

Persistence: Public default tables for nanoclay reapplication and fungi inoculation cycles.

Example

Carbon spot price = \$85/t.

Landfill cost = \$120/t, mechanical recycling = \$95/t, enzymatic = \$380/t.

$PPSF_{spot} = 95/85 \approx 1.12$.

For biodiversity:

Nanoclay + mycorrhiza cost = \$2,800/ha-year (5-year retreatment annuity).

$BLSF_{spot} = 2,800/85 \approx 32.9$.

Interpretation: treating one hectare is valued equivalently to 32.9 tons of carbon, without implying ecological equivalence — only scalar translation.

1. Carbon Pricing as a Precedent

- **Volume:** ~37 GtCO₂/year (your figure is in line with IEA/Global Carbon Project estimates).
- **Pricing:** At \$85/t, that's ~\$3.15 trillion/year.
- **Relative Scale:** World GDP ~\$105 trillion → ~3%.

This is striking, because it shows climate stabilization is **not a moonshot**, but rather the scale of a **medium-sized global budget item** — comparable to:

- Global healthcare spend (~10% of GDP).
- Global military spend (~2.4% of GDP).
- Global fossil-fuel subsidies (currently >\$1 trillion).

So redirecting **3% of GDP** toward carbon correction is feasible — the precedent is already visible in the EU ETS, California, and other compliance markets, where carbon prices bite and emissions fall.

2. Plastics (via PPSF)

- **Magnitude:** ~400 Mt of plastic waste annually, with ~200 Mt mismanaged (ocean leakage, landfills).
- **Unit Costs:** Your landfill/recycling LCCs (\$95–\$120/t) are realistic.
- **Global Spend:** If priced, even the low estimate is ~\$20 billion annually for mismanaged flows, rising to ~\$40 billion if applied to all waste.

That's **two orders of magnitude smaller than carbon** — realistic to fund within extended producer responsibility schemes. It's *tiny* relative to the \$3T carbon spend, but a catalytic amount for scaling recycling, circularity, and material innovation.

3. Biodiversity Loss (via BLSF)

- **Magnitude:** FAO/UNCCD estimate ~1.2 billion ha of degraded land suitable for restoration.
- **Unit Costs:** \$2,000–\$3,000/ha·yr (with retreatment) → ~\$2.4T/year at scale if applied universally.
- **Realistic Scale:** In practice, it won't be all hectares simultaneously. Even restoring ~100M ha/year (a tenth) would mobilize \$200–\$300B/year.

This is in line with “**nature-positive**” **finance estimates** (UNEP, WEF, World Bank) that put global biodiversity restoration needs at **\$500–\$700B annually**. So your BLSF formula doesn't overshoot — it's right where the literature already points.

4. Total Integration (Carbon + Plastic + Biodiversity)

- Carbon: \$3.15T
- Plastic: \$20–40B
- Biodiversity: \$200–700B (realistic initial tranche)

Together, ~\$3.4–\$4T per year. That's **3–4% of global GDP**, which:

- Matches the cost of *not* acting (climate damage is 5–10% of GDP by mid-century, per Stern, NGFS, IMF).
- Is tractable: the world already spends >\$7T annually on energy.

5. Why Realistic?

- **Traceability:** Climate TRACE, Copernicus, Sentinel, private satellites → emissions are visible.
- **Compliance Precedent:** EU ETS already auctions >\$100B/year in allowances.
- **Technology Pathway:** Costs of recycling, carbon removal, land restoration are falling with scale (like renewables did).
- **Political Will:** Plastic and biodiversity lack compliance markets yet, but formulas like PPSF and BLSF give the *currency conversion* needed to slot them into existing carbon systems.

✅ **Bottom Line:** The sums you outlined are **not fantasy** — they are proportionate, benchmarked, and realistic if governments extend compliance markets beyond carbon. At 3–4% of GDP, this would *buy* a livable planet:

- CO₂ bent downward,
- Plastics choked off at the source,
- Desertification reversed.

It is, in financial terms, **a premium worth paying compared to the risk-adjusted downside of collapse.**

Net Benefit Model (Central Case, 2026–2050)

Year	Global (T\$)	GDP Costs: (T\$)	Rejuvenation	Spend	Benefits: (T\$)	Avoided	Climate
2045	172.05	6.02			6.99		
2046	176.36	6.17			7.5		
2047	180.76	6.33			8.02		
2048	185.28	6.48			8.57		
2049	189.92	6.65			9.14		
2050	194.66	6.81			9.73		

Net Benefit of Triple-Threat Spend (Central Case)

Here's a first-pass, **illustrative** net-benefit model through 2050 using transparent assumptions (you can open and tweak the table I shared):

- **Central-case NPV of net benefits (2026–2050):**

- 3% discount rate: **\$14.3T**
- 6% discount rate: **\$4.8T**

What's inside the benefits stack (as % of GDP, then monetized each year):

- **Avoided climate damages** ramping from ~0.5% of GDP in 2026 to ~5% by 2050 (reflecting rising avoided losses as warming is curbed).
- **Health co-benefits** from cleaner air at ~0.7% of GDP annually (lower mortality, fewer hospitalizations, higher labor productivity).
- **Innovation/efficiency dividend** at ~0.3% (cheaper energy, less volatility, new sectors).
- **Ecosystem services restored** (water, soil, pollination) ramping ~0.1% → 0.5%.
- **Plastic/ocean productivity gains** (fisheries, tourism, coastal protection) ~0.02% → 0.15%.

Costs were set to **3.5% of GDP** annually (your carbon + plastics + biodiversity spend). With those trajectories, the model crosses into **annual net-positive** territory mid-2030s and compounds from there.

Greenhouse gases (GHGs)

Two complementary lenses:

1. **By U.S. demand (consumption-based):** The U.S. typically accounts for the mid-teens share of global CO₂ when you adjust for trade (consumption-based accounting). Our World in Data provides country profiles and trade-adjusted series used by policymakers. In recent years the U.S. hovers around the **~14–16%** range of global CO₂ on a consumption basis (interactive series; see “consumption-based” and “share of global” charts). [Our World in Data](#)
2. **By U.S.-headquartered fossil producers (supplier lens):** The Carbon Majors database attributes emissions to extractors. Investor-owned firms account for ~31% of historical emissions in their dataset; within these, **Chevron, ExxonMobil and (often) ConocoPhillips** are repeatedly singled out among the top contributors. Recent summaries find that a small set of fossil-fuel and cement producers (state-owned + investor-owned) account for **~50–80%** of global fossil CO₂ since 2016; **U.S. investor-owned firms (ExxonMobil, Chevron, ConocoPhillips)** make up a material slice of that total (on the order of a few percentage points of global emissions). Use this as a lower-bound proxy for “U.S. company responsibility” on the supply side. [carbonmajors.org+2Financial Times+2](#)

Takeaway for GHGs: if you need a single working number tied to *U.S. firms and demand combined*, a **teens-percent share of global CO₂** is reasonable for planning, with supplier-side Carbon Majors shares providing corroboration and a named-entity list for compliance allocation. [Our World in Data+1](#)

Plastic waste

- **U.S. generation:** The National Academies concluded the U.S. produces **the most plastic waste of any nation**(and has historically exported substantial volumes to countries with inadequate waste management), underscoring a large U.S. contribution to ocean leakage risk. [National Academies Press+1](#)
- **Brand attribution (company lens):** Global brand audits consistently find **The Coca-Cola Company** (U.S.-headquartered) as the #1 identifiable source of branded plastic litter worldwide, with U.S. peers (e.g., **PepsiCo**), plus non-U.S. multinationals, in the top tier. A 2024 write-up of a Science Advances analysis estimated **~11%** of branded items traced to Coca-Cola alone. These are litter shares, not tonnage shares, but they’re the best public company-level indicators available. [Axios+1](#)

Working proxy: U.S.-headquartered FMCGs (Coke, PepsiCo et al.) are **disproportionately represented** among top global plastic polluters; paired with the U.S.’s **outsized national plastic waste generation**, it’s fair to state that **U.S. companies**

are among the largest single-country corporate contributors to global plastic pollution. [National Academies Press+1](#)

Desertification / biodiversity loss (land-degradation drivers)

Direct company-level “desertification shares” don’t exist, but we can attribute **land-use change risk** (a main precursor to degradation) to U.S. corporate supply chains via deforestation-exposure studies:

- **U.S. import exposure:** Trase’s 2024 analysis quantifies the **deforestation exposure of U.S. direct imports** for seven high-risk commodities (beef, soy, palm, cocoa, coffee, rubber, wood), giving a defensible basis to allocate responsibility to **U.S. importers and their upstream suppliers**. [resources.trase.earth](#)
- **Policy corroboration:** The U.S. government’s 2024 demand-side framework acknowledges U.S. responsibility in imported deforestation and signals regulatory measures—useful scaffolding for compliance allocation to companies. [State Department](#)

Working proxy: Use **deforestation-embodied-in-imports** to assign a **material** U.S. corporate share of land-degradation risk, then translate into your Biodiversity Loss Scalar (BLSF). Trase provides the transaction-level granularity you’d need to apportion costs to specific U.S. firms. [resources.trase.earth](#)

How to turn this into allocatable numbers (practical recipe)

1. **GHGs:**
 - Start with **U.S. consumption-based CO₂ share** (~14–16%) as the top-down anchor for U.S. demand. [Our World in Data](#)
 - Overlay **Carbon Majors** to allocate a **supply-side slice** to U.S.-headquartered producers (ExxonMobil, Chevron, ConocoPhillips, Peabody), ensuring no double counting. [carbonmajors.org+1](#)
2. **Plastics:**
 - Use **U.S. national waste generation** (tonnes) for the country share. [National Academies Press](#)
 - Allocate to companies with **brand-audit weights** (e.g., Coca-Cola 11% of branded litter) normalized against packaging market shares in each region—then link to **PPSF** pricing at the corporate level. [Axios](#)

3. Desertification (via deforestation risk):

- Pull **Trase** import-exposure numbers for each U.S. importer and commodity; convert land-use change to **tCO₂e** and **hectares** restored; price with **BLSF**. resources.trase.earth

Bottom line

- **GHGs:** Expect the U.S. share attributable to American companies (combining U.S. demand + U.S.-HQ producers) to lie in the **mid-teens percent of global CO₂**, with named U.S. producers contributing a **distinct, documented** portion of fossil-fuel emissions on the supply side. [Our World in Data+1](#)
- **Plastics:** The U.S. is the **largest plastic waste generator**, and U.S. consumer-goods firms (Coke, PepsiCo) appear at the **top of global brand-polluter lists**—supporting a **large U.S. corporate share** of plastic leakage risk. [National Academies Press+1](#)
- **Desertification:** Use **deforestation embedded in U.S. imports** as the best proxy; **U.S. buyers of beef/soy/palm/etc.** carry a **material, traceable share** of global land-degradation risk that can be priced via your BLSF.

From *Triple Threat Scalars* and *Extending Scalar Climate Metrics*:

- **Biodiversity Loss Scalar Factor (BLSF):**
 - Defined as the **lifecycle cost per hectare restored**, normalized against the carbon price

Triple Threat Scalars

Extending Scalar Climate Metrics

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- Inputs include CapEx, OpEx, re-treatment cycles (e.g., nanoclay every ~5 years), MRV, and risk premiums

Symbols

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- Example: restoring degraded land with nanoclay + fungi = ~\$2,800/ha-year
→ ~33 tCO₂-equivalent at \$85 carbon price

Triple Threat Scalars

- **Implication:** This doesn't *dictate how* biodiversity is restored. It creates a **translation scalar**, allowing any certified hectare-based project (coral reefs, wetlands, desert soil) to plug into the same carbon-denominated trading framework.

Market Dynamics: “Low Hanging Fruit” First

- By pricing biodiversity rejuvenation through **normalized hectare restoration costs**, the system naturally drives capital toward the **cheapest, highest-impact interventions first**.
- Over time, as **technologies scale and costs fall**, more expensive or technically challenging projects become viable.
- This mirrors the **renewables learning curve**: wind/solar became mainstream once costs dropped below fossil benchmarks.

Government's Role in the New Model

- Governments retain responsibility for **sensitive or high-risk interventions** (e.g., large-scale ocean alkalization, geoengineering pilots).
- But — unlike carbon taxes where **80%+ of revenues vanish into general budgets** — under GHG-PATS, **a much higher share of funds flow directly into verifiable habitat rejuvenation and offset markets**

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- Governments become **stewards of edge-case projects**, not the primary allocator of climate revenues.

The Unifying Market Vehicle

- Carbon (via GWP), plastics (via PPSF), and biodiversity (via BLSF) are scalarized into **carbon-equivalent terms**.
- This creates a **fungible derivative market** where offsets and allowances are interchangeable, stable, and liquid.
- Crucially: **biodiversity restoration enters carbon markets for the first time** as a priced, tradable unit — no longer sidelined as a “co-benefit.”

Climate Finance Integration with Scalars

1. Financing Negative Externalities

- **Mechanism:**
 - Polluters receive short environmental derivative contracts (obligations).
 - These must be covered by purchasing long carbon-equivalent contracts (via scalars).
 - The financing of these longs = the source of capital for biodiversity restoration, plastic remediation, and decarbonization.
 - **Actors:**
 - **Private bank Climate Finance divisions:** structure off-balance sheet vehicles, securitize flows.
 - **Supnationals (IMF, World Bank, regional banks):** provide first-loss guarantees, reduce sovereign and credit risk.
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2. Hedged IRR as the Driver of Adoption

- **Hedged Projects:**
 - Each funded project has both a **cash outflow (CapEx/OpEx)** and a **carbon- or biodiversity-linked derivative hedge** that ensures a positive expected IRR.
 - High-productivity projects (cheap interventions with big externality reduction) rise to the top of the allocation stack — “low hanging fruit.”
 - **Dynamic Innovation:**
 - As technology advances, the IRR of more marginal projects improves.
 - These projects enter the investable set once replication costs fall relative to carbon forward curves.
 - Examples: enzymatic plastics degradation, nanoclay soil treatment, advanced carbon capture.
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3. Accounting Treatment

- **Off-balance sheet:** Structured as environmental derivative contracts, positions can sit in **Other Comprehensive Income (OCI)**, not as immediate P&L drains.
- **Cash neutrality:** Projects are self-funding through matched hedges; no ongoing drag on corporate cashflow.
- **Positive realization:** Over time, as externalities are internalized and market liquidity increases, these hedges deliver **positive IRR** into realized income.

4. Why It Accelerates the Transition

- **Liquidity + Hedging:** The derivative backbone reduces volatility in carbon-equivalent pricing, making capital deployment predictable.
- **Capital Recycling:** Banks and supranationals recycle repayments into new offsets, scaling flows far beyond grant-based models.
- **Market Discipline:** Projects must clear a market-defined IRR hurdle, ensuring efficient allocation.
- **Political Acceptance:** Unlike taxes, this is framed as a **market-financed, profit-seeking system** that grows balance sheets while repairing the planet.

Unified Compliance Market (Article 6.4) — Finance & Operations Snapshot

What this is

A **global compliance carbon market** (Article 6.4-aligned) that uses existing **risk-management and banking plumbing** to enforce the **Polluter Pays Principle**—just like the **EU ETS, China, and California**—and extends it to **plastics** and **biodiversity** via scalars so everything clears in **carbon-equivalent** units.

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Triple Threat Scalars

Why a compliance market (not voluntary)

- **Level playing field:** Even firms publicly favoring a carbon tax (e.g., Exxon since 2009) cannot move unilaterally without losing competitiveness; compliance coverage is the remedy.
- **Revenue fidelity:** Unlike general taxes, **allowance/offset** flows are **earmarked** to fund certified decarbonization, plastic remediation, and habitat rejuvenation under standardized MRV.

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How it's metered

- **GHGs:** Measured and attributed by facility/type using satellite + AI (e.g., **Climate TRACE**) to create auditable emissions ledgers.

UNFCCC - Article 6.4 Mechanism

- **Plastics:** Priced via **PPSF** = lifecycle \$/t (mechanical/chemical/enzymatic vs. landfill baseline) ÷ carbon price. Lowest compliant track sets the scalar.

Triple Threat Scalars

Symbols

- **Biodiversity:** Priced via **BLSF** = lifecycle \$/hectare (e.g., nanoclay + mycorrhiza + MRV + persistence) ÷ carbon price. **Hectares restored** is the unit; methods are **not** prescribed—innovation wins.

Triple Threat Scalars

Symbols

Order-of-magnitude economics

- **Carbon proceeds** at \$85/t on ~37 GtCO₂ ≈ **\$3.15T/yr**.

Triple Threat Scalars

- **Plastics remediation:** realistic **\$20–40B/yr** at global scale.

Triple Threat Scalars

- **Biodiversity rejuvenation:** **\$200–700B/yr** initial tranche (e.g., ~100M ha/yr).

Triple Threat Scalars

- **All-in envelope:** ~**\$3.4–\$4.0T/yr** (≈ 3–4% of world GDP)—well within macro precedent and **less than the cost of inaction**.

Triple Threat Scalars

Capital & hedging stack (why this accelerates)

- **Polluter obligation** → **financed long**: Short environmental derivative (obligation) must be covered by **purchasing long carbon-equivalent** contracts (GWP/PPSF/BLSF).
- **Climate-finance desks + supranationals** (IMF, World Bank, MDBs) provide term funding, credit wraps, and structured risk transfer.
- **Hedged IRR discipline**: Projects must pencil with **hedges against allowance/offset price paths**, so capital **prioritizes the “low-hanging fruit”** first; as tech costs fall, more projects clear the IRR hurdle.
- **Accounting**: Structures can be **off-balance sheet (OCI)** until realization; **no cash drain**, positive IRR at settlement. (Framework detail in your scalars pack.)

Triple Threat Scalars

Symbols

Why this mitigates the Triple Planetary Threat

- **Price embeds externalities:** Fuel demand falls as **negative externalities are priced in**; firms hedge/finance **transition upgrades**.
- **Plastics go circular:** Dedicated funding closes the loop (capture → sort → mechanical/chemical/enzymatic), using PPSF to pick the **cheapest compliant** route.

Triple Threat Scalars

- **Habitats rebound first where cheapest:** BLSF channels capital to **high-impact/low-cost hectares** (reefs, wetlands, arid lands), with standardized MRV and periodic persistence refresh.

Triple Threat Scalars

Symbols

Governance in one page

- **Annual scalar recalibration** (with mid-cycle tech-shock triggers) from verified cost data + carbon forward curves; **median rule** for robustness.
- **Outcome MRV:** vegetation cover, soil/water metrics, plastics diverted; **persistence tables** (e.g., nanoclay ~5-year re-treat).

Triple Threat Scalars

Symbols

- **Public finance focus:** Governments retain **sensitive wedges** (e.g., ocean alkalinity pilots), but a **smaller share** of proceeds is diverted to general budgets; most flows **reach projects**.

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