

Imagery-Based Quantification of Biodiversity Impacts near a Local Industrial Refinery, Commerce City, Colorado

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Goal Statement

To quantify how chronic pollution from a local industrial refinery in Commerce City, CO, has altered biodiversity—using drone, aerial, and satellite imagery, supplemented by historical GIS datasets and minimal field validation.

Rationale & Background

- Historic richness of Sand Creek/South Platte riparian woodlands & mixed-grass prairies
- Current fragmentation & degradation by refinery and urbanization
- The need for non-invasive, imagery-based biodiversity metrics

Research Question

How does biodiversity—quantified via spectral indices, object-based image analysis, and historical land-cover change—differ between areas adjacent to a local refinery and nearby protected ecosystems?

Objectives:

- Remote-Sensing Metrics
 - NDVI/EVI, texture, 3D structure (drone + LiDAR)
 - Habitat indicators (canopy cover, patch size, wetland extent)
- Historical Trend Analysis
 - GIS land-cover change (Before 1980–present)
 - Fragmentation, riparian loss, wetland shrinkage
- Minimal Field Calibration
 - Various site visits, 50 GPS plots
 - Indicator-species photos for model training
- Comparative Analysis & Visualization
 - Statistical comparison of imagery indices
 - Spatial gradient maps from refinery
- Actionable Insights
 - Change-detection reports & biodiversity maps
 - Restoration recommendations

Experimental Design & Methods

Study Sites & Data Sources:

- Drone Surveys: Monthly RGB + NIR multispectral & LiDAR (1 km²)
- Aerial Orthoimagery: Past 10 years archives
- Satellite Data: Sentinel-2 MSI (10 m), Landsat 8 OLI (30 m)
- Historical GIS: USGS topo & land-use maps (Before 1980–2000)
- Field Visits: Spring green-up & late-summer validation

Imagery-Derived Metrics:

- NDVI/EVI for greenness & biomass
- GLCM texture & LiDAR canopy height for structure
- Fragmentation: patch size, edge density (QGIS)
- Wetland extent: object-based classification
- Change detection: pixel-based hotspot mapping

Deliverables

- Biodiversity maps (NDVI, fragmentation, wetlands)
- Time-series change-detection report (Before 1980–present)
- Validated Random-Forest classification models (>85 % accuracy)
- Technical brief & restoration recommendations
- RRCC symposium poster & community presentation

Timeline

1. Planning & Literature Review (1–3 mo)
2. Baseline Imagery & GIS Setup (4–6 mo)
3. Data Collection & Field Work (7–12 mo)
4. Analysis & Model Refinement (13–15 mo)
5. Reporting & Outreach (16–18 mo)

References

