Notes on Mississippian Urban Scaling Measures

Overview for "Settlement Scaling in the Ancient World," Santa Fe Institute workshop, June 2014. John Blitz 6/14/14

Mississippian Populations at a Glance:

- Native American populations in the US Midwest and Southeast, 1000-1500 CE.
- Mixed agriculture and wild foods subsistence economy; maize dependency regionally variable.
- Technologies for significant intensification of food production absent.
- No significant technological differences in regional populations.
- Local and regional central places marked by monumental earthen mounds.
- Two and three-level site size hierarchies common; four-level site size hierarchy for Cahokia polity.
- External warfare geographically widespread and temporally variable.
- Polity cycling common; corporate and network emphases highly variable.
- Political integration declined sharply with distance from polity center; polity boundaries 18-20 km from polity center common; extensive buffer zones between population centers in many regions.
- Little or no environmental/social circumscription in most regions.
- Habitation sites, even large centers, relatively short-lived, usually < 150 years duration of settlement; population/site aggregation, fission, abandonment, re-occupation common.
- Non-local materials common at central place sites in some regions, rare in others.
- Reciprocal and redistribution exchange; market exchange not documented.
- Archaeological correlates of institutionalized inequalities among groups highly variable.
- Evidence for elite controls over the means of production and access to basic resources absent or limited and un-sustained.

Mississippian Settlement Sample (Excel data file available)

Twenty Mississippian sites were examined for relationships between site population and socio-economic/infrastructure measures. Sample sites range in settlement area size from 0.6 ha (Moon, AK) to 180 ha (central Cahokia, IL) and in estimated contemporary population from 70 persons (Grossman, IL) to 10218 persons (central Cahokia, IL). Sites that calculated to an estimated total contemporaneous population < 70 were excluded from sample.

Methods for Calculating Population at Mississippian Sites

- Data requirements: mean floor area of domestic structures, structure longevity and duration of occupation in years, and settlement area. Mississippian domestic structure remains are not visible on the ground surface; excavation/remote sensing data are required.

Structure longevity (L): For this sample, L standardized at 10 years between rebuilding episodes, based on modern experiments with like materials. Mississippian structures were composed of wood, thatch, matting/daub, thus quite perishable.

Settled area: Identified two ways for this sample, (a) Total area enclosed by palisade in hectares, or (b) maximum extent of surface remains, including mounds and plazas, if different than (a).

Duration of occupation in years: The interval over which the structures were occupied was determined by the phase span (50-150 yrs.). However, a sub-phase occupation interval (10-30 yrs.) was assigned to several sites (i.e., King, Snodgrass, Southwind, early Town Creek, Turner) based on few or no rebuilding episodes, lack of feature superposition, and other observations made by the excavators, including in several cases rapid site destruction by fire followed by site abandonment. In these cases, duration of occupation was on the order of a single human generation or less. Other sample sites may have had sub-phase occupation intervals, but these data were unavailable.

Sherburne F. Cook 1972. *Prehistoric Demography*. Addison-Wesley Modular Publications 16:1-42:
2.25 m^2 floor space per person for the first six persons (i.e., 13.5 m^2 house = 6 persons) and every additional 9 m2 = 1 person (i.e., 22.5 m^2 house = 7 persons).
1.   Calculate **mean floor area (m^2)** of excavated buildings (i.e., roofed, domestic, non-mound structure patterns).
2.   Apply Cook formula to mean floor area to calculate average number of persons per structure.
3.   Calculate **excavated or observed structure density**: n structures per ha or m^2 of excavated area (i.e., total number of observed or excavated structures divided by excavation area ha or m^2). Note "observed" structure density may be derived from remote sensing survey.
4.   **Extrapolate excavated or observed structure density to the unexcavated settlement area** (structure density x unexcavated area ha or m^2) to get the estimated number of structures in the unexcavated settlement area.
5.   The resulting number of structures estimated in unexcavated area is added to the number of excavated structures to get the **total number of structures estimated to exist in the settled area**.
6.   The total estimated number of structures is multiplied by L = 10 (**structure longevity** in years).
7.   This resulting number is multiplied by the **duration of interval (years) over which buildings were occupied** and that yields the number of contemporary structures in use at any one time.
8.   The number of contemporary structures is multiplied by average number of persons per house to get **total number of people living at the site at any one time**.

Measures of Socio-economic output/Infrastructure at 20 Mississippian Sites:
•   Total length of palisade wall or ditch.
•   Total number of mounds.
•   Area of largest mound.
•   Total number of plazas.
•   Total area of plaza(s) m^2.
•   Largest structure S1 (non-mound, roofed, domestic) m^2.
•   Largest structure S2 (mound or non-mound, roofed, special-purpose) m^2.

- Diversity index of non-local materials (scale 1-10).

Relationships between Population and Socio-economic/Infrastructure variables for sample sites (bivariate plots and stat file available)**.**

- Statistically significant positive correlations were found between site population (x) and (y) settled area, wall or ditch length, area of largest mound, total area plazas, total number of mounds, and high non-local resource score. There is also a statistically significant (but perhaps unremarkable) positive correlation between size of settled area and area of largest mound and total plaza area.
- Correlations between site population and estimated total number of structures, total number of plazas, largest domestic structure s1, and largest special purpose structure s2 were not statistically significant.

Problems Meeting Urban Scaling Data Requirements for Mississippian Sample:

- Inadequate chronological control and missing data result in reduced number of sites for sample.
- No data for certain socio-economic/infrastructure variables at some sample sites.
- **Cahokia**: In estimated population, size of settled area, number of mounds and plazas, Cahokia is larger than all other Mississippian sites by several orders of magnitude. Only the 1 km^2 central "downtown" Cahokia was included in the sample. Within 12 km of central Cahokia are more than 200 earthen mounds, with plazas, habitation areas, and mortuaries; two of these additional mound groups rival in size all other known Mississippian mound groups.
  Cahokia is a known unique case and outlier. It is included in the site sample (excel file) to illustrate the upper range of values for the measured variables in Mississippian settlements. However, as a case it is removed it from the bivariate plots to avoid obscuring the other relationships.

Observations Concerning Mississippian Sites as Urban Settled Places

Population:

- Most population estimates by investigators of the largest Mississippian sites are rarely more than 1000 persons at any one time.

Economic specialization and wealth:

- Evidence for full-time craft specialization weak.
- Tri-modal domestic structure size distribution at largest sites; bi-modal domestic structure size distribution common at small sites.
- Ratio of small to large domestic structures higher at largest sites (i.e., higher proportion of small houses at largest sites).

- There is evidence for differences in domestic structure size by residential group at some sites (e.g., Cahokia), but I am not aware that this has been systematically examined.

Site Spatial Organization

- Structure nucleation and density at sites extremely variable.
- Spatial ordering of community plan – houses in rows, courtyard groups, plazas – common at both large and small sites; mound-and-plaza arrangements exhibit formal plans.
- At some sites, large portions of area enclosed by a palisade lack evidence of structures; such "oversized" palisades are interpreted as enclosing agricultural fields and/or accommodating temporary non-resident aggregation.
- Most mound centers were fortified, but often not continuously. Palisades may appear early, middle, or late in a site occupation span; multiple rebuilding episodes are common. Houses do not abut palisade walls.