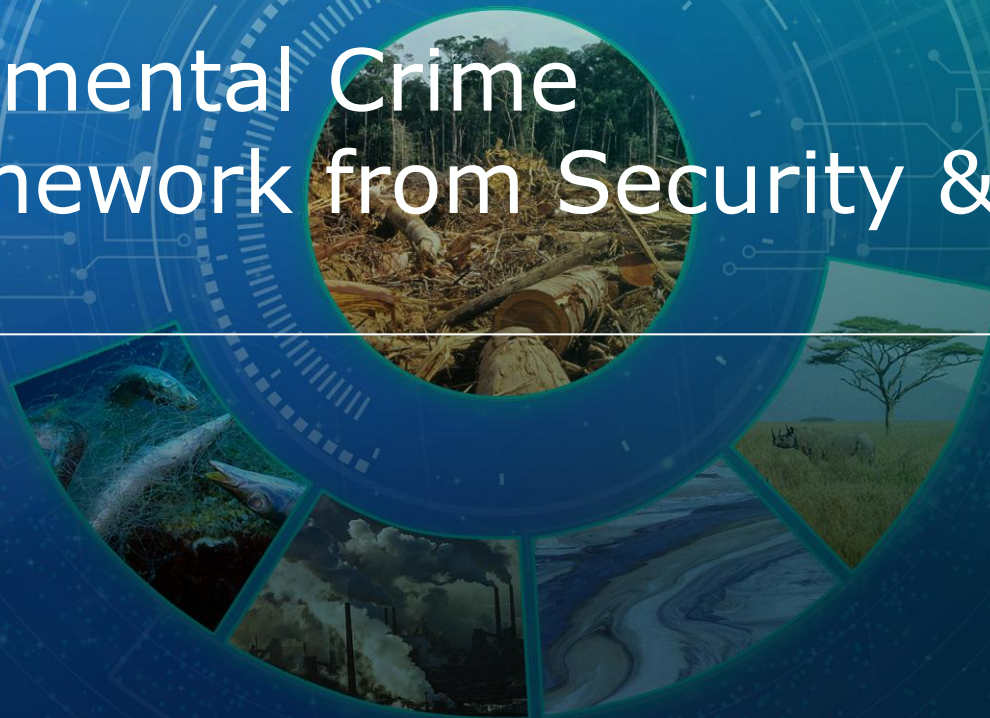


29 September - 01 October 2026 ESA-ESRIN | Frascati | Italy

# Environmental Crimes joint workshop with ESA-JRC-UNODC

## OSINT-IMINT Fusion for Environmental Crime Intelligence: A Transferable Framework from Security & Counterterrorism



# SCOPE

- The framework: OSINT tips IMINT, IMINT extends OSINT
- Applications: Security and Counterterrorism (ESA projects, EOLAW – 6 use cases, EO4Security – 3 use cases)
  - Localisation of critical events and placement into geographic context
  - Supplementation of OSINT work with EO-driven insight
  - Spatial data analysis to highlight potential illegal activity patterns
- Transfer conditions: what must be true of a phenomenon for the framework to move to environmental crime
  - ✓ Five conditions, drawn from the common ground of the two domains
  - ✓ Method transfer map, and the honest limits
- In practice: environmental parameters already sit inside the counterterrorism pipeline

# FRAMEWORK OVERVIEW: FOUR STEPS



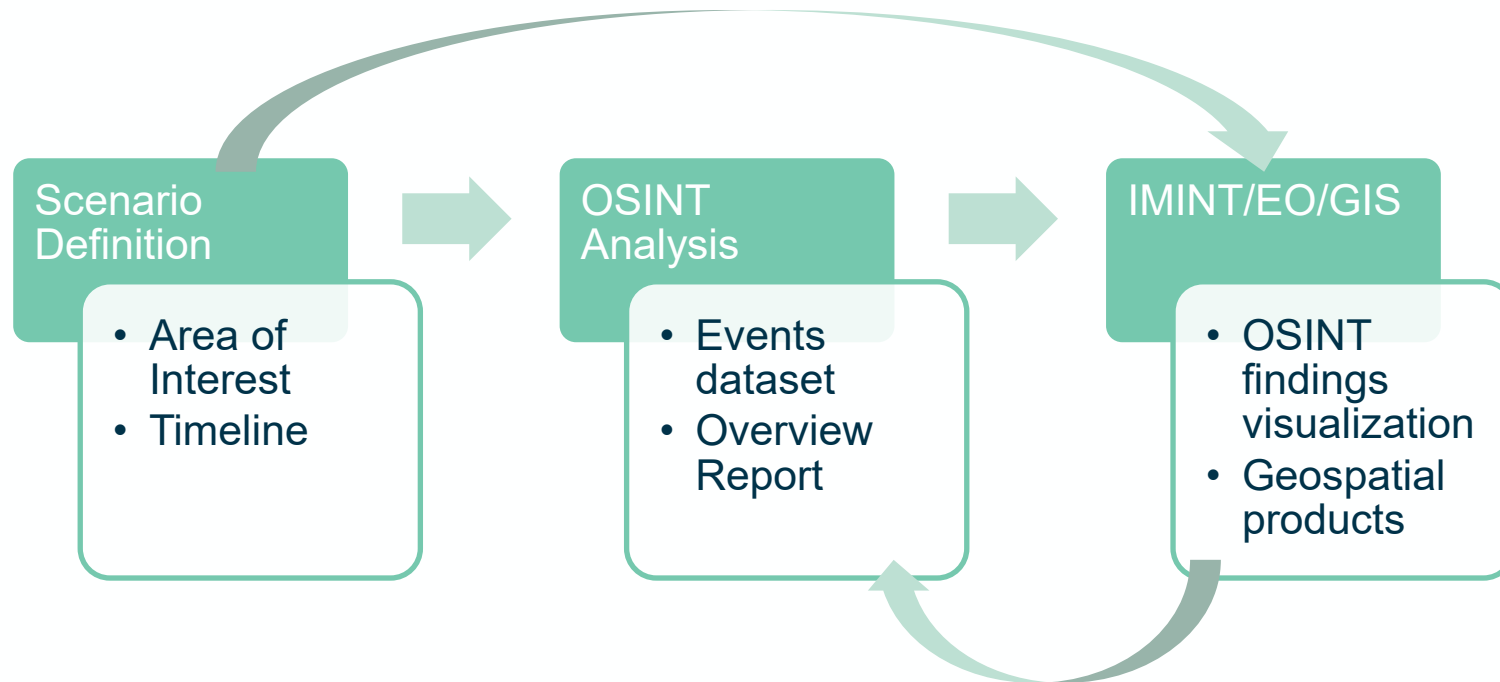
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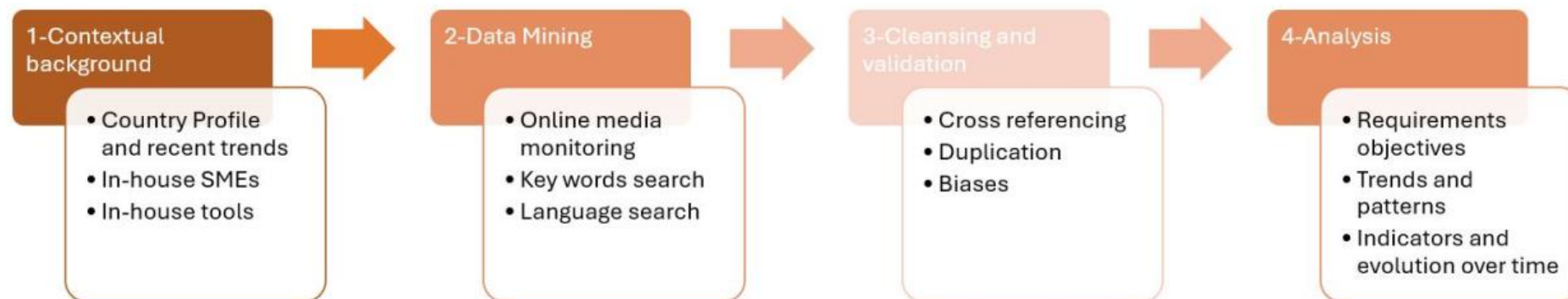
1. Scenario definition: area of interest, timeline and focus points, set with the end user
  2. OSINT analysis: media mining, event extraction, geolocation, verification
  3. EO and geospatial analysis: change detection, multi-criteria surfaces, photointerpretation
  4. Linking: EO-derived change points intersected with OSINT-derived activity points
- Analysis findings return to OSINT for targeted re-investigation







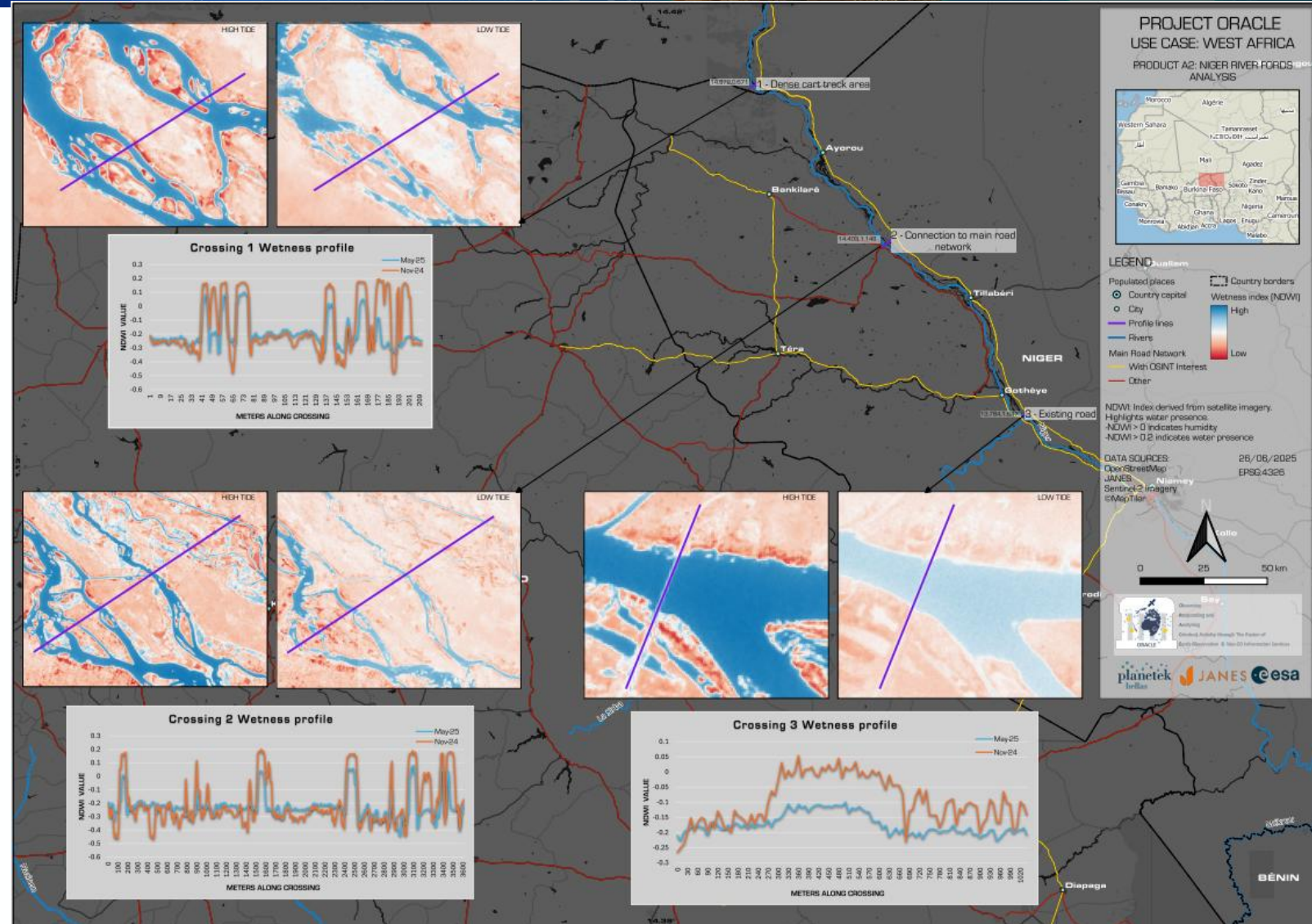
- Structured event write-up: where, when, what, why, how, and source (ABCL rule)
- Triple-lock verification: multi-source validation and multi-point analysis audit
- Source credibility grading (Gold, Silver, Bronze) and a per-event confidence level
- TRACS quality metric: Timeliness, Relevance, Accuracy, Completeness, Shareability
- Every related geospatial product inherits the confidence attached to its OSINT input





# NIGER FORDS ANALYSIS (WA-A2)

- Question: when does a natural barrier stop being a barrier
- Sentinel-2 NDWI =  $(B3 \text{ Green} - B8 \text{ NIR}) / (B3 \text{ Green} + B8 \text{ NIR})$
- Two acquisitions compared: high-water stage and low-water stage
- Profile lines drawn across three OSINT-indicated crossings, with NDWI sampled along each
- Low-water profiles show sustained drops consistent with fordable sections
- Output: candidate ford locations, with coordinates and the seasonal window in which they open



# WAP COMPLEX MONITORING (WA-A3)



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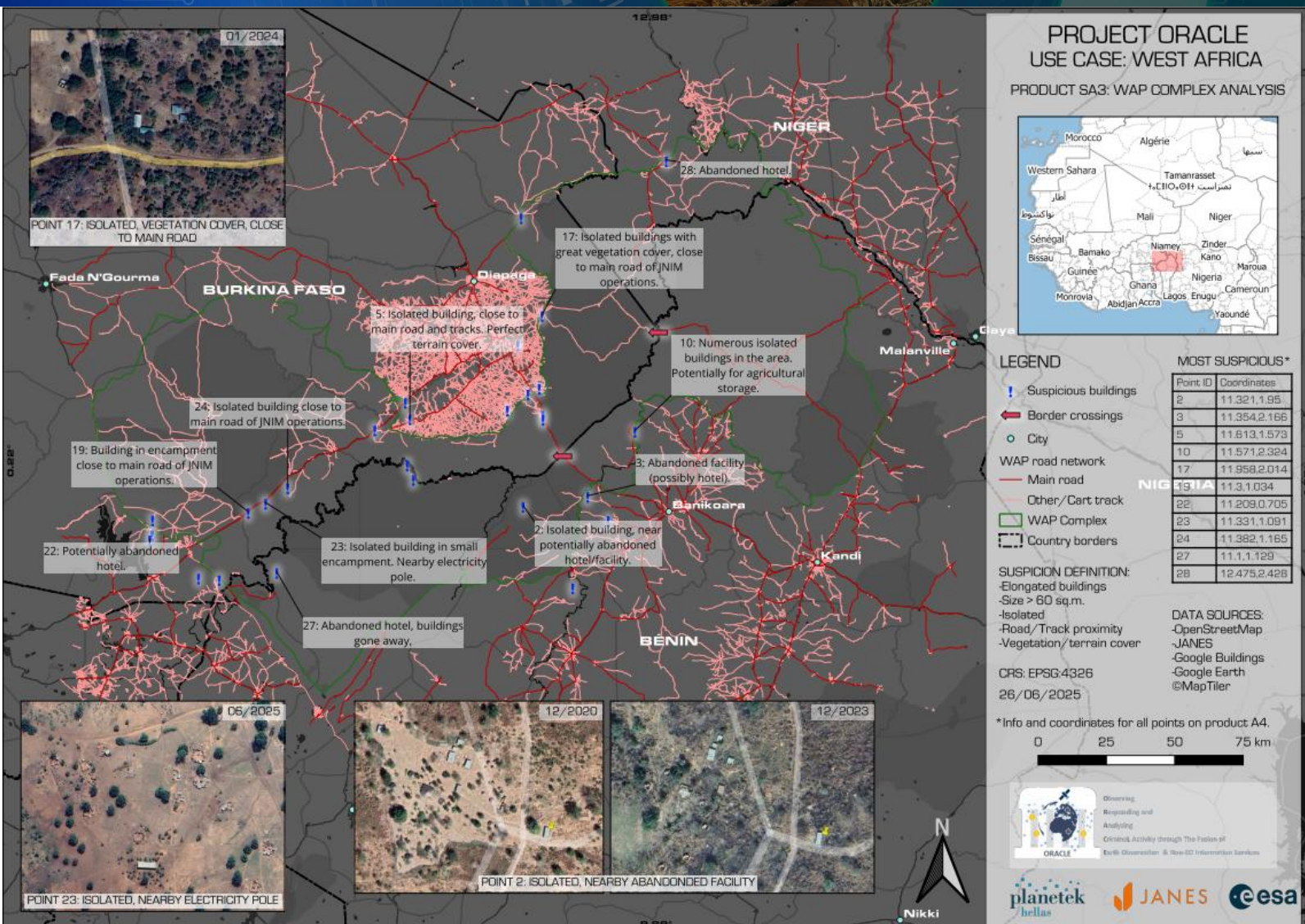


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- Question: which structures inside a vast transboundary reserve deserve a closer look
- Input: Google Open Buildings footprints, retrieved for the reserve extent
- Automated filtering against a logistics signature:
  - ✓ Shape and size: elongated, above 60 sqm, capable of holding equipment
  - ✓ Isolation from villages and towns, providing discretion
  - ✓ Proximity to roads or cart-track formations
  - ✓ Vegetation and terrain cover
- Surviving candidates inspected manually in VHR and historical imagery, looking for abandonment and new tracks
- Output: 28 structures with coordinates, descriptions and imagery extracts



# FINDINGS OVERVIEW (WA-A4)



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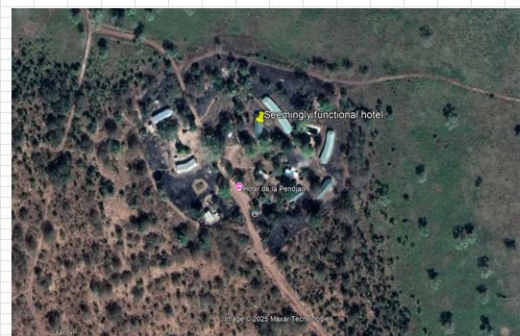


| A  | B                                                            | C          | D                   |
|----|--------------------------------------------------------------|------------|---------------------|
| id | Description                                                  | latitude   | longitude           |
| 1  | RN 17 Highway. First area of focus for Wilayat al-Sahel.     | 15.517209  | 0.64684             |
| 2  | RN 1 Highway. Projected cross-border movement by Wilayat al  | 14.611383  | 1.0266772           |
| 3  | RN 5 Highway. Recorded area of operations of Wilayat al-Sahe | 14.442007  | 0.7390111           |
| 4  | Potentially fordable locations of Niger river                | 14.3091495 | 1.2695930477776518  |
| 5  | RN 4 Highway. Main road connecting Niger with Burkina Faso.  | 13.98399   | 0.8747684           |
| 6  | Markoye town. Contested area between Wilayat al-Sahel and S  | 14.6438771 | 0.033467744         |
| 7  | Beli river bridge. Potential crossing point.                 | 14.9348215 | 0.063733687         |
| 8  | Storage buildings.                                           | 14.6555111 | 0.18616785974060232 |
| 9  | N28 Highway. Part of JNIM logistics route.                   | 10.969033  | 0.4812639           |
| 10 | N19 Highway. Part of JNIM logistics route.                   | 12.2596681 | 1.6844551320803873  |
| 11 | N6 Highway. Part of JNIM logistics route.                    | 12.1313574 | 0.8899910242903672  |
| 12 | Point Triple Campsite.                                       | 11.8983385 | 2.4115307316244983  |

| A  | B                                                                                                                | C        | D         |
|----|------------------------------------------------------------------------------------------------------------------|----------|-----------|
| id | Description                                                                                                      | Latitude | Longitude |
| 1  | Very permeable point. Main road border crossing, multiple tracks, friendly terrain and land cover.               | 14.361   | 0.239     |
| 2  | Very permeable point. Main road border crossing, multiple tracks, friendly terrain and land cover.               | 14.009   | 0.419     |
| 3  | Multiple tracks running through unfriendly terrain.                                                              | 13.431   | 1.099     |
| 4  | Main road crossing, surrounded by highly unfriendly terrain and land cover.                                      | 12.738   | 1.634     |
| 5  | Multiple tracks and main road nearby enable crossing through unfriendly land cover.                              | 11.901   | 2.409     |
| 6  | Multiple tracks and main road nearby enable crossing through unfriendly land cover.                              | 11.48    | 2.069     |
| 7  | Multiple tracks and main road enable crossing.                                                                   | 10.977   | 0.511     |
| 8  | Very permeable point. Main road border crossing, multiple tracks, friendly terrain, land cover and nearby towns. | 11.105   | 0.035     |

| id | Description                         | Latitude | Longitude |
|----|-------------------------------------|----------|-----------|
| 1  | 1 - Dense cart track area           | 14.9838  | 0.6705    |
| 2  | 2 - Connection to main road network | 14.40295 | 1.14718   |
| 3  | 3 - Existing road                   | 13.78352 | 1.6463    |

| A  | B                                                                                  | C        | D         |
|----|------------------------------------------------------------------------------------|----------|-----------|
| id | Name                                                                               | Latitude | Longitude |
| 1  | Isolated building, near main road and tracks.                                      | 11.625   | 2.016     |
| 2  | Isolated building, near potentially abandoned hotel/facility.                      | 11.321   | 1.95      |
| 3  | Abandoned facility (possibly hotel).                                               | 11.354   | 2.166     |
| 4  | Seemingly functional hotel.                                                        | 11.41    | 1.584     |
| 5  | Isolated building, close to main road and tracks. Perfect terrain cover.           | 11.613   | 1.573     |
| 6  | Small encampment, close to main road of JNIM operations. Perfect vegetation cover. | 11.576   | 1.456     |
| 7  | Isolated building with perfect vegetation cover. New structure risen nearby in 2   | 11.459   | 1.564     |
| 8  | Isolated building, close to main road of JNIM operations.                          | 11.668   | 1.558     |
| 9  | Isolated building, close to main road and tracks.                                  | 11.695   | 1.967     |
| 10 | Numerous isolated buildings in the area. Potentially for agricultural storage      | 11.571   | 2.324     |
| 3  |                                                                                    |          | 2.017     |
| 4  |                                                                                    |          | 1.933     |







|             |                        |                                                                    |
|-------------|------------------------|--------------------------------------------------------------------|
| CONDITION 1 | Organised activity     | A repeatable logistics footprint supports the activity             |
| CONDITION 2 | Limited reference data | Transparent expert criteria replace unavailable labels             |
| CONDITION 3 | Medium-scale effects   | Broad screening narrows the area for VHR review                    |
| CONDITION 4 | Jurisdictional seams   | Routes cross borders and administrative boundaries                 |
| CONDITION 5 | Physical enablers      | EO shows the footprint; OSINT and legal data establish attribution |

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# METHOD TRANSFER MAP



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- Kernel density of OSINT events, to hotspot mapping of reported dumping, poaching or illegal logging
- Border permeability index, to access and trafficking-route modelling toward protected areas
- NDWI change detection, to water abstraction, tailings ponds, dredging, seasonal extraction windows
- Geometric building filtering, to informal processing sites, camps, storage sheds, kilns
- Multi-temporal photointerpretation, to confirming activity, dating change, evidencing abandonment
- Consolidated findings dataset, to an inspection tasking list for rangers and enforcement units

## Example Method (counterterrorism case)

Border permeability index: weighted cost surface of slope, land cover, road distance, sampled along border segments (A1)

NDWI and multi-date change detection, Sentinel-2 (A2)

Geometric filtering of building footprints: size, elongation, isolation, road proximity, cover (A3)

Multi-temporal photointerpretation, VHR and historical imagery  
 

## Environmental crime application

Access and route modelling toward reserves, concession edges, coastlines; add river navigability, checkpoint distance, exit points

Water abstraction, tailings and settling ponds, dredging and sand extraction, seasonal extraction windows

Processing sites, mining and logging camps, storage sheds, kiln clusters, unpermitted structures inside protected areas

Confirming activity, dating onset of change, separating active from dormant sites, evidencing abandonment or expansion



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# WHAT DOES NOT TRANSFER



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- OSINT yield per unit area is lower: violence is newsworthy, environmental crime is quiet by design
  - ✓ Invert the tipping direction more often, letting EO change detection cue OSINT
  - ✓ Draw on different source classes: NGO and ranger reporting, customs seizures, court records, trade and shipment data, corporate registries
- The evidentiary standard rises, from intelligence toward admissible evidence
  - ✓ Provenance metadata, reproducible thresholds, defensible processing chain
- Attribution shifts from actor mapping toward ownership mapping
- Disclosure risk profiles differ, and dissemination rules have to follow

# CONCLUSIONS AND WAY FORWARD



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- The transferable asset is a prioritisation chain, not a detector
- It applies wherever activity is organized, remote, under-reported and medium-scale
- Environmental crime meets all four conditions, and adds a legal geometry that counterterrorism lacks
- Next steps:
  - ✓ Pilot the chain on one thematic case, with a defined end user and AOI
  - ✓ Re-weight the permeability and suspicion criteria against that thematic
  - ✓ Close the loop by recording inspection outcomes as labels

# Thank you!

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