

Spatial Video Assessment of Environmental Conditions in Displacement Camps near Goma, Democratic Republic of the Congo

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Key finding: Ground-level spatial video showed meaningful variation in WASH infrastructure, environmental risk, and camp organization within and across displacement camps near Goma, DRC.

Background

- Forced displacement is a major public health and humanitarian crisis.
- In eastern Democratic Republic of the Congo (DRC), recurrent conflict has displaced millions, leading to development of multiple temporary relief camps.
- Camp environmental conditions can create significant public health challenges, such as outbreaks of communicable diseases like cholera.
 - Key concerns include overcrowding, poor sanitary conditions, and inadequate access to clean water.
- Spatial video (SV) is a methodology combining ground-level video with GPS-enabled mapping that can capture visible conditions like standing water, waste, animals, and infrastructure for water, sanitation, and hygiene (WASH).
- This practicum used SV footage to assess camp conditions across three displacement camp settings near Goma.

Population

- Displacement camp settings near Goma, DRC:
 - Don Bosco
 - Bulengo
 - Eastern Mass / Kanyarunchinya

Learning Objectives

- Apply geospatial and environmental health principles to the analysis of SV footage from displacement camps in the DRC.
- Develop a structured process for organizing and coding SV data for public health analysis.
- Characterize environmental risk factors across three major displacement camp settings and multiple time points to inform future humanitarian / public health assessment.

Activities

- Reviewed archived GPS-linked SV footage from displacement camp settings in DRC.
- Organized videos by camp, route, and time point.
- Created annotated route maps and grouped recurring corridors within each camp.
- Recorded structures observations on built environment, activity, water/drainage, sanitation, and access/safety.
- Compared patterns within and between Don Bosco, Bulengo, and the Eastern Mass / Kanyarunchinya.

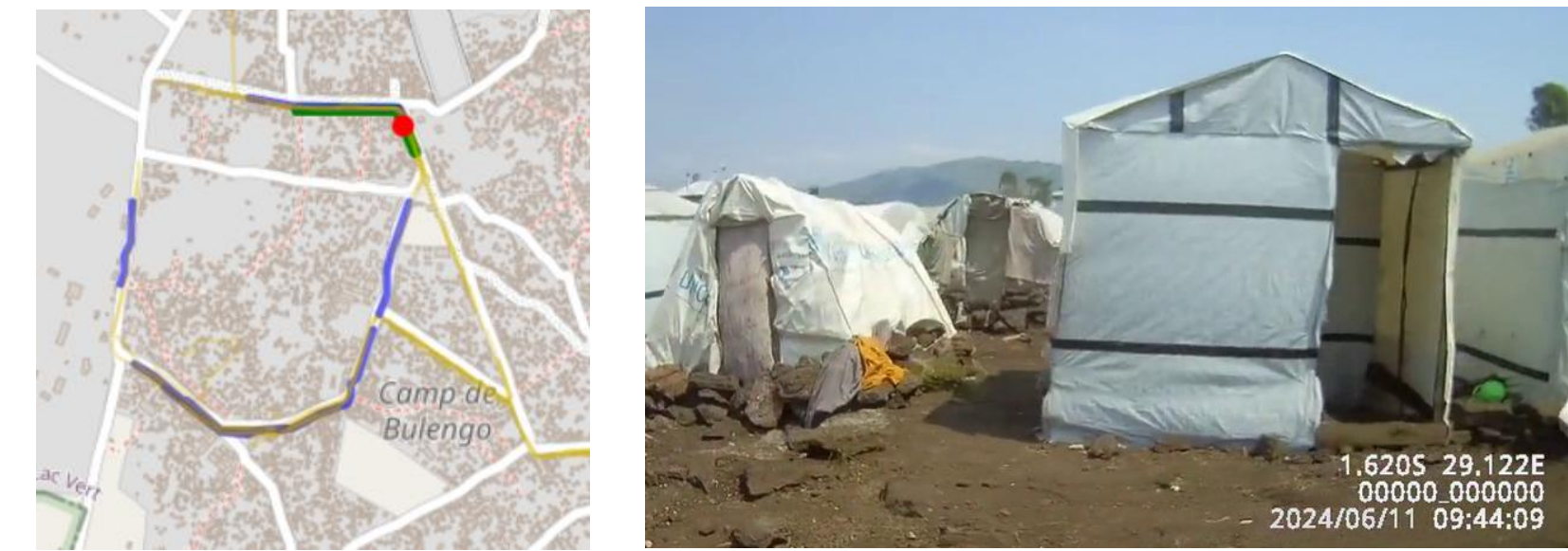
Deliverables

- Route-based maps and annotated visual figures for three camp settings.
- Structured summary tables and cross-site comparisons of observed camp conditions.
- Practical workflow guide for organizing, reviewing, interpreting, and summarizing SV data in displacement camp settings.

Methods

1 Archived spatial video

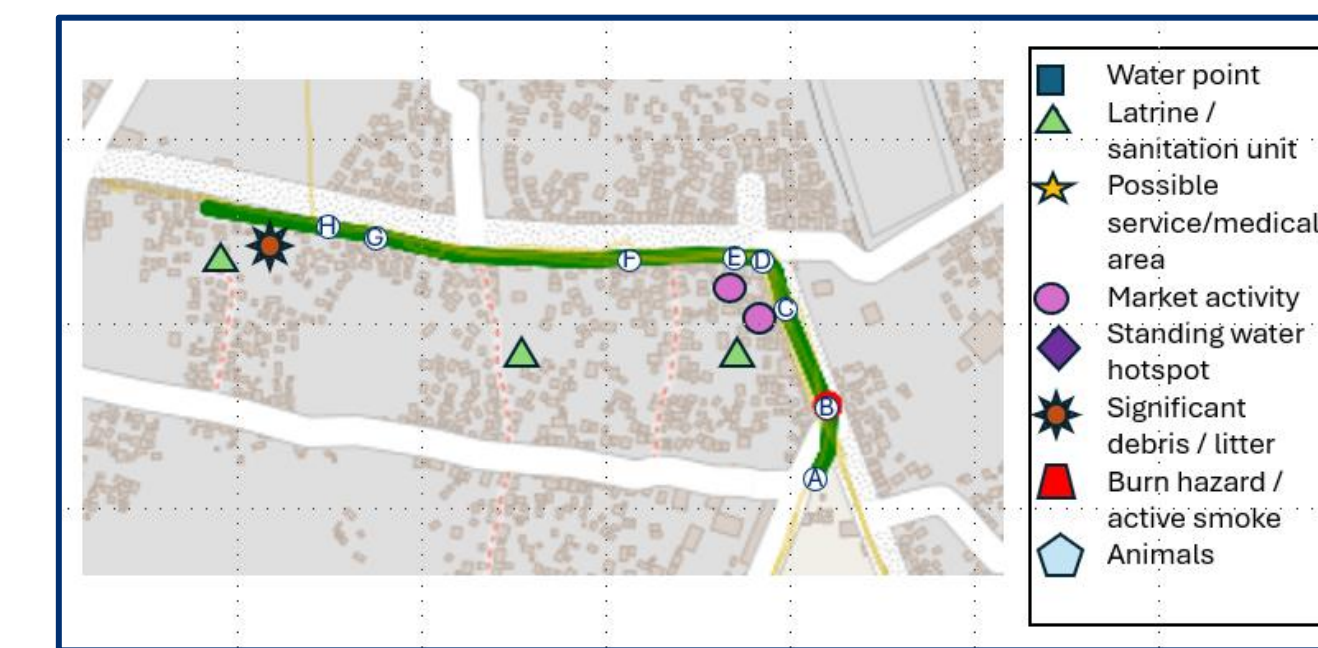
Archived GPS-linked footage was reviewed by camp, route segment, and time point using interactive software developed by the Curtis lab.



2 Structured video review

Each segment was reviewed for observable features under standard domains:

- Built environment / shelter density
- Population activity
- Water / drainage
- Sanitation / hygiene
- Access / safety
- Other notable features

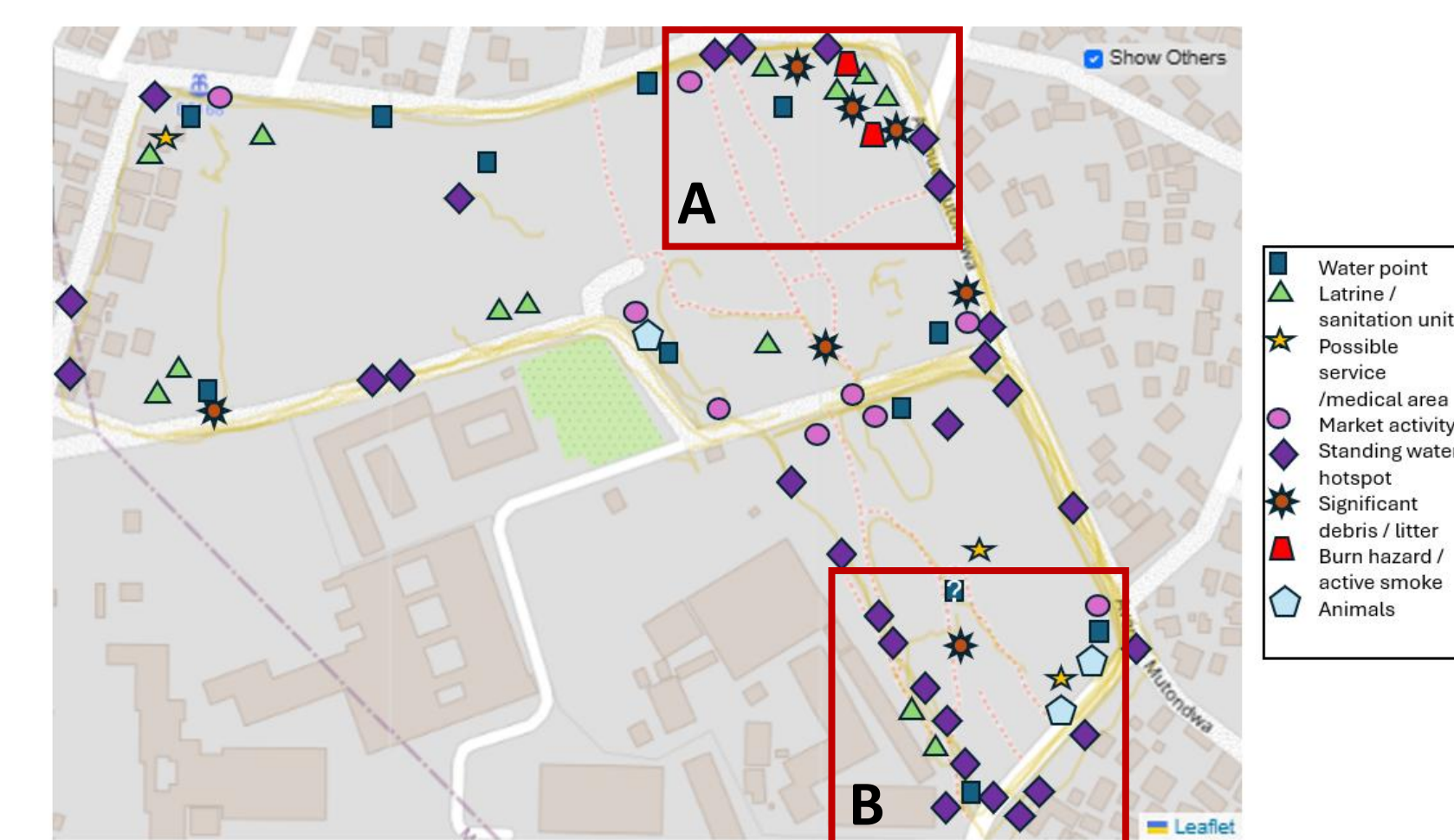


3 Spatial / camp synthesis

Segment-level observations were synthesized into annotated maps, route summaries, and cross-site comparisons.

Results

Figure 1. Illustrated mapped findings: Don Bosco



Don Bosco was densely packed and predominantly residential. Major observable public health hazards included a debris-laden latrine block with later evidence of burning refuse (A) and accumulation of standing water, particularly in southeastern parts of the camp (B).

Figure 2. Representative observed features across camp sites



Dense, low-quality sheltering / crowding

Standing water / muddy access

Sanitation infrastructure + debris / burning hazards

Results

Figure 3: Cross-site comparison of spatial and public health patterns

Site	Spatial pattern	WASH / services	Main concerns
Don Bosco	Dense, residential	Nodal / peripheral	Standing water clustering, poor latrines, debris / burning
Bulengo	Mixed-use, expansive	Distributed / embedded	Crowding, mixed-use congregation, localized safety hazards
Eastern Mass	Roadside-integrated	Embedded / interior	Sanitation deterioration, inactive infrastructure, smoke / burning

Lessons Learned

- Spatial video (SV) was effective at capturing ground-level detail.
- A structured review framework, including public health-relevant domains, helped organize large amounts of visual data and identify key insights.
- Repeated route review identified both stable patterns and temporal change across sites.

Public Health Implications

- Camps were not spatially uniform. Risks, infrastructure, and services varied both within and between camps.
- SV helped identify key cholera risk factors, such as standing water near latrines and overcrowding. It may help identify localized clusters of risk that could be missed by satellite imagery or camp-wide assessment alone.
- SV can support monitoring and future geospatial risk mapping in dynamic displacement / humanitarian settings.

Acknowledgements

Special thanks to Andrew Curtis, Jayakrishnan Ajayakumar, and the GIS Health & Hazards Lab at Case Western Reserve University for practicum mentorship and project support.

This work was connected to DRC projects at the University of Florida (UF) and supported by R01 AI138554, Cholera in Goma (Morris, PI), through a sub-award to Case Western Reserve University.

Additional thanks to John Glenn Morris (UF PI), Felicien Maisha (UF in DRC who organized data collection), and other collaborators in the DRC.