

LuaZero

Field evidence for low-emission rice

Software proof of concept and proposed Vietnam validation plan. Prepared for Net Zero Challenge 2026, Food Systems & Sustainable Agriculture. 7 September 2026.

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What works today

An interactive scenario calculator, editable synthetic water-log example, missing/conflicting/uncertain evidence review, and downloadable calculation and evidence reports. All sample field records are synthetic.

What the pilot must establish

Actual satellite coverage and local calibration; agreement with ground observations; reporting effort and farmer participation; credible recurring costs; and an evidence package suitable for independent pre-assessment. Zalo integration and real Sentinel-1 processing remain planned.

Why Vietnam

The one-million-hectare low-emission rice programme offers a concrete setting for testing cooperative reporting workflows. The World Bank reports a TCAF commitment of up to USD 40 million for programme carbon purchases. This is programme context, not funding awarded to LuaZero or a payment guarantee.

Readiness and ownership

The team confirms no institutional funding, revenue or signed pilot partner, and confirms control of rights to use the code. The integrated technology remains a proof of concept. No certification, patent, field-accuracy result or institutional endorsement is claimed.

Live demo, no login required: www.luazero.online. Supporting materials: [LuaZero evidence folder](#).

A transparent scenario

Calculation walkthrough, not verified impact. The organic-amendment assumption materially affects the result.

Parameter	Default
Area / season / annual repetition	50 ha / 95 days / 2 identical seasons
Country / water / pre-season factors	1.13 kg CH ₄ /ha/day / 1.00 to 0.55 / 1.00
Organic amendment factor	2.88; 5 t/ha straw incorporated shortly before planting
Baseline / project nitrogen	100 / 100 kg N per ha
Other emissions / GWP	0 assumed; CH ₄ 28, N ₂ O 265
Uncertainty / SOC adjustment	15% / 5%

Calculation for 50 hectares	tCO ₂ e
Gross methane reduction	194.775840
Less: estimated N ₂ O (deducted in full)	4.160500
Balance before deductions	190.615340
Less: 15% uncertainty	28.592301
Less: 5% SOC adjustment	8.101152
Final seasonal scenario	153.921887
Per hectare, per season	3.078438

Two identical seasons produce an illustrative 307.843774 tCO₂e for 50 ha. At an assumed USD 10/t, gross value is USD 3,078.44 before costs, allocation and eligibility review. At 300 ha and two seasons, the same illustration is 1,847.06 tCO₂e.

N₂O is retained in full; no automatic de-minimis exclusion is claimed. The increased-nitrogen branch uses 0.00786 kg N₂O/kg project N. Other emissions are user inputs. Negative balances remain negative with zero gross value. Actual seasons and strata require separate calculations.

Evidence before claims

The example contains 12 synthetic weeks. Nine are aligned; week 6 has no observation, week 7 conflicts with the farmer log, and week 10 is below a synthetic 80% confidence threshold. These three records remain held for human review.

The review flow

A user changes a demo farmer entry. The original observation remains intact. The report exports the original/updated value and time of the edit. “Aligned” means only that the two sample records agree; it cannot certify a field or authorize credit issuance.

Proposed validation measures

Measure	Proposed target / approach
Held-out water-state classification	Balanced accuracy $\geq 85\%$; confusion matrix, class precision/recall and confidence intervals
Observation coverage	$\geq 70\%$ of required windows; retain missing observations in denominator
Field separation	Hold out fields and season two; freeze model before evaluation
Emission comparison	Investigate differences $> 20\%$ where reference reductions are above zero; otherwise use absolute error
Farmer participation	$\geq 70\%$ of plots log in 10 of 12 weeks; drop-off $< 20\%$ between seasons
Agronomic safeguards	Local professional oversight; yield, residue and safe water-level monitoring

Satellite limitations

Acquisition gaps, crop canopy, mixed pixels, small parcels and crop-stage effects require local calibration. Radar is not a direct methane measurement and cannot independently confirm every short drainage period. Conflict resolution uses ground evidence and human review.

Revisit sets a ceiling before any classifier is involved. On a 12-day repeat, a single satellite catches a 3-day drainage roughly 25% of the time; the 6-day two-satellite pair reaches about 50%. A planned 7-10 day dry-down is usually observable, a short or partial one often is not. These are published orbit characteristics worked through, not a measured detection rate.

The 20 loggers are a planning allowance, not a statistical power calculation. A research collaborator must set placement, sampling frequency, appropriate replication and data-quality criteria.

Vietnam pilot and budget

200-300 unique hectares; one or two cooperatives; two crop seasons; nine months from partner/crop-calendar readiness. At the 300-ha target the effort covers 600 hectare-seasons. No location or partner is secured.

Window	Planned work
M1-2	Partner agreements, data consent, mapping, local reporting and 20 installed loggers
M3-5	Season-one field records, actual satellite processing and reference measurements
M6-8	Season-two held-out evaluation, farmer adoption and cost tracking
M9	Independent pre-assessment, buyer renewal decision and go/no-go

Planning allowance	USD
Reference measurements	12,000
Verifier pre-assessment	8,000
Field coordination	9,000
Travel / in-country work	6,000
Legal and data compliance	5,000
Farmer training / onboarding	4,000
Twenty installed loggers	3,000
Cloud / processing	2,500
Contingency	5,500
TOTAL	55,000

Base USD 49,500; contingency 11.1% of base. All figures are allowances, not quotes. Founder time is in-kind. Full research cost is USD 91.67/ha-season at 600 hectare-seasons, before founder replacement cost. The separate recurring delivery-cost target below USD 5/ha-season applies to future scale.

Commercial test and sources

The intended payer is a cooperative, exporter or project developer. Test willingness to pay USD 3-6 per hectare per season and the measured cost of field assistance. At a conditional 50,000 ha and two seasons, this implies USD 300,000-600,000 annual service revenue; it is not current revenue or a forecast.

Competition and positioning

Manual field reporting, project developers and established providers such as Regrow are credible alternatives. LuaZero will test a narrower cooperative evidence workflow, transparent exceptions and local usability. Its proposed advantages are hypotheses until measured.

Deployment conditions

A Vietnamese collaborator must review national MRV, programme payments and voluntary certification separately, including data rights, claim ownership and applicable authorisations. Local counsel must review the carbon-market framework and personal-data law. A pre-assessment is not certification. No partner means the deployment gate is not met.

Primary sources and detailed notes

Gold Standard rice methodology

SOC rule update, July 2025

World Bank Vietnam programme context

IRRI regional MRV analysis, April 2026

Regrow rice programme, March 2026

Full methodology walkthrough

Source and claim register