



Every S.H.O.T. Counts: Hunting Signatures Across 12,000 Years



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Projectile points and cartridge casings, though separated by thousands of years, can both be viewed as S.H.O.T.s, Signatures of Hunting Over Time. Each represents the material residue of a hunting event and provides evidence of human interaction with alpine landscapes. Since 2002, the Greybull River Sustainable Landscape Ecology (GRSLE) Project has systematically recorded thousands of projectile points and hundreds of cartridge casings in the high elevations of northwest Wyoming. This poster outlines an exploratory framework for comparing these datasets. GIS will be used to examine their spatial distributions relative to elevation, proximity to resources such as water, and known game migration routes. Analytical approaches such as kernel density mapping and nearest neighbor analysis will be applied to assess clustering and possible associations. Although analysis is ongoing, framing projectile points and cartridges as S.H.O.T.s emphasizes their value as comparable hunting signatures, offering new opportunities to investigate long-term human use of mountain environments.

I. INTRODUCTION

Projectile points and cartridge casings, though separated by thousands of years, both represent material signatures of hunting activity across time. These artifacts provide insight into how humans have interacted with alpine landscapes and animal movement patterns in northwest Wyoming. This study uses GIS-based spatial analyses, including kernel density estimation, nearest neighbor analysis, and proximity measures, to evaluate whether hunting evidence is clustered and spatially associated with elk movement. By comparing ancient and modern hunting signatures, this research explores long-term patterns in human hunting behavior and landscape use.

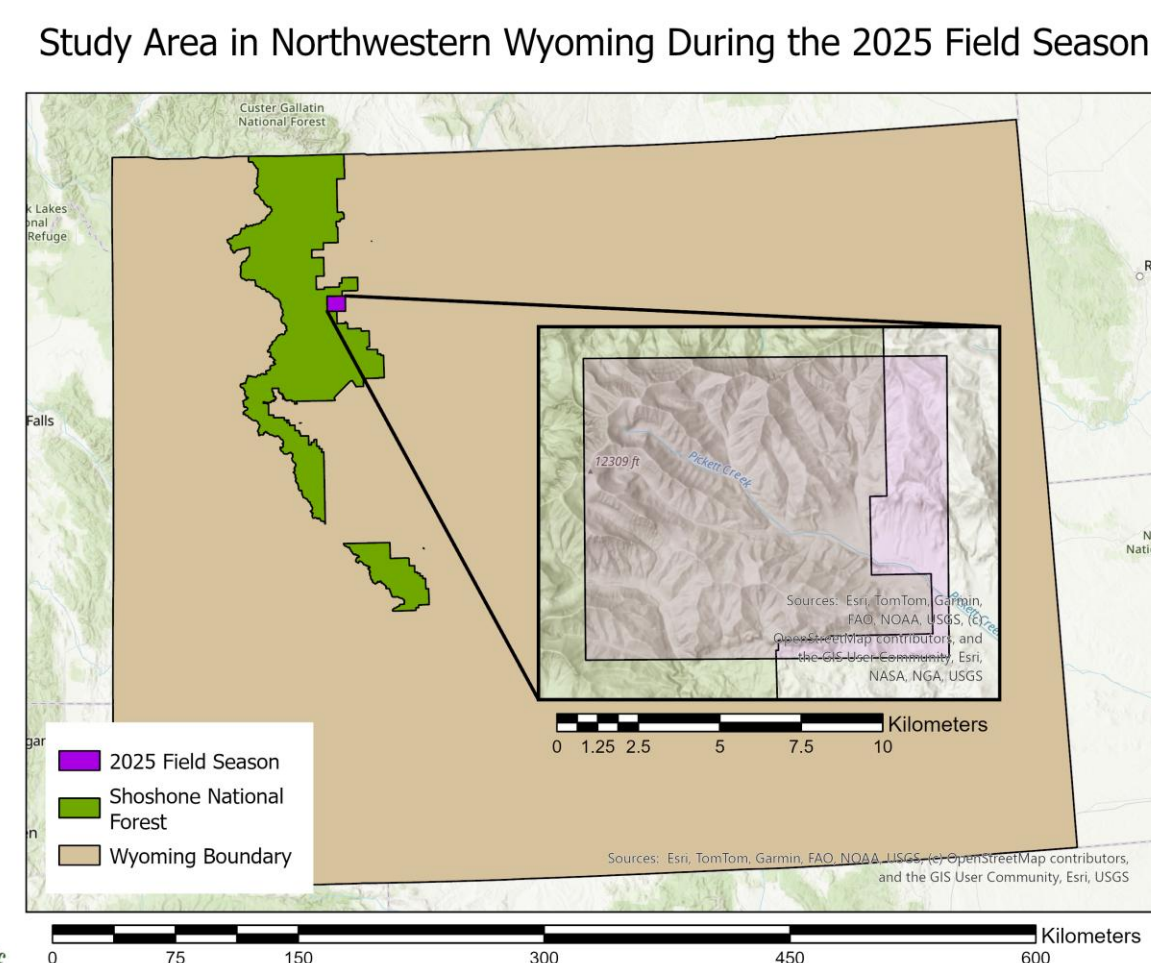


Figure 1. Study area in northwestern Wyoming showing the 2025 field survey area.

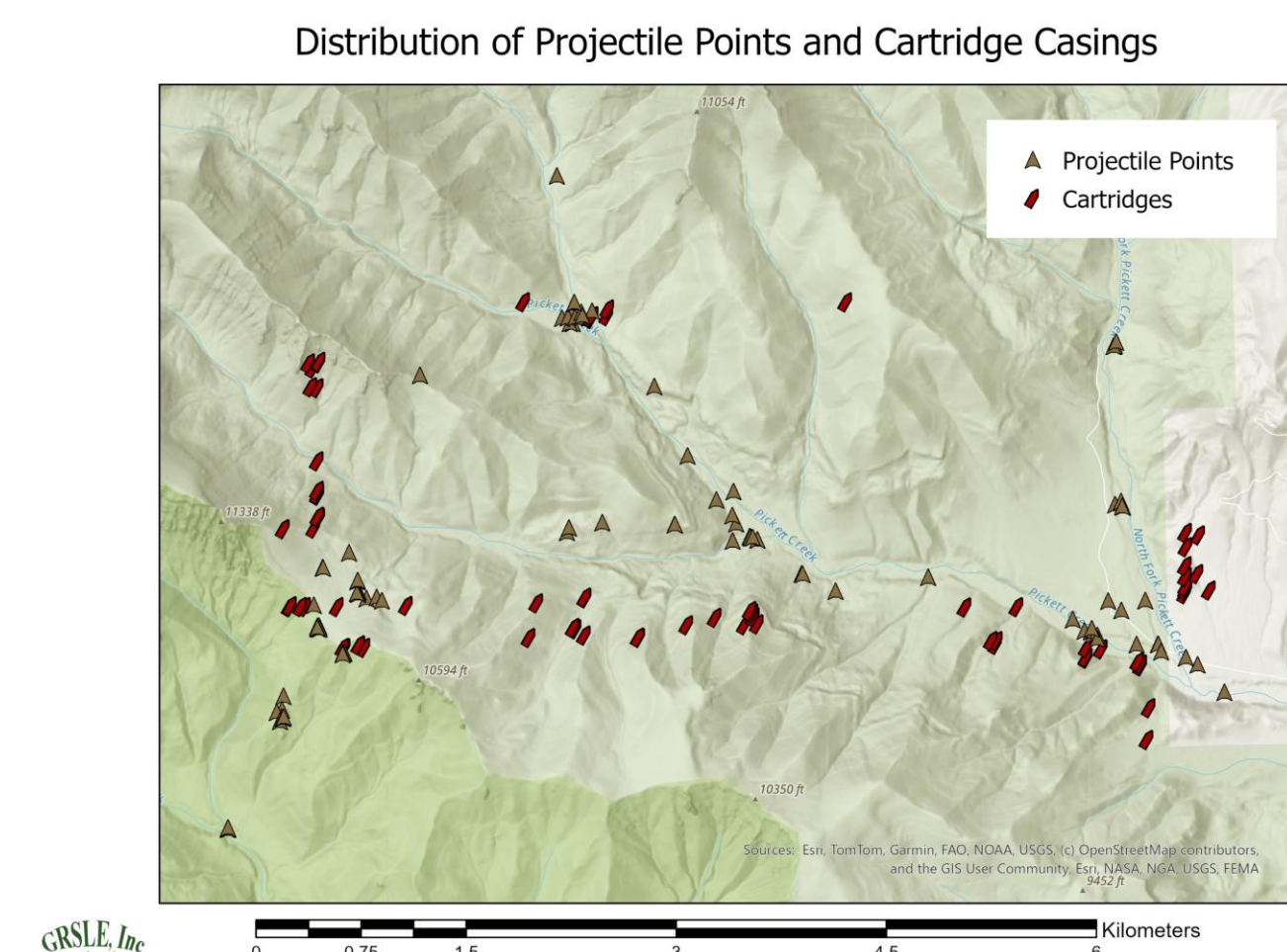


Figure 2. Distribution of projectile points and cartridge casings across the study area.

Spatial Overlap of Hunting Evidence and Elk Movement Patterns

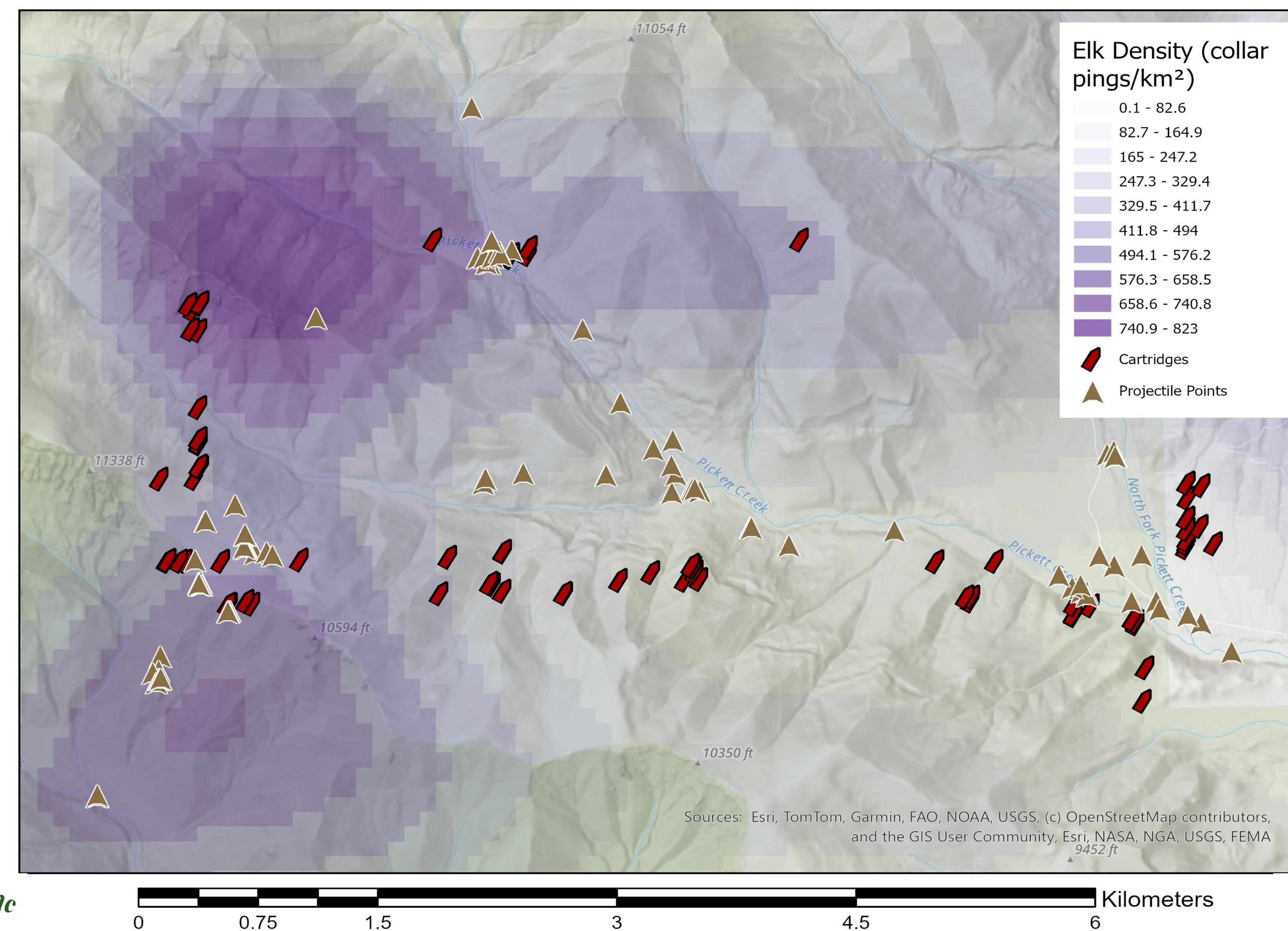


Figure 6. Spatial overlap of hunting evidence and elk movement density, illustrating persistent associations between human hunting behavior and game movement across time.

Dataset	Mean Distance (m)	Std Dev (m)	Min Distance (m)	Max Distance (m)
Cartridges	92.67	148.09	0.55	607.3
Projectile Points	61.02	89.79	0.2	332.21

Table 3. Summary statistics of distances from S.H.O.T.s to elk movement paths.

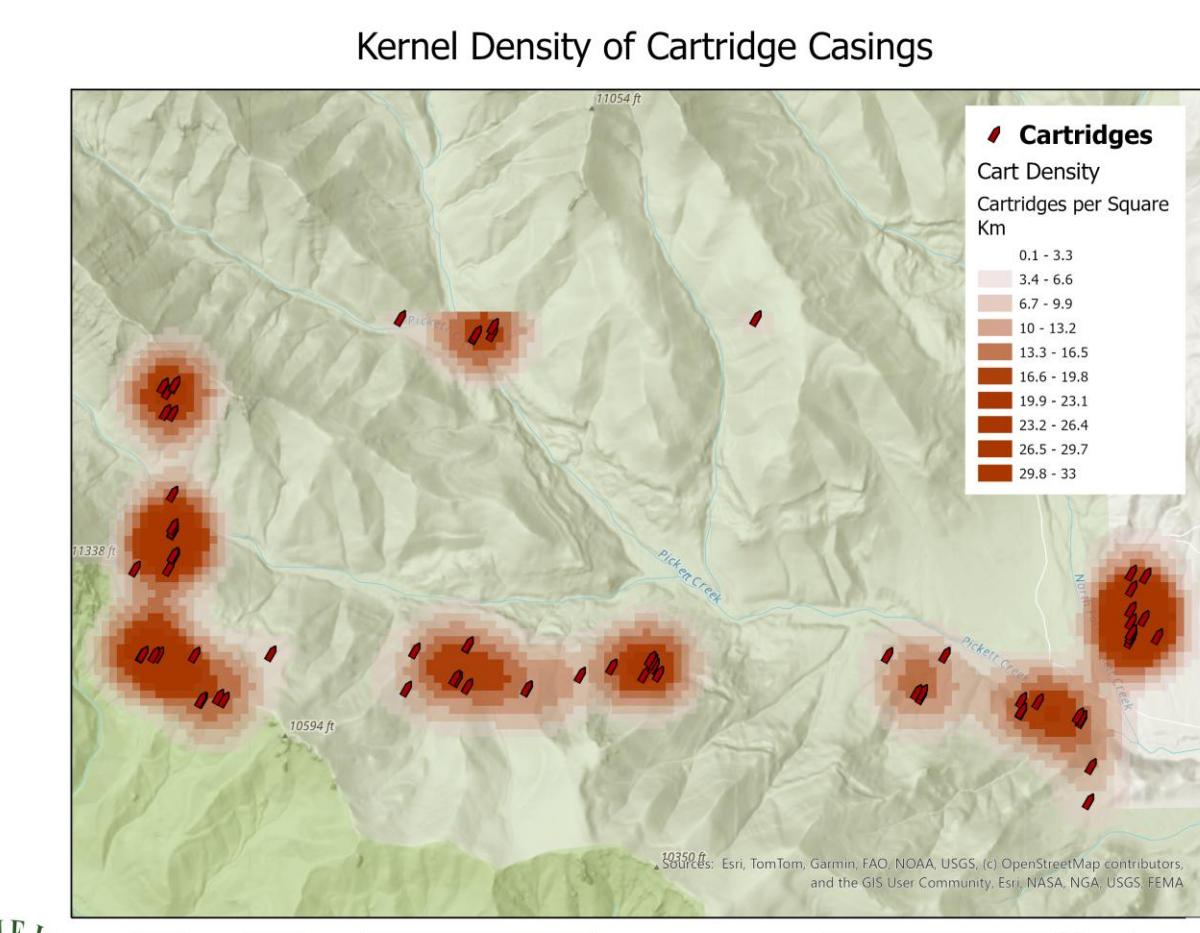


Figure 4. Kernel density of cartridge casings showing hotspots of modern hunting activity.

Metric	Value
Observed Mean Distance (m)	96.03
Expected Mean Distance (Random) (m)	249.38
Nearest Neighbor Ratio	0.38
z-score	-10.26
p-value	<0.001

Table 1. Average nearest neighbor statistics for cartridge casings.

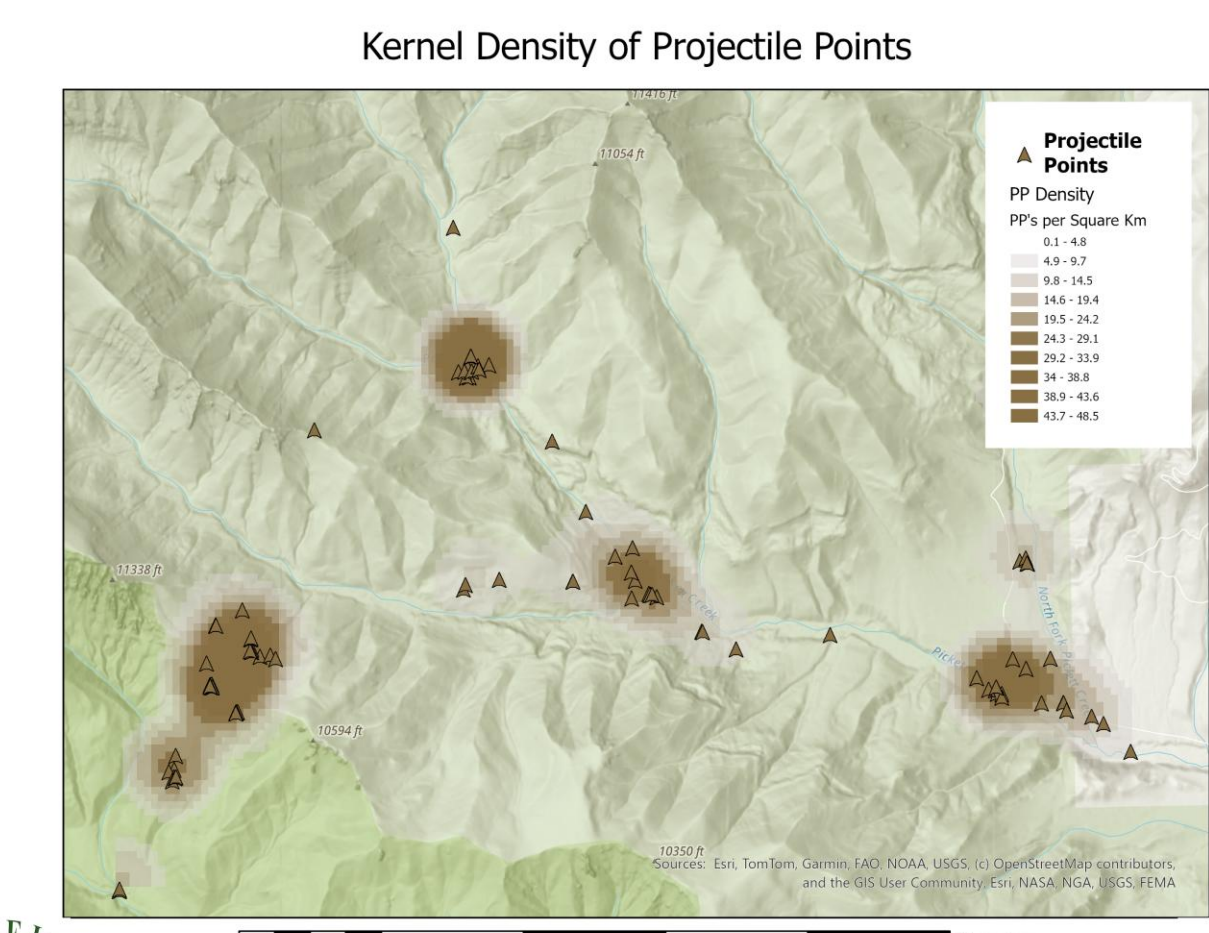


Figure 5. Kernel density of projectile points showing concentrations of prehistoric hunting activity.

Metric	Value
Observed Mean Distance (m)	79.28
Expected Mean Distance (Random) (m)	258.08
Nearest Neighbor Ratio	0.28
z-score	-13.46
p-value	<0.001

Table 2. Average nearest neighbor statistics for projectile points.

II. METHODS

Spatial analyses were conducted in ArcGIS Pro to evaluate the relationship between hunting evidence and elk movement patterns in northwestern Wyoming.

- Datasets:** Projectile point locations (n = 95), cartridge casings (n = 76), and elk GPS collar pings
- Kernel Density Estimation:** Generated density surfaces to identify spatial clustering and hotspots of artifacts and elk movement
- Average Nearest Neighbor Analysis:** Measured clustering within each artifact dataset and assessed proximity to elk movement.
- Near Analysis:** Calculated distances from each artifact to the nearest elk movement feature to assess spatial proximity
- Summary Statistics:** Mean, standard deviation, and range were calculated to compare spatial patterns between datasets
- Spatial Overlay:** Density surfaces were visually compared to identify areas of overlap between hunting evidence and elk activity

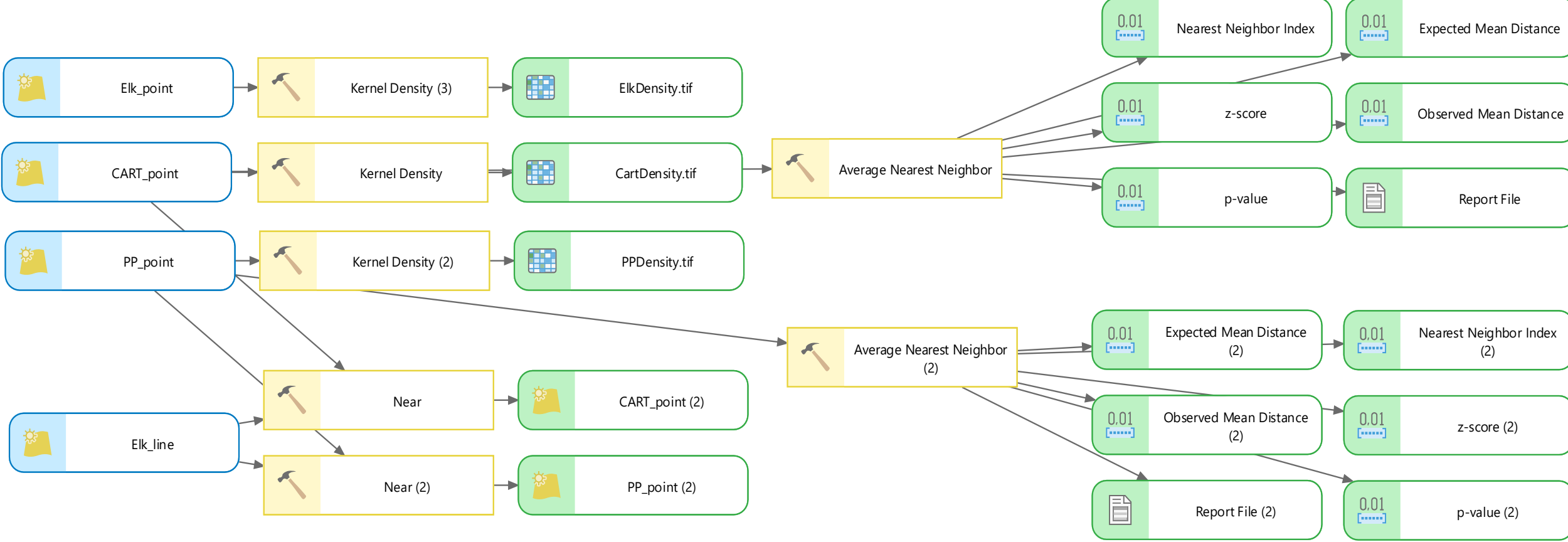


Figure 3. GIS workflow used to analyze spatial clustering and proximity of hunting evidence relative to elk movement patterns.

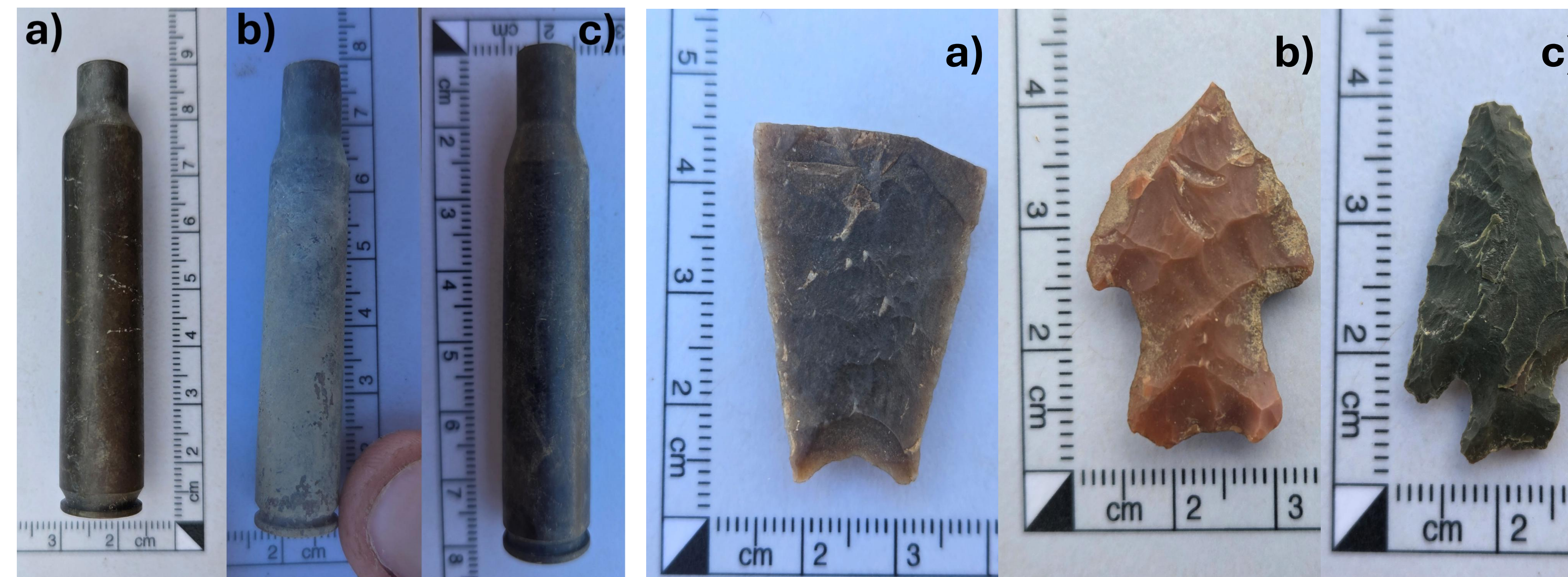


Figure 7. Examples of elk-capable cartridges recorded in high frequency in the GRSLE dataset: (a) .30-06 Springfield, (b) .300 Winchester Magnum, and (c) 7mm Remington Magnum.

Figure 8. Examples of projectile points recorded in the GRSLE dataset: (a) Paleoindian, (b) Middle Archaic, and (c) Late Prehistoric.

III. Results

Spatial analyses reveal strong clustering of hunting evidence and a clear spatial relationship with elk movement patterns.

Artifact distributions show visible clustering for the study area (Fig. 2). Kernel density analysis identifies distinct hotspots for both cartridge casings (Fig. 4) and projectile points (Fig. 5), indicating concentrated areas of hunting activity.

Average Nearest Neighbor results confirm that both datasets are significantly clustered relative to a random distribution (Tables 1, 2), with low nearest neighbor ratios and statistically significant z-scores (p < 0.001).

Elk density mapping highlights areas of concentrated movement across the landscape (Fig. 6). Visual comparison of density surfaces demonstrates spatial overlap between hunting evidence and elk activity (Fig. 6).

Near analysis shows that artifacts occur in proximity to elk movement, with mean distances of approximately 92.67 m for cartridge casings and 61.02 m for projectile points (Table 3).

IV. CONCLUSION

- Hunting evidence (projectile points and cartridge casings) is strongly spatially clustered, indicating repeated use of specific locations across time.
- Both ancient and modern hunting signatures show clear spatial association with elk movement patterns, supported by density overlap and proximity analyses.
- Projectile points occur closer on average to elk movement than cartridge casings, suggesting potential differences in hunting strategies or technological constraints.
- These results demonstrate long-term continuity in how humans use alpine landscapes for hunting, despite major technological changes over ~12,000 years.
- Importantly, modern refuse such as cartridge casings, often overlooked as litter, provides valuable insight into human behavior, offering a comparative framework for interpreting archaeological patterns.
- GIS-based spatial analysis provides a powerful framework for comparing archaeological and modern ecological datasets.

