Midwestern Sand Dunes, Geoarchaeology, and LiDAR: Preliminary Geomorphic Landform Analysis of the Sandy Springs Paleoindian Site in the Upper Ohio River Valley

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Paleoindian Sites in Southern Ohio

# of Diagnostic Points at Sandy Springs Almost = All Other Sites Combined
Paleoindian Temporal Period:
• 13.5 – 11.4 ka cal yrs B.P.
• Initial large-scale human colonization of North America
• Low populations and high mobility
• Regionally, large sites away from high-quality chert sources are uncommon

Sandy Springs Site:
• Unusually large site with multiple occupations throughout Paleoindian period.
• >100 fluted points documented
• Little professional archaeological or geomorphological study

Clovis and Gainey-style fluted points from Sandy Springs (Photo courtesy of Mark Seeman)
Why Sandy Springs?

Proposed Reasons for Intense Occupation (Cunningham 1973; Seeman et al 1994):

- Sand Dunes had excellent views of landscape
- Natural Ohio River ford
- Animal migration trails
- Saline springs

Beaver Lake-style fluted points from Sandy Springs (Photo: Mark Seeman)
LiDAR imagery:
Data tiles at 0.762 m resolution obtained from the Ohio Geographically Referenced Information Program (OGRIP)
ArcScene View

Vertical exaggeration = 7
Hillshade = 1

2 m exposure of sand dune on Rt. 52
ArcScene View

Vertical exaggeration = 7
Hillshade = 1

Opuntia humifusa (Prickly Pear), Sandy Springs Cemetery
Surficial Geology after Pavey et al. 1999:

O1 - High-level outwash terrace
22-18 ka years BP

O2 - Intermediate outwash terrace
18-15 ka years BP

A – Alluvium
Holocene

Soils:
Otwell, Fine-silty, Mixed, Active, Mesic Oxyaquic Fragiudalfs
Plainfield, Mixed, Mesic Typic Udipsamments
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Gilpin Run

Dune

Dune

Ridge and Swale

Ohio R.

A to A' Profile = 11,000 linear ft.
Eolian Features

Morphological Dune Forms
- Source-bordering
- Complex
- Compound barchan-like
- Possible climbing
- Sand sheet
Vertical exaggeration = 7
Hillshade = 1
Morphometrics of Compound Barchan-like Dune

- Max. height = 3.7 m (12.1 ft)
- Length/width ratio = 1.85 (non-elongated, after Pye 1982)
- B side slope = 1.8 %
- B’ side slope = 4.1 %
Morphometrics of the Complex Dune

- Max. height = 5 m (16 ft)
- C side slope = 2.5 %
- C’ side slope = 5 %
Morphometrics of the Complex Dune

- Max. height = 5 m (16 ft)
- D side slope = 8.75 %
- D' side slope = 6.25 %
Morphometrics of Source-Bordering Dune

- Source “basin” area = 111 ha (276 acres)

E to E' Profile

Linear Distance (ft.)

Elevation (ft.)
Morphometrics of Source-Bordering Dune

- Source “basin” area = 111 ha (276 acres)
• South of US 52:
  Dune Height: ~1.5 to 3 m (~5 to 10 ft)

• North of US 52:
  Dune Height: Up to ~9 m (~30 ft)

• Variable Texture: Sand Near U.S. 52 Cut, Increasing Silt to the West
Possible Fluvial Erosion Trim Line
(Above 1937 Flood Limits)
Proposed Dune Formation Model
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Source
Pleistocene
Outwash or
Reworked
Outwash
Proposed Dune Formation Model

**Source**
- Pleistocene
- Outwash or Reworked Outwash

**Local Controls**
- Saline Springs and Soils
- Sparse Vegetation
- Lowering Water Table (with Incision)
- Varying Soil Moisture
- Long Fetch for WNW Winds
Proposed Dune Formation Model

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Sediment Mobilization
• Pleistocene Prevailing WNW Winds
• May Be Analog to Playa Lunette & Carolina Bay Formation
• Eolian transport
  • Suspension (Silt)
  • Saltation (Fine-Med. Sand)
  • Clay-Silt Pelletization
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Sediment Deposition
- Reduced Wind Velocity Associated with Surface Roughness or Topographic Barriers
- Dunes Form Immediately Downwind of Source
- Stabilized by Vegetation with Increased Soil Moisture or Decreased Soil Salinity

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**Sediment Remobilization?**
- Possible Remobilization to Form Sand Sheet, Complex Dune and Compound Barchan
- Potential Burial of Paleoindian Sites or Eolian Reworking of Artifacts
Proposed 2015-2016 Investigations

Project Objectives
Landscape geochronology: especially the dunes. Determine if eolian sediments blanket unknown Paleoindian components within the dunes or on adjacent landforms.
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• Cut-Bank descriptions
• Truck-mounted and hand-operated auger cores
• Archaeological shovel testing of Highlands property

Primary Lab Methods
• OSL and $^{14}C$ dating
• Particle-size analysis
• Soil micromorphology
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Great Potential Contributions
Look for More to Come from Matt Purtill
References Cited:

Cunningham, Roger M.

Seeman, Mark F., Gary Summers, Elaine Dowd, and Larry Morris


Pye, Kenneth