

Niger Delta Gas Flaring

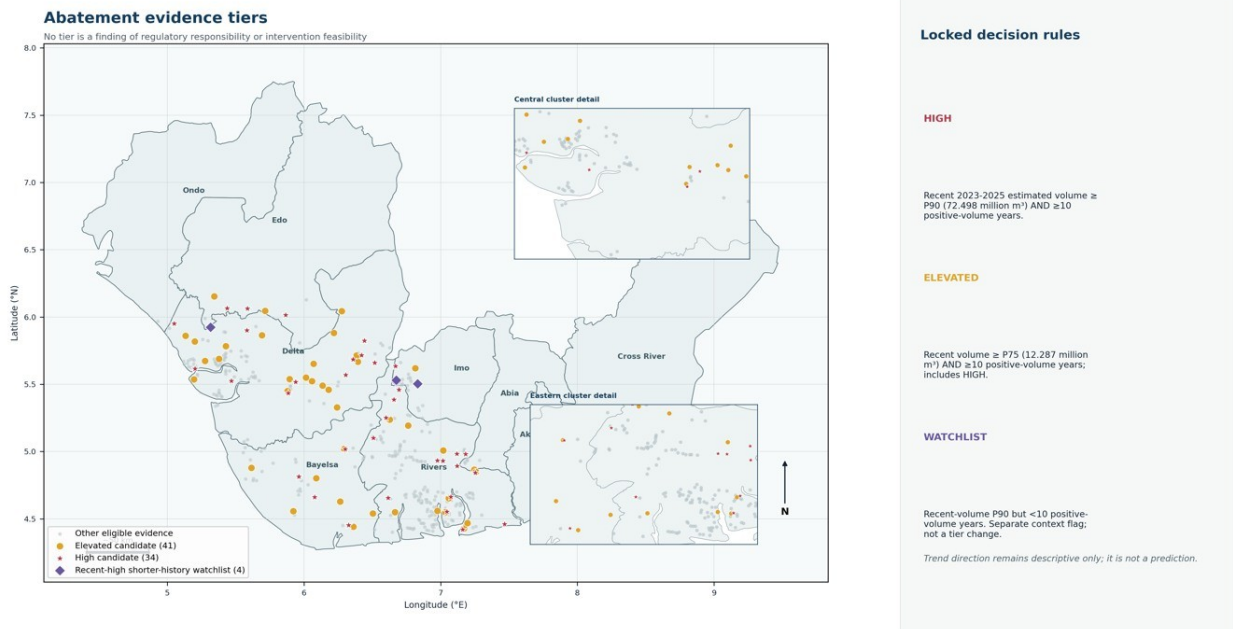
Evidence-led abatement and environmental-monitoring screening, 2012-2025

Final scientific cartography and integrated report | Stage 04 | 10 October 2026

ND_GF_03

Evidence-Led Abatement Priorities

Locked Stage 03A tiers | recent volume and recurrence gates, with a separate short-history watchlist



Executive findings

- The locked inventory contains 372 confirmed nine-state onshore sites. Offshore screening candidates (70), source/spatial conflicts (33), and one other Nigerian onshore site remain analytically separate.
- The locked Stage 03A rules identify 34 HIGH and 41 ELEVATED abatement candidates. Four sites meet the recent-volume P90 threshold but have fewer than 10 positive-volume years; they are retained as a separate watchlist, not re-tiered.
- Environmental-monitoring results remain independent: 24 community-monitoring candidates use 2020 GHSL population context; 7 ecosystem-monitoring candidates use 2021 ESA WorldCover mangrove context. These values are not measures of exposure, health effect, or damage.

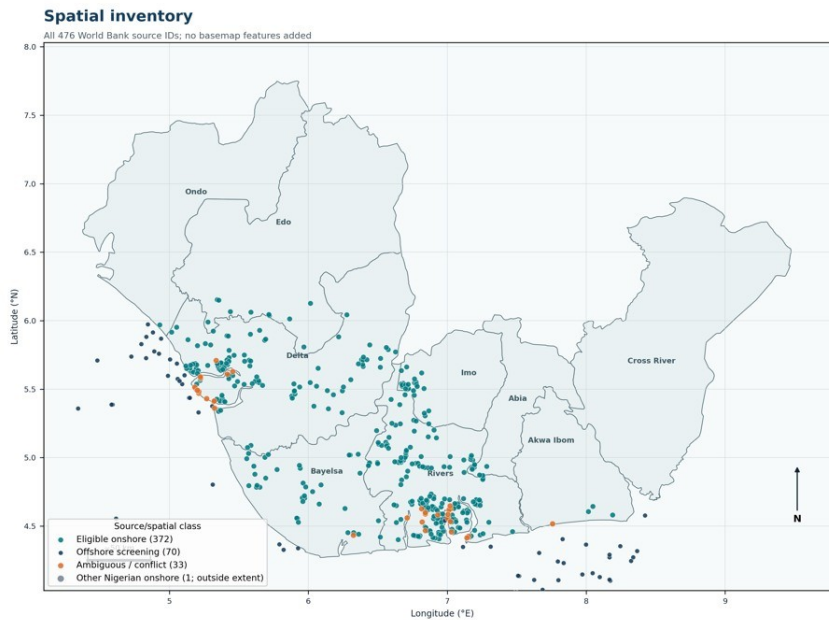
1. Objective and study area

This report presents transparent site-level screening outputs to guide evidence-based investigation of gas-flaring abatement and environmental monitoring across Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers States. The cartography uses supplied validated ADM1 geometry in WGS 84 geographic coordinates; no basemap features were added.

ND_GF_01

Regional Flare Inventory and Evidence Eligibility

Niger Delta study region | analytical populations are separated before priority assessment



Eligibility ledger

372 confirmed nine-state onshore

Included in locked Stage 03A

70 offshore screening

Excluded from onshore analysis

33 ambiguous / conflicting

Excluded; retain for QA

1 other Nigerian onshore

Outside nine-state region

Off-frame source record

s_38320 (7.188729°E, 10.140916°N) is the one other Nigerian onshore site. It is outside this regional display extent, remains in the ledger, and is not plotted on-map.

Categories remain separate. Symbol overlap reflects co-located source points, not merged records.

ND_GF_01 | WGS 84 geographic coordinates (EPSG:4326) | Sources: World Bank GGFR (2026); geoboundaries gtoOpen NGA ADM1 (2022); locked Stage 00B-03A results.

Inventory and eligibility

2. Inventory and eligibility

The World Bank Global Gas Flaring Tracker individual-location inventory supplies source coordinates and satellite-derived estimated flare volumes for 2012-2025. Catalogue presence is distinct from positive estimated flaring; reported zero estimates are retained as zeros, not converted to missing values or interpreted as verified flare elimination. The sole other Nigerian onshore source record, s_38320 (7.188729°E, 10.140916°N), is outside the regional map extent and is identified in the Map 01 ledger rather than displaced or reclassified.

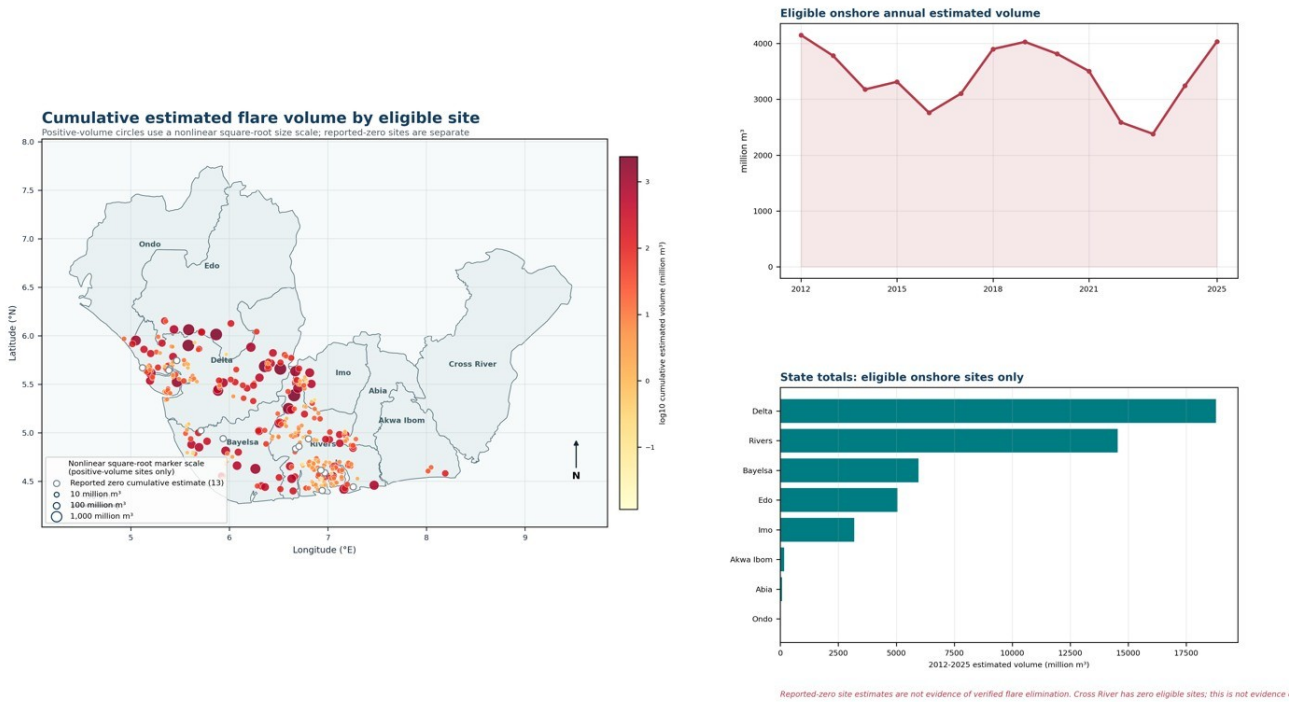
Class	Sites	Analytical treatment
Confirmed nine-state onshore	372	Included
Offshore screening	70	Excluded from onshore analysis
Ambiguous / source-spatial conflict	33	Excluded from state totals
Other Nigerian onshore	1	Outside nine-state region

3. Historical flaring evidence, 2012-2025

ND_GF_02

Historical Flaring Distribution and State Trends

Eligible onshore evidence, 2012-2025 | estimated flare volume is not a measured emission



ND_GF_02 | WGS 84 geographic coordinates (EPSG:4326) | Sources: World Bank GFR (2026); geoboundaries gboOpen NGA ADM1 (2022); locked Stage 00B-03A results.

Site circles and state totals are not interchangeable

Map 02 uses a nonlinear square-root marker-size scale for positive cumulative estimated volumes, with a fixed minimum marker area for legibility; marker area is not proportional to volume. The 13 sites with reported zero cumulative estimated volume are plotted as a distinct hollow-symbol category and are not assigned an artificial positive colour value. Reported zero estimates do not establish verified flare elimination. State totals summarize eligible site-level estimated volumes only; they must not be interpreted as a count of continuous flaring or as measured emissions. Cross River has zero eligible sites in this inventory, which does not establish absence of flaring.

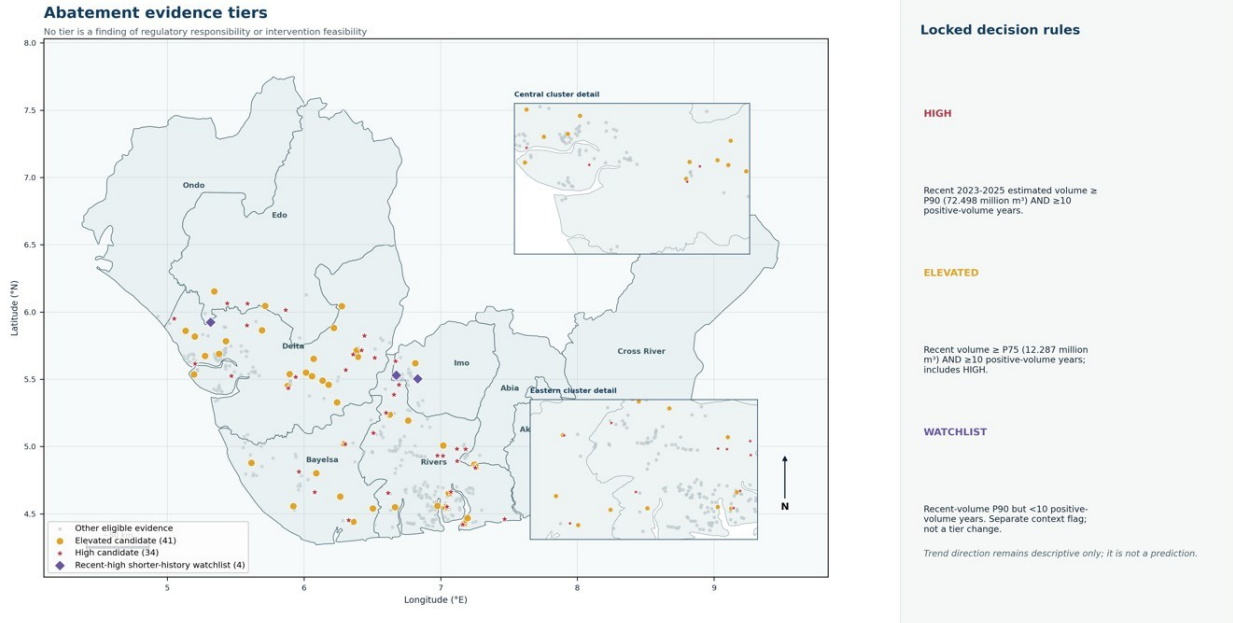
State	Eligible sites	Cumulative estimated volume (million m³)
Delta	116	18,778.16
Rivers	170	14,539.06
Bayelsa	38	5,957.69
Edo	10	5,056.04
Imo	26	3,191.99
Akwa Ibom	3	173.38
Abia	8	71.49
Ondo	1	16.95

4. Abatement-priority assessment

ND_GF_03

Evidence-Led Abatement Priorities

Locked Stage 03A tiers | recent volume and recurrence gates, with a separate short-history watchlist



ND_GF_03 | WGS 84 geographic coordinates (EPSG:4326) | Sources: World Bank GGR (2026); geoboundaries gboOpen NGA ADM1 (2022); locked Stage 00B-03A results.

P90 / P75 threshold gates and ≥ 10 positive-volume-year recurrence

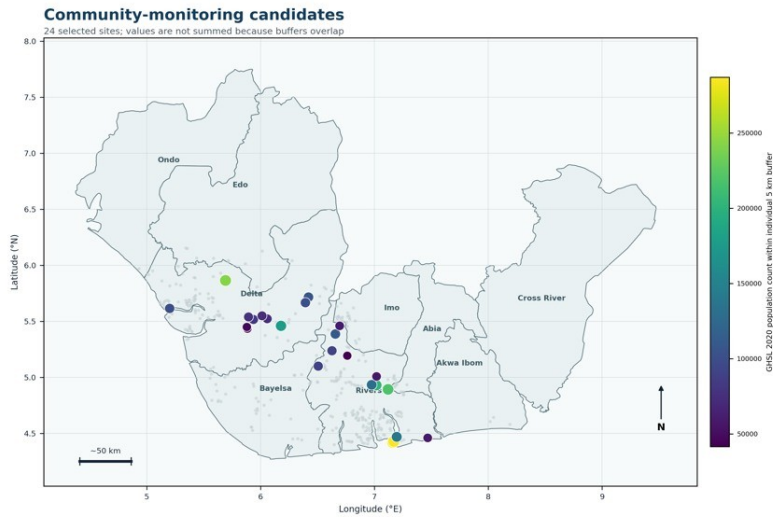
The approach uses rule-based evidence, not a weighted prediction score. HIGH requires recent 2023-2025 estimated volume at or above the eligible-site P90 (72.498 million m^3) plus at least 10 positive-volume years. ELEVATED requires the P75 recent-volume threshold (12.287 million m^3) plus the same persistence gate. Trend direction is descriptive and does not claim future performance.

5. Independent environmental-monitoring context

ND_GF_04

Community-Monitoring Screening

Independent screening shortlist | GHSL 2020 modelled population context in each individual 5 km buffer



How to read this map

Selection applies the locked flare-evidence gate (recent volume ≥ 0.75 and ≥ 10 positive-volume years) plus population context ≥ 0.75 (39,298 people). GHSL values are modelled 2020 population counts per native grid cell, summed within each individual geodesic 5 km buffer.

Critical limit

Overlapping buffers must not be summed as unique people, and the context does not measure exposure or health effects.

Context year: 2020

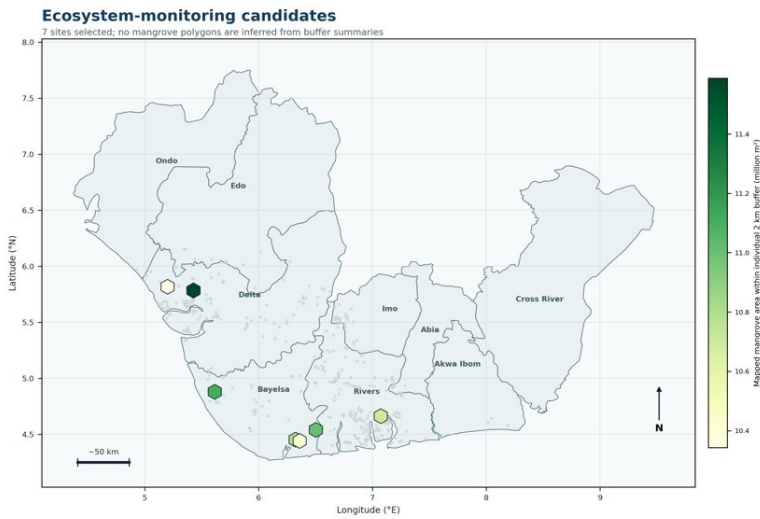
ND_GF_04 | WGS 84 geographic coordinates (EPSG:4326) | Sources: World Bank GPR (2026); geoboundaries gbOpen NGA ADM1 (2022); locked Stage 00B-03A results.

GHSL P2023A | Population count, not population density

Community screening uses GHSL P2023A 2020 population_count summed at native grid scale within each individual 5 km geodesic buffer. The Stage 02B correction replaced seven -200 NoData-affected pilot outputs with corrected native-grid results; all 372 integrated sites now have valid non-negative population values. Overlapping buffers are not summed as unique people.

Mangrove-Monitoring Screening

Independent, threshold-sensitive shortlist | ESA WorldCover 2021 class-95 mapped context in each 2 km buffer



How to read this map

Selection applies the locked flare-evidence gate (recent volume $\geq$ P75 and $\pm$ 10 positive-volume years) plus mapped mangrove area $\geq$ P75 (10,187 million m²). Area is calculated by pixel-area weighting from ESA WorldCover v200 class 95 in each individual geodesic 2 km buffer.

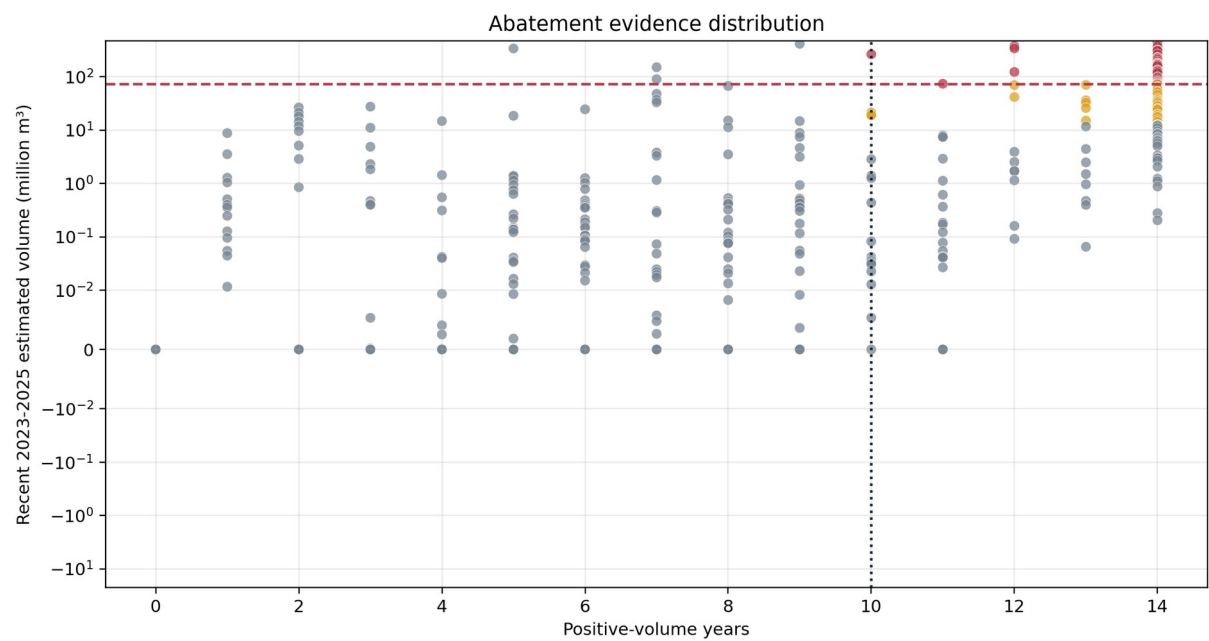
Threshold sensitivity

The shortlist is weakly stable: a strict P90 context rule retains 1 site; strict flare-and-context selection retains 0. This is a screening cue, not mapped habitat damage.

Context year: 2021

Ecosystem screening uses ESA WorldCover v200 (2021), class 95, pixel-area-weighted within each individual 2 km buffer. It does not map mangrove polygons or establish damage. The ecosystem shortlist is threshold-sensitive: strict P90 context retains one site and strict flare-and-context selection retains none.

6. Sensitivity, interpretation and limitations



Sensitivity results vary flare thresholds and persistence gates, plus the separate population or mangrove contextual threshold. No population-mangrove composite was constructed because the quantities have different meanings and units. The four recent-high shorter-history sites are a watchlist for follow-up, not evidence to override locked tiers.

Domain	Scenario	Candidates	Jaccard vs baseline
abatement	inclusive	79	0.430
abatement	baseline	34	1.000
abatement	conservative	14	0.412
community_monitoring	inclusive	24	1.000
community_monitoring	baseline	24	1.000
community_monitoring	strict_context	12	0.500
community_monitoring	strict_flare_and_context	7	0.292
community_monitoring	conservative	2	0.083
ecosystem_monitoring	inclusive	8	0.875
ecosystem_monitoring	baseline	7	1.000
ecosystem_monitoring	strict_context	1	0.143
ecosystem_monitoring	strict_flare_and_context	0	0.000
ecosystem_monitoring	conservative	0	0.000

Interpretation for next decisions

The outputs support prioritizing detailed feasibility investigation, operational monitoring design, and verification planning. They do not demonstrate gas-utilization feasibility, prove operator responsibility, quantify emissions, measure pollutant exposure, establish health outcomes, or establish mangrove damage.

7. Source provenance and reproducibility

World Bank GGFR Global Gas Flaring Tracker, June 2026 individual flare-location estimates; geoBoundaries gbOpen Nigeria ADM1, GRID3 representation 2022 (CC BY 4.0); JRC GHSL P2023A population_count 2020; ESA WorldCover v200 class 95, 2021.

Production and validation record

- The package retains the validated nine-state ADM1 boundary, source/spatial assignment evidence, Stage 01 state summaries, and the Stage 03A 372-site priority assessment.
- The production script re-creates the five A3 maps, presentation charts, report source, and locked-result tables without network access or Earth Engine.
- Automated checks require the 372 / 70 / 33 / 1 inventory reconciliation, 34 HIGH and 41 ELEVATED tiers, 24 community candidates, 7 ecosystem candidates, and the four-site shorter-history watchlist.
- The maps are WGS 84 geographic-coordinate layouts with approximate scale bars calculated at map latitude. No basemap or unverified coastline feature is introduced.

Interpretive limits

This work preserves modelled and estimated context as such. It supports targeted verification and feasibility investigation; it does not show measured pollutant exposure, health impact, ecological damage, regulatory responsibility or demonstrated gas-utilization feasibility.