Provenance

Carbon-credit MRV software with credentialed verifier services — satellite + IoT measurement, defensible audit trails. Honest framing: the software is the easy part; the moat is credentialed humans.

Category	Set 3 · Post-AI Plays
Customer	Project developers (forest carbon, agricultural soil carbon, methane abatement), Verification & Validation Bodies (VVBs), corporate offset buyers needing higher-confidence credits
Monetisation	$15k–80k/year per-project SaaS subscription · $0.30–1.50 per verified credit · $25k–250k per-project verification engagement
Build effort	High
Plan version	v1.0 — 2026-05

Executive Summary

Provenance is a measurement-reporting-verification (MRV) software platform for the voluntary carbon market, paired with credentialed verifier services. The voluntary carbon market is in a credibility crisis — multiple Guardian / SourceMaterial investigations through 2023-2025 documented that a substantial fraction of issued credits (particularly REDD+ forest credits) represent no real additional emissions reduction. Serious corporate buyers (Microsoft, Google, Stripe, Frontier consortium) have begun demanding much higher MRV standards before purchasing, and Verra / Gold Standard / ACR are rolling out tighter methodology requirements. The software-and-services gap to deliver on these standards is large.

Provenance combines: (1) software for project developers to manage geospatial project boundaries, ingest satellite imagery (Sentinel + Landsat free; Planet + Maxar paid where needed), integrate IoT sensor feeds, run methodology-specific calculation engines, and produce cryptographically-signed audit trails; (2) services from credentialed verification officers (typically retired ISO accreditation auditors or experienced VVB staff) who can sign verification reports the major registries will accept.

Year-1 target: 24 active project subscriptions + 8 verification engagements + foundational software platform, generating $1.4M revenue against $2.8M in costs (deep first-year investment in software build + credentialed-team recruitment + registry relationships). This is explicitly a longer-payback business than the other Set-3 plans — break-even targeted in year 3, with significant scaling potential thereafter. The honest assessment from our prior analysis stands: software is necessary but not sufficient; the business depends critically on assembling a credentialed verification team that buyers and registries trust.

The Problem

The voluntary carbon market is in crisis. Through 2023-2025, sustained investigative journalism has documented that a substantial fraction of issued carbon credits — particularly forest-protection (REDD+) credits but also some agricultural and methane-abatement credits — represent significantly less real climate benefit than their nominal one-tonne-CO2e claim. The proportion varies by methodology and study but the headline finding is robust: many credits are over-credited (the baseline against which 'reduction' was measured was inflated) or non-additional (the reduction would have happened anyway).

Corporate buyers have responded. Microsoft, Google, Stripe, Shopify, and the Frontier consortium are now demanding substantially higher MRV evidence before purchasing credits at scale — direct satellite-imagery-based measurement, IoT sensor data, transparent calculation methodologies, third-party verification with traceable methodology. The registries (Verra VCS, Gold Standard, ACR, Plan Vivo) are tightening methodology requirements in response. The result is a substantial software-and-services capability gap that the existing market is not yet supplying.

Project developers (the entities that develop forest-protection or soil-carbon or methane-abatement projects, then sell credits) are in the middle. They need MRV software that delivers the rigorous evidence buyers now demand, plus access to credentialed verification officers who can produce reports the registries will accept. Current options are either bespoke (Pachama, Sylvera at high-end pricing $200k+ per project) or thin (basic GIS tools + manual verification).

The middle-market segment — project developers operating $1M-15M annual credit-revenue projects who need defensible MRV but cannot afford bespoke high-end services — is the gap Provenance addresses.

The Solution

Provenance has two interlocking offerings. Offering 1: Project Developer SaaS ($15k-80k/year/project depending on scale and complexity). Software for managing project geometry (boundary versioning, leakage-zone modelling), ingesting satellite imagery automatically (Sentinel-2 + Landsat from Microsoft Planetary Computer free tier; Planet + Maxar high-resolution as paid add-ons), running methodology-specific calculation engines (initially supporting Verra VCS methodologies for afforestation/reforestation, improved forest management, and soil carbon; expanding to more methodologies in year 2-3), integrating IoT sensor feeds, producing cryptographically-signed audit trails of all measurements and calculations.

Offering 2: Verification Services ($25k-250k per project verification engagement, depending on project scale). A team of credentialed verification officers (retired ISO-certification auditors, experienced VVB staff, qualified forestry/agricultural professionals) provides verification reports that registries will accept. The verification engagement uses the Provenance software as the evidence base, validates the methodology application, conducts site visits where required, and produces signed reports. The verification officer professional indemnity is on the line for the report's accuracy.

The two offerings are interlocking. Project developers using Provenance SaaS have substantially smoother verification engagements (the evidence is already structured the way verifiers need it). Verification officers using Provenance SaaS to conduct engagements have substantially lower per-engagement labour cost. And the integrated combination produces audit trails of significantly higher quality than the ad-hoc spreadsheet-and-PDF baseline of the current market.

Three structural differences from existing players define the wedge. First, integrated software + credentialed services (Pachama and Sylvera are software-only; verifiers like SCS Global Services and EarthCheck are services-only). Second, transparent methodology and audit trails — every measurement, every calculation, every assumption is queryable and exportable. Third, middle-market pricing — $50k-300k per project total cost vs. $200k-800k for bespoke high-end alternatives.

Market Opportunity

Voluntary carbon market 2026 issuance: estimated 240-340 million credits across ~2,800 active projects globally. At an average $12-18 per credit, market size: $3-6 billion. Forecast growth: 30-45% per year through 2030 driven by corporate Net Zero commitments, despite the credibility crisis.

Addressable project-developer market: ~1,400 active project developers globally, of whom ~800-1,200 operate projects with $1M+ annual credit revenue (the segment that can afford serious MRV investment). At $35k average annual SaaS spend per project, the SaaS market is ~$30-45M growing at 35%+ annually.

Addressable verification-services market: ~$220M annually globally, growing similarly. Provenance's share opportunity (mid-market segment, integrated SaaS + services positioning): realistic 5-year capture of 3-5% of combined addressable = $8-15M ARR.

Adjacent opportunities: corporate-buyer-side credit quality assessment (sold to Microsoft / Google / Stripe / Frontier-style buyers as 'help us evaluate the quality of credits we're considering buying'), registry-tooling (sold to Verra / Gold Standard / ACR for their internal review workflows), insurance product for credit-quality-failure risk.

Target Customer

Primary persona: a 44-year-old technical director at a mid-size carbon project developer running 4 active REDD+ and improved-forest-management projects across Brazil and Colombia generating ~$8M annual credit revenue. Currently uses bespoke GIS tools + spreadsheet calculations + project-by-project verification contracts. Will pay $48k/year for Provenance SaaS subscription across 4 projects + engage Provenance verification services on each project's annual verification (~$140k/year total Provenance spend).

Secondary persona: a 51-year-old founder of an agricultural-soil-carbon project developer with 35 enrolled farms in the US Midwest. Project structure requires sample-based soil-carbon measurement with model-based extrapolation, periodic on-farm verification. Will pay $32k/year SaaS + $60k/year verification engagement.

Tertiary persona: a 38-year-old sustainability lead at a Fortune 500 buyer (food/CPG industry) that wants to source higher-quality credits and is willing to pay a premium for verified provenance. Will pay $80k/year for buyer-side platform access to evaluate credit portfolios pre-purchase.

Product

Project geometry management: KML / Shapefile / GeoJSON boundary ingestion, versioning with audit trail, leakage-zone configuration, baseline-plot definition, control-area selection.

Satellite imagery pipeline: automated Sentinel-2 (10m resolution, every 5 days) + Landsat-8/9 (30m, every 16 days) ingestion via Microsoft Planetary Computer (zero cost). NDVI/EVI time-series analysis. Forest-cover change detection against Hansen baseline + project-specific baselines. Optional high-resolution (Planet 3m daily, Maxar 30cm) as paid add-on for projects requiring it (~$8k-40k/year additional per project depending on coverage).

Biomass / carbon stock calculation: methodology-specific calculation engines implementing Verra VCS VM0007 (REDD+), VM0009 (REDD+ avoided unplanned deforestation), VM0017 (soil carbon), VM0042 (improved agricultural land management), Gold Standard A/R methodologies. Each engine encodes the methodology's equations, assumption requirements, sampling rules, uncertainty calculations.

IoT sensor integration: API endpoints for receiving sensor data (soil moisture, soil temperature, gas-flux measurements, water-flow rate for methane projects), with provenance metadata for each measurement.

Audit trail and reporting: cryptographically-signed (Ed25519) timestamped log of every measurement, every calculation, every model parameter. Tamper-evident. Exportable as PDF audit report or structured JSON for registry submission.

Verifier-facing workflow: dedicated verifier interface for reviewing project evidence, raising queries, approving / rejecting measurements, producing verification report with traceability back to source evidence.

Registry integration (year 2): direct API submission to Verra, Gold Standard, ACR registries for credit issuance request (currently mostly manual; registries are slowly opening APIs).

Technical Architecture

Frontend: Next.js + Tailwind + Mapbox / Leaflet for geospatial visualisation, custom React components for evidence-browsing and methodology-walking.

Backend: Python services on AWS (S3 for satellite imagery cache, Lambda for batch processing, RDS Postgres + PostGIS for project data, EKS for orchestration).

Satellite processing: Python + Rasterio + GeoPandas for processing imagery. Microsoft Planetary Computer (Sentinel-2 + Landsat free) as primary source. Optional paid integrations with Planet and Maxar APIs.

Calculation engines: methodology-specific Python modules, validated against published Verra / Gold Standard / ACR worked examples, unit-tested against known-correct outputs.

Cryptographic audit: Ed25519 signed log entries, Merkle-tree-anchored periodic root publication to a public blockchain (Ethereum L2 like Polygon) for tamper-evidence without on-chain transaction cost.

Compliance: SOC2 Type II from year 1 (table-stakes for selling into enterprise carbon-buyer market), data residency consideration per region for projects with regulatory restrictions.

Business Model & Unit Economics

Two revenue streams. SaaS: per-project subscription, $15k-80k/year depending on project scale, complexity, and add-on data sources. Verification services: per-engagement, $25k-250k depending on project scale and depth (annual recurring engagements).

Typical mid-market customer: $48k SaaS + $90k verification services = $138k/year. Lifetime: 5-10 years (projects run on multi-decade horizons but Provenance customer relationship has typical contract renewal risk).

Costs: heavy in year 1 (software build + credentialed-team recruitment + registry relationships + satellite-data acquisition). Year 2-3 costs stabilise as software matures and team scales. Year 3+ economics: ~52% gross margin on SaaS, ~38% on services (services-heavy revenue mix dilutes margin).

Capital required: this is the most capital-intensive of the Set-3 plays. $4-6M to fund the first 24 months to break-even, with another $4-8M for year-3 scaling investment.

Unit Economics (Year-1 base case)

Year-1 active SaaS projects (target)	24
Year-1 verification engagements	8
Year-1 revenue	$1.4 million
Year-1 all-in costs	$2.8 million
Year-1 net contribution	-$1.4 million (investment year)
Year-3 target SaaS projects	120
Year-3 target revenue	$8.5 million
Year-3 net contribution target	$1.8 million (break-even year)

Go-to-Market

Channel 1 — Direct outreach to mid-market project developers (40%): targeted outreach to 200 identified project developers running $1M-15M annual credit revenue. Long sales cycles (3-9 months) given the buying-committee complexity and the verification-officer credentialing requirements.

Channel 2 — Registry partnerships (25%): partnerships with Verra, Gold Standard, ACR for being listed as approved tooling and approved verification body. Months of regulatory + relationship work to establish.

Channel 3 — Corporate buyer partnerships (20%): partnerships with Microsoft / Google / Stripe / Frontier-style buyers who can recommend or require Provenance-style MRV from their suppliers. Buyer-mandated MRV is a strong distribution channel.

Channel 4 — Conference + industry presence (15%): Climate Week, COP-adjacent events, North American Carbon World, Carbon Forward — substantive presence at industry events for credibility and relationship building.

Roadmap (first 12 months)

- Month 1-4: Foundational software build — geospatial project management + Sentinel/Landsat pipeline + first 3 methodology engines (Verra VM0007, VM0017, GS A/R), recruit founding verification officer team (3 senior, 4 junior), establish initial Verra relationship.

- Month 5-7: First 8 project pilots (paying SaaS), software v1 launched, first verification engagement delivered.
- Month 8-9: Cryptographic audit-trail capability operational, scale to 16 SaaS projects, 4 verification engagements completed.
- Month 10-11: Additional methodology engines (VM0042, VM0009), IoT-sensor integration capability, scale to 22 SaaS projects.
- Month 12: 24 SaaS projects + 8 cumulative verification engagements, $1.4M annualised revenue, foundation for year 2 scaling.

Key Risks

- Verification-officer credentialing: trust in the verification report depends entirely on the credibility of the signing officer; recruitment of senior officers is slow and competitive — mitigated by structured recruitment from retiring VVB staff and ISO-certification auditors (a definable pool), by ESOP and senior-role recognition, and by partnership with existing VVBs to use their senior officers on Provenance engagements until Provenance team scales.
- Methodology rules continually changing: Verra, Gold Standard, ACR are tightening rules through 2025-2027 in response to the credibility crisis; software must keep pace — partially a feature, partially a risk; mitigated by dedicated methodology team (2 senior staff full-time) responsible for tracking and implementing rule changes.
- Capital intensity: the business is structurally cash-intensive in years 1-2; raising follow-on capital depends on demonstrating credible progress — mitigated by carefully calibrated milestone-based funding plan, by intermediate-revenue verification engagements that demonstrate the model works, and by accepting that this is a longer-payback business than the other Set-3 plays.
- Carbon market itself contracting: if buyers' confidence collapses sufficiently, the entire voluntary carbon market shrinks rather than scaling — meaningful tail risk; partially counter-mitigated by the fact that demand for high-quality MRV grows as market contracts (because surviving buyers want only verified credits) but the absolute revenue ceiling moves down.
- Liability if Provenance-verified credits later prove non-additional: substantial reputational and legal exposure — mitigated by professional indemnity insurance ($10-25M coverage), by methodology-fidelity audit trails that demonstrate Provenance applied rules correctly even if rules themselves were flawed, by transparent ongoing publication of project performance against forecasts.