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Alliances, Clusters, and Spatial Analysis

A Multiscalar Approach to Studying Warfare in the Middle Missouri

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The term "ethnic warfare" has been frequently applied to explanations of group conflict worldwide (Horowitz 1985) and archaeological interpretations have been no exception, favoring this model to explain warfare in the Middle Missouri (Hollimon and Owsley 1994; Kay 1995; Johnson 1998; Johnson 2007a; Lehmer 1971). Two models of ethnic warfare exist: internecine warfare between resident Initial Middle Missouri and Extended Middle Missouri populations (Lehmer 1971), and external warfare between invading Coalescent and resident Middle Missouri groups. The former scenario of intercommunity conflict either occurred between different Middle Missouri populations occupying similar territory or was generated from a political split between the two Middle Missouri variants. The latter hypothesis postulates an "invasion" by central Plains villagers, as seen in the Initial variant of the Coalescent tradition, into the homeland of the Middle Missouri–tradition villagers. This influx of people created territorial battles between the Middle Missouri–tradition and the Coalescent-tradition villagers. This interpretation follows the more prevalent view of group conflict as "ethnic" and provides a tidy and attractive explanation of the archaeological evidence for violent conflict.

For some, the discovery of the Crow Creek massacre in 1977 has reinforced the model of ethnic warfare. But what if this does not fully explain violent conflict in the Middle Missouri? What if relationships between

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and among the Middle Missouri and Coalescent villagers are more complex than the traditional model implies? What if Middle Missouri warfare is not adequately explained by an "us versus them" model? Though Great Plains archaeologists have challenged these assumptions (Hollinger 2005; chapter 10, this volume; Mitchell 2007; Stewart and Zimmerman 1989; Zimmerman and Bradley 1993) many researchers adhere to the traditional model.

Settlement studies, specifically site cluster analysis, may not yet be able to identify the Crow Creek attackers, but they can help describe the dynamic and intricate relationships among the village horticulturalists of the Missouri River trench. Clustering studies have had important implications for the study of warfare ranging from simply identifying warfare to identifying state formation (LeBlanc 1999, 2006). In the case of the Middle Missouri, clustering can be used to identify locations of potential political alliances.

BRIEF CHRONOLOGY AND CULTURAL INTERACTION

Any discussion of cultural interaction must be preceded by an exanimation of the taxonomic framework of the archaeological region in question. The taxonomy of the Middle Missouri was first proposed by Lehmer (1954) and further refined by Lehmer and Caldwell (1966) and Lehmer (1971). The intent here is not to rehash a detailed description of Middle Missouri taxonomy but to provide a basic framework for the archaeologically defined cultures. Lehmer's modified taxonomy defines two major cultural traditions in the Middle Missouri geographical division, with each divided into three variants: the Initial (IMM), Extended (EMM), and Terminal (TMM) Middle Missouri as well as the Initial (IC), Extended (EC), and Post-Contact Coalescent (PCC). The Initial Middle Missouri is further broken into two subvariants: Initial Middle Missouri east (IMMe) and west (IMMw). The majority of sites in the Missouri River valley in South Dakota are assigned to the IMMw and the debate concerning the origins of the IMM are centered on two models. The first argues that the IMM is the result of migrant populations from northwestern Iowa and southeastern Minnesota mixing with local Late Woodland populations (Toom 1992). More recently, archaeologists have argued that there is continuity between indigenous Late Woodland and IMM populations with local development (Tiffany 2007; Henning and Toom 2003). Similarly there is some debate regarding the origin of the EMM. While some contend the EMM is not a direct outgrowth of the IMM (Lehmer 1971), Ahler (2007) argues that the EMM is result of the interaction of the northern expression of the IMM with northern Late Woodland groups. Regardless of

its origination, the EMM is first identified in North Dakota and later expands into South Dakota (Johnson 2007a). As far as the TMM is concerned, there is little argument that these populations are descended from the EMM groups (Johnson 2007a; Toom 1992).

The emergence of the Coalescent tradition is attributed to the influx of village horticulturalists from the central Plains. While the origin of the Coalescent tradition needs additional clarification, it is clear that each subsequent variant within the Coalescent is an outgrowth of the previous. By definition, the Coalescent shows traits of both central Plains and Middle Missouri groups, indicating some sort of positive material and cultural trade between the two groups. This is evident in the IC, the earliest Coalescent variant, where ceramic analysis indicates that IC pottery derives from Loup River/Itskari, St. Helena, and Anoka phases of the central Plains while settlement patterns and fortifications are similar to Middle Missouri styles (Johnson 2007a). To what extent the Middle Missouri and central Plains migrants coalesced is still up for some debate. Steinacher and Carlson (1998) and Tiffany et al. (2011) argue that the IC is better viewed through the Central Plains–tradition Anoka phase rather than a Middle Missouri variant. It is fairly clear that the EC are descendent from the IC but Steinacher and Carlson question to what extent the EC mingled with the Middle Missouri–tradition villagers. Settlement patterns in the EC shift from larger nucleated sites to smaller, more-dispersed sites, perhaps as a result of warring during the occupation of IC sites (Zimmerman and Bradley 1993). Finally, the PCC is marked by the appearance of a change in pottery styles and introduction of European trade goods (Johnson 2007a).

Contemporaneity between variants of both the Middle Missouri and Coalescent traditions poses some confounding issues for a regional-scale study with considerable temporal depth within the Missouri area. Johnson (2007a) helped to alleviate this problem by organizing sites into 13 time periods, each spanning from 35 to 100 years in length, that encompass the period between AD 1000 and 1850. Assignment to each period was identified by chronometric dating and ceramic typologies. Though the inherent nature of chronologies dictates continued verification and refinement, this work allows village locations to be interpreted within a regional framework with a relatively tight chronological control for the first time. Table 12.1 shows the potential intervillage cultural interaction within the chronological framework presented by Johnson (2007a).

Table 12.1. Aggregation of Chronology and Taxonomy presented by Johnson (2007a)

Period	*Dates (AD)*	*Tradition/Variant Present*
1	1000–1100	IMM
2	1100–1200	IMM; Charred Body Complex (North Dakota only)
3	1200–1300	IMM; EMM
4	1300–1400	EMM; TMM (North Dakota only); IC
5	1400–1500	TMM (North Dakota only); IC ; EC
6	1500–1550	IC; EC
7	1550–1600	EC
8	1600–1650	EC; PCC
9	1650–1700	PCC
10	1700–1750	PCC
11	1750–1785	PCC
12	1785–1830	PCC
13	1830–1886	PCC

CLUSTERING AND WARFARE STUDIES

Site clustering has been used in several forms in the study of warfare. Archaeologists often cite the practice of clustering as a causal factor in sociopolitical development related to the formation of chiefdoms and states (LeBlanc 2006). Under this model, a centralized sociopolitical organization can derive from an initial condition of geographic isolation among allied villages, thus forming a functional need for political groups to perform the increased roles of a central, coordinating leadership. Some archaeologists working from an evolutionary perspective are beginning to study warfare beyond the confines of developing complexity. For example, Allen (2008) suggests warfare as a contributing factor in sociopolitical collapse and disorganization, and Arkush (2011) examines clustering and buffers in a non-centralized society, using Sahlins's (1961) segmentary lineage as a model to explain warfare in the Titicaca Basin.

The importance of geographic buffers has been noted in the Middle Missouri region as well. First discussed by Lehmer (1971) and expanded by Kay (2007), buffers have been used to show social distance and frontier expansion in the Cannonball subdivision that has been interpreted as evidence for a separation of TMM villages from Coalescent-tradition villages. In any region, this clustering and separation would have been a tactical move that created protection for villages through physical proximity with friendly neighbors. At

the same time there were significant expanses of land, referred to as no man's lands, which were sacrificed as uninhabited territories to maintain these protective alliances. These sacrifices included the losses of arable land and access to wood resources for both construction and fuel, and were amplified during times of drought (LeBlanc 1999). The extant studies of Middle Missouri subdivision buffering can be enhanced twofold. First, archaeologists can look at alliance building beyond the strict confines of ethnic boundaries as defined by the taxonomic framework. Second, researchers can utilize a suite of statistically derived locational information to understand the function of clustering beyond the mere visual identification of buffers.

Similar to Arkush (2011), I find it useful to return to Sahlins and the concept of segmentary societies in order to understand alliances. While the "segmentary lineage" concept may not perfectly fit the villagers of the Middle Missouri, the segementary aspect of tribal organization does provide a good foundation from which to address intergroup social relations. Acknowledging the caveats of stringent labels, the Band-Tribe-Chiefdom-State model is used herein as a convenient framework for comparison and not as a doctrine concerning evolutionary trajectories. Sahlins describes a tribe as a "segmental organization" (Sahlins 1961: 325) with an organization based upon multiple family groups or bands. Each band is a self-sufficient unit and is the smallest family group that occupies a specific territory. While bands may meet at seasonally appropriate times, and are bound through social rules and intermarriage, the tribe is not a strongly unified political organization. More so, the tribe may be better described in terms of ethnic identity instead of political consolidation (Sahlins 1961:325). Sahlins suggests three "facts" of tribal life. First, because of the segmentation, there is an inherent disunity within the tribe and no permanent confederation. Second, despite this loose political structure, the tribal units will ally when faced with an external enemy. Third, after the competition is resolved the bands will return to the relative political independence of the segmental organization (Sahlins 1961:326). While the Tiv and Nuer of Sahlins's original study were patrilineal, matrilineal kinship systems can be segmented as well (see Schwimmer 2003): the kinship system of the historic Mandan, Hidatsa, and Arikara was matrilineal. The important factor is that segmented societies are loose confederations of hierarchical political groups. In the Middle Missouri subregion, these political unit—families, clans, or bands—were organized into villages, with related villages loosely tied politically together (Bowers 1992:26; 2004:26). In fact, among the Hidatsa, the intervillage confederation was so loose that there was no unifying tribal council prior to the smallpox epidemic of 1780s (Bowers 1992:26–27).

This fluid model can become more complex through relationship-building practices. Generally speaking, Plains groups depended on their neighbors in a symbiotic relationship based around both kinship relationships and sodalities (Albers 1993). Ethnographic evidence throughout the Great Plains and the greater Midwest shows a broad trend of solidifying existing ties between communities and creating new relationships through encounters with external groups. Formal rites such as the Calumet of the Captain Ceremony (Blakeslee 1981; Albers 1993; Hall 1997) and the Making of Relations among the Ogallala (Brown and Steltenkamp 1993) served to initiate kinship ties between previously unrelated people. Not only do these kinship mechanisms reduce warfare, but they also create trading relations. No direct application of these particular ceremonies to the prehistoric past is intended here, but it is important to note that, at least during historic times, mechanisms were in place to create peace within potentially hostile relationships. While these sodalities did not prevent war, it did serve to reduce raiding between symbiotic groups (Albers 1993).

Archaeologically identifying the sociopolitical unit of the band may be difficult, but one could treat each village as an autonomous political unit. Bamforth and Nepstad-Thornberry (2007b) show that there are interactions between Middle Missouri and Coalescent villages, as shown through ceramic styles. Mitchell (2007) sees an interplay between trade and war in the late Plains Village–pattern sites in North Dakota. These studies show that while the taxonomies serve as useful tools to describe who, when, and where, they do not aid archaeologists in defining base political units. That is, each village makes its own decisions based on social and economic justifications. Genetic and linguistic relationships play a role in decisions, but are not the defining reason for being an ally or enemy. Simply put, archaeological taxonomies do not define cooperative or competing relationships—interactions between villages do.

If intervillage alliances were complex during historic times, it is reasonable to believe that these relationships were equally complicated throughout the prehistoric past. The nature of alliances is dynamic and, while it may be common for alliances to be forged, many are broken and few persist unchanged for very long durations. However, it is these long-term relationships that are most identifiable in the archaeological record. Though it may be difficult to identify the mechanisms for alliance building, settlement patterns can be used to infer when and where these alliances may have occurred. Specifically, cluster analyses, informed by fortification strategies, can indicate where and when these complex relationships existed.

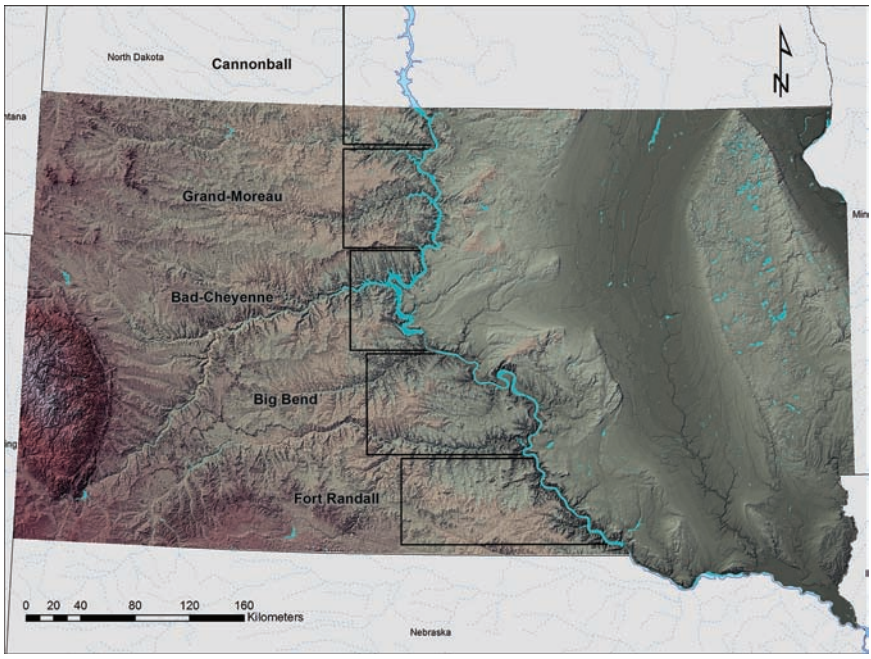

Figure 12.1. *Study area overview, South Dakota. Shaded relief map courtesy of the South Dakota Department of Environment & Natural Resources (SD DENR).*

VILLAGE LOCATIONS AND CHRONOLOGY

In order to investigate the presence of alliances in the Middle Missouri and how these relationships may have changed across time, cluster analyses are performed here using locational data from Plains Village–pattern sites located along the Missouri River in South Dakota (figure 12.1). These sites occupy, in order from north to south, the Cannonball, Grand–Moreau, Bad–Cheyenne, Big Bend, and Fort Randall geographical divisions of the Middle Missouri, as defined by Lehmer (1971). Sites located outside the trench along major tributaries, as well as sites located in the James River floodplain, were excluded from the study. The sites within each of the 13 time periods defined by Johnson (2007a) are treated as contemporaneous villages, with the understanding that this assumption may not hold true as more data are analyzed. In total, a population of 141 site locations is included in the study group and individual time-period populations varied from one site location (Period 13) to 29 locations (Period 9).

METHODOLOGICAL APPROACH

To conduct the analysis, I used a series of geographical statistical techniques that fall under the category of point pattern analysis. Therefore, the data included in the analysis comprise geographical site centroids for each of the village locations. Two of the techniques utilize measures of randomness while the third is a non-parametric density analysis. Inherent in many geographical analyses is the Modifiable Areal Unit Problem (MAUP). Simply stated, the MAUP refers to changes in the results due to the changes in the size and location of the study area. One way to visualize this is to think of election results. When the results are tallied at the state level there is one result. When broken down by county, there is a different result, and yet another result when aggregated by voting district. This does not mean that any one of these results is inherently flawed, but that it is important to understand results within the scale of analysis.

With point pattern analysis, issues arise with the size and shape of the study. Study areas can be arbitrary. That is, the area can be defined by a shape (rectangle, ellipse, envelope, etc.) that encloses all of the points. Study areas can also be bounded naturally, as in the case of a river basin, plateau, or terrace. Each of these methods has both benefits and limitations. In the case of archaeological point patterns, natural study areas are defined by the landscape. They attempt to replicate a livable area as defined by the environment, but they explicitly eliminate areas that may have been the focus of some human activity. Arbitrary areas are defined by the parameters of the technique, but they can include multiple environments that natural areas exclude. I took several steps in order to reduce the effects of the MAUP. First, I used multiple analyses, including nearest neighbor analysis, Ripley's *K* statistic, and kernel density estimates. Second, the analyses were conducted at different scales and with different areas. Lastly, one technique (Ripley's *K*) utilizes a multiscalar approach to show the variability in the size of clustering.

Nearest neighbor (NN) analysis has been used in archaeology for many years and, in the past, has been a primary tool for identifying cluster patterning at both the regional and the site scale (Hodder and Orton 1976; Whallon 1974). The use of NN statistics may have become prevalent because it is simple to calculate and interpret (Conolly and Lake 2006:164). Its detractors claim that the use of the NN statistic is not multiscalar and its use allows for assumption violations as well as errors due to edge effects (Durand and Pippin 1992:264; Conolly and Lake 2006:164).

The most common NN equation was developed by Clark and Evans (1954). The results of this equation can interpret the data in terms of clustered,

random, or regular distributions. The concept behind the statistic is that, in a random distribution of points, the estimated mean NN distance is related to density. Restated, it is "the expected mean distance between nearest neighbors in a random distribution is equal to the reciprocal of twice the square root of points in that given space" (Durand and Pippin 1992:264). The coefficient is simply calculated as the ratio of the observed mean distance of nearest neighbors divided by the expected mean distance of nearest neighbors. The results will produce a value between 0 and 2.1491. A value of 1 equates to a random distribution, a value less than 1 identifies clustering, and a value greater than 1 is evidence of uniform distribution (Durand and Pippin 1992:265).

Ripley's *K* statistic is an index of non-randomness for differing scale values used to identify clusters. It creates a random distribution of points, from a Monte Carlo simulation, and compares the highest and lowest values, or the "envelope," to the sample value. The statistic is calculated from a value of point intensity, or λ. The formula $\lambda K(r)$ is the expected number of points within the radius (r). The *K*-distribution is an aggregate of frequency of λ at different intervals of r. Using 1,000 to 5,000 iterations of the simulation can usually obtain 95 percent confidence (Bevan and Conolly 2006:221). Clustering can then be identified by comparing the actual population to the random population.

Kernel density estimates (KDEs) are a well-discussed statistical method that has seen minimal use in archaeology (Baxter et al. 1997:347; Wheatley and Gillings 2002). A KDE is a form of histogram that is represented in a smoothed fashion and allows for the presentation of multiple datasets in one figure. It can be used for either univariate or multivariate statistics (Beardah and Baxter 1996; Baxter et al. 1997:347) but bivariate statistical analysis (x and y coordinates) is generally used for spatial studies.

Univariate KDE can be thought of as a number of points (x_1 to x_n) located on a line. At each variable on the line a bump is placed and the shape of the bump is a result of the weighting function (kernel), or $K(x)$, while the spread is determined by the bandwidth (h). The value of h can be defined through a priori knowledge of the data, either through an equation or other knowledge of the data. Alternatively, h can be defined by "plugging-in" techniques where different values are tested in order to find the best fit. A value that is too large will "over-smooth" the results; while underestimating h will yield results that are too coarse (Baxter et al. 1997:348).

Bivariate KDEs have a similar principle except that, instead of points on a line, variables x and y are displayed as points on a plane. Each point is again represented by a "bump." Choices of bandwidth are performed in a similar fashion as univariate decisions for h, but tend to be more subjective. With an

individual point, the results appear as a "bull's eye." If there are overlapping results they are displayed as contour lines (Baxter et al. 1997:348–349). Most examples of KDE have been performed to show clustering of artifacts at the site level (e.g., Beardah and Baxter 1996; Baxter et al. 1997), but KDEs can also be used at the much larger regional level (Wheatley and Gillings 2002:187).

The use of these three techniques in concert alleviates the issues of any one of the methods individually. The NN analysis, while showing clustering at the global scale, does not show clustering at the local scale. The Ripley's *K* statistic addresses the multiscalar issue but is affected by the MAUP. The KDE helps to visualize the location of the clustering, while comparing scalar issues through calculating the statistic multiple times with different parameters.

RESULTS

Nearest Neighbor Analysis

The NN analysis was conducted using an area defined by a combination of the Missouri River Trench and the extent of all the sites located within the trench with the calculations made using ArcGIS 10. One study area was used for all of the time periods and I calculated the NN for seven out of the 13 periods identified by Johnson (2007a). Periods 1–3 and 13 were excluded due to an extremely low population ($n < 10$). The results are presented in table 12.2.

Periods 5 through 7 show a dispersed settlement pattern, while Periods 8, 9, and 11 fall within a normal distribution. Only Period 10 indicates a clustered patterning. The average NN ranged from roughly 8 to16 km for the dispersed settlement pattern and roughly 5.75–9.80 km for the random pattern. The average NN for the clustered settlement pattern was 4.5 km.

Ripley's *K* Statistic

To test the potential for and significance of clustering, I first ran the Ripley's *K* statistic using Crimestate III (Levine 2010). There were four time periods—Period 5 (AD 1400–1500), Period 6 (AD 1500–1550), Period 9 (AD 1650–1700), and Period 10 (AD 1700–1750)—that had large enough populations ($N = 19, 22, 29$, and 28, respectively) to garner significant results. For comparison, 1,000 random populations were calculated for each time period. The bounding study area was defined by a minimum enclosing rectangle. A new rectangle was calculated for each time period, resulting in study areas that were defined by the centroids of village locations and the sample relevant only to each individual time-frame.

Table 12.2. Results of the Nearest Neighbor Analysis

Period (AD)	N	*Result*	*Ratio*	*Z-Score*	*Expected (m)*	*Observed (m)*
5 (1400–1500)	19	Dispersed	1.601229	5.013573	6,674.74	10,687.79
6 (1500–1550)	22	Dispersed	1.279397	2.507055	6,202.97	7,936.07
7 (1550–1600)	13	Dispersed	1.96265	6.640047	8,069.37	15,837.36
8 (1600–1650)	12	Random	1.163473	1.083346	8,398.87	9,771.86
9 (1650–1700)	29	Random	1.073497	0.757178	5,402.72	5,799.80
10 (1700–1750)	28	Clustered	0.819657	−1.82562	5,498.35	4,506.76
11 (1750–1785)	11	Random	1.031614	0.200586	8,772.33	9,049.66

Figure 12.2 shows the results of Ripley's *K* analysis. It charts a square root of *k* [*L(t)*] by distance in kilometers. The solid line charts *L(t)* for the actual population, while the dashed lines indicate the maximum and minimum *L(t)* for the random populations. The latter two create the random "envelope" indicating the boundaries for non-random significance. For Period 5, the population falls outside of the random envelope between 2 and 25 km (represented by the dotted lines). This indicates that clustering occurs non-randomly (intentionally) at scales ranging from 2 to 25 km. The results from Period 6 show similar results, but clustering is significant at smaller scales (2–16 km), while Periods 9 and 10 show significant clustering at much larger scales (0–60 km and 0–45 km, respectively). Overall, these results indicate that village clustering is evident and significant during these four time periods and that clustering shifts from relatively smaller to relatively larger scales over time.

Kernal Density Estimates

Although the KDE analysis does not show statistically significant clusters, it allows one to visualize clusters and identify patterns. The analysis is not inherently temporal or multiscalar but, when calculated for multiple periods and at different scales, it can be used in those capacities. This analysis shows intensity of occupation during each of the defined chronological periods. To tie in the results of the Ripley's *K* statistic, the KDE search was conducted at two scales—16 km and 25 km—the results of the two smallest significant cluster groups. This allows for a relatively localized analysis (16 km) and a more regional scale analysis (25 km). I calculated KDEs for Periods 1–10, excluding Periods 11–13 because of the relatively small number of sites and the random results for the NN statistic in Period 11.

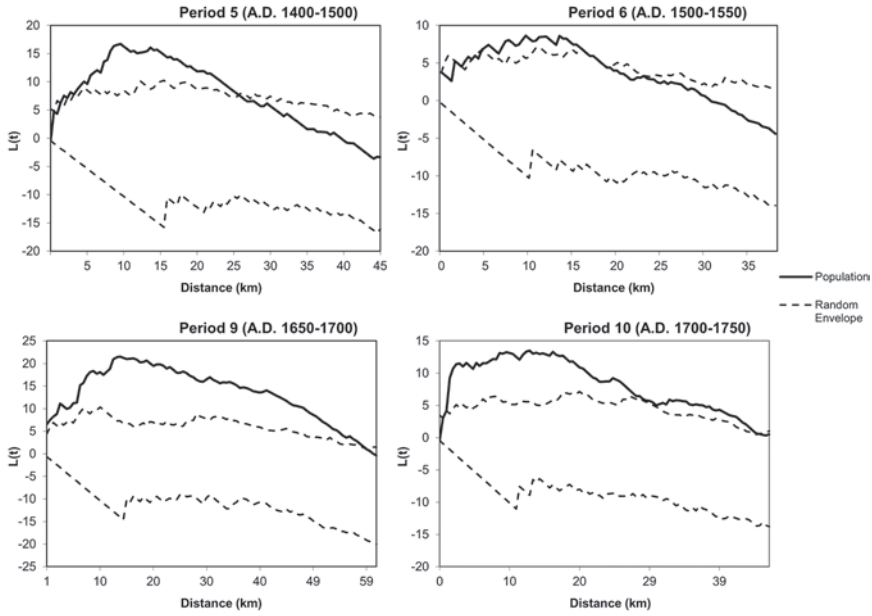

Figure 12.2. *Ripley's K results for Periods 5, 6, 9, and 10.*

While one must be careful not to equate ditches with warfare (LeBeau, chapter 6, this volume), the structures can still be viewed as one line of evidence for defensive strategies and I will mention their locations. The chronology of fortification building is poorly defined with current data. It is difficult to estimate at what point the fortifications were built, and in the case of villages with multiple fortifications it can be difficult to identify the order of construction. The presence of fortification needs to be understood within this context, but patterns do exist and these data are used anecdotally.

Some interesting patterns emerge during the analysis of Johnson's (2007a) Period 1 (AD 1000–1100). The earliest, and the most intense, occupations occur in the Big Bend and Bad–Cheyenne geographical divisions. At the regional (25 km) scale there is one cluster that lies mostly in the Big Bend and two outlying isolated sites, one each in the Cannonball and Fort Randall divisions (figure 12.3). Throughout time, settlements aggregate around the Big Bend clusters and the outliers in the Cannonball and Fort Randall division. This sets up the major clustering groups and unoccupied zones. At the local scale, two concentrations are exhibited within the Big Bend cluster. Fortifications are present at three of the seven villages in the

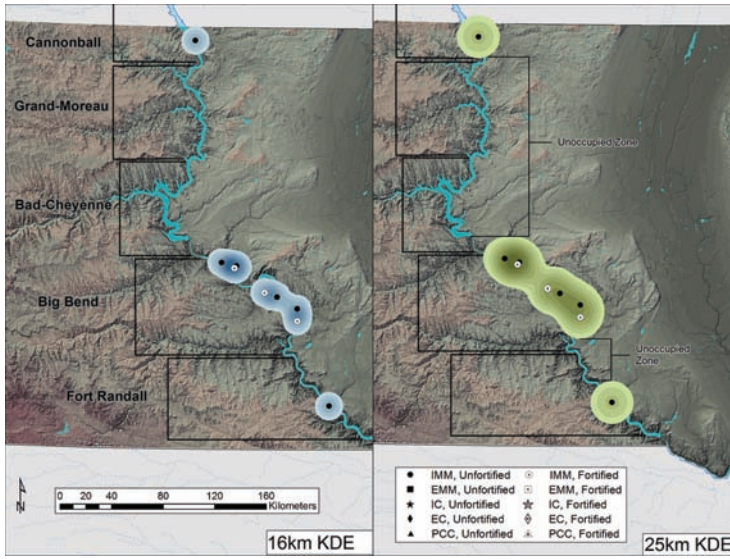

Figure 12.3. *Results of the 16-km (left) and 25-km (right) KDEs for Period 1 (AD 1000–1100). Shaded relief map courtesy of the SD DENR.*

region during this first period, which at this point is only occupied by Initial Middle Missouri villagers.

During Period 2 (AD 1100–1200) the local clusters expand well into the Bad–Cheyenne division (figure 12.4). The Grand–Moreau division remains unoccupied, but the unoccupied zone decreases in size while the Fort Randall unoccupied region remains approximately the same size. Four of the nine villages are fortified. Interestingly, within the Big Bend and Bad–Cheyenne regions an additional unoccupied zone is introduced.

Period 3 (AD 1200–1300) marks the end of the Initial Middle Missouri, the beginning of the Extended Middle Missouri, and the beginning of occupation in the Grand–Moreau region. Following the split in the Bad–Cheyenne and Big Bend settlement clusters during Period 2, the buffer zones between these groups decrease in size at the regional scale during Period 3 (figure 12.5), but local clustering is still present. Despite the additional population living in the Grand–Moreau area, there is still a significant separation between the Grand–Moreau and Bad–Cheyenne regions, with a smaller separation between the Big Bend and Fort Randall regions. While fortifications are now present in all three regions, they are most abundant within the Bad–Cheyenne and Big Bend clusters.

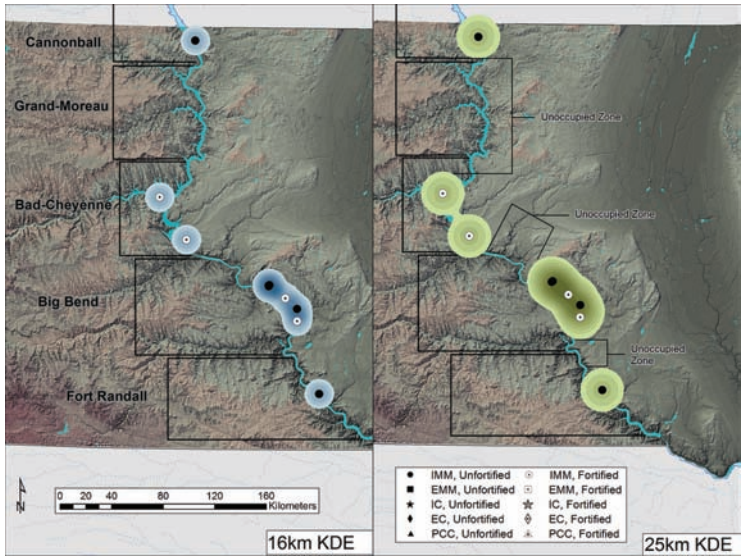

Figure 12.4. *Results of the 16-km (left) and 25-km (right) KDEs for Period 2 (AD 1100–1200). Shaded relief map courtesy of the SD DENR.*

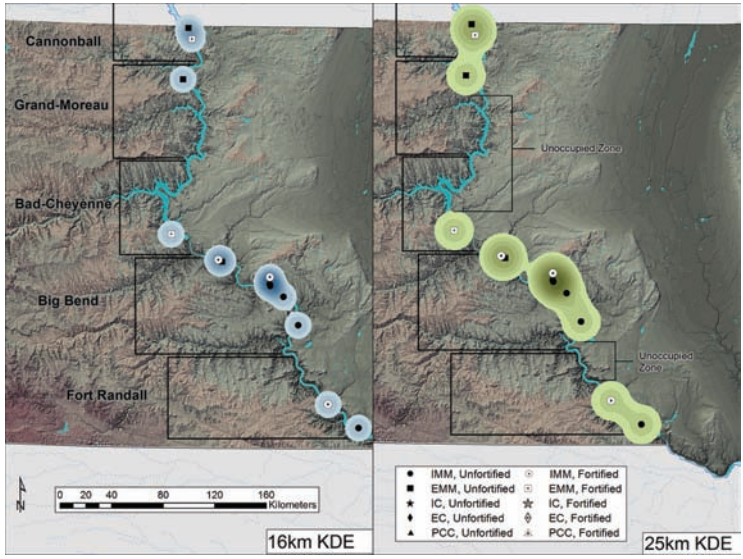

Figure 12.5. *Results of the 16-km (left) and 25-km (right) KDEs for Period 3 (AD 1200–1300). Shaded relief map courtesy of the SD DENR.*

Overall, Period 4 (AD 1300–1400) shows less-intense occupation of the region and a more dispersed settlement pattern. There is a separation, both regionally (figure 12.6) and locally, into paired villages, which are relatively evenly distributed regionally. The unoccupied area of the Grand–Moreau is significantly reduced and the Bad–Cheyenne to Big Bend empty area reemerges. The settlements of this period are also heavily fortified with all but two of the villages possessing fortifications and each pair having at least one fortification. It is within this period that we see the first appearance of the Initial Coalescent villagers. Contrary to expectations of initial ethnic-group separation, one of the site pairs includes both cultural traditions.

Period 5 (AD 1400–1500) marks the beginning of the Extended variant of the Coalescent tradition. During this time there is a further reduction in the unoccupied buffer of the Grand–Moreau. The buffer between the Big Bend and Bad–Cheyenne divisions remains the same and serves to separate two fortified Initial Coalescent communities (figure 12.7). At the regional scale there appears to be a general trend for dispersal, while at the local scale, smaller clusters are evident within Bad–Cheyenne, Grand–Moreau, and Cannonball divisions. Five of the 19 villages are fortified, including the two southernmost villages.

During Period 6 (AD 1500–1550) the unoccupied zones are not significantly present at the regional scale (figure 12.8), but the local clustering trend continues. Fortifications are present at northern sites in the Grand–Moreau subdivision and southern sites in the Big Bend. This period marks the end of the Initial Coalescent.

The border of the Fort Randall geographical division is reoccupied during Period 7 (AD 1550–1600), ending the general northward settlement trend. Coupled with this southern expansion is another increase in the Grand–Moreau/Bad–Cheyenne buffer zone (figure 12.9). At both the regional and local scales there is a dispersed settlement pattern in the Bad–Cheyenne and Big Bend geographical divisions, but an intense local cluster on the Cannonball/Grand–Moreau border. There is also a dramatic shift in fortification strategy with only two walled sites (one at the northern periphery) in the Bad–Cheyenne region but palisades present at three of the four of the Cannonball/Grand–Moreau sites. It is noteworthy that there is a large unoccupied zone north of the Cannonball/Grand–Moreau cluster, spanning the territory up to the Heart River in North Dakota.

During Period 8 (AD 1600–1650) there is an overall decrease in occupation intensity throughout the region. The most intense area of occupation is located at the southern boundary of the Big Bend division near the mouth of the White River. The largest unoccupied zone is between the White River group and the

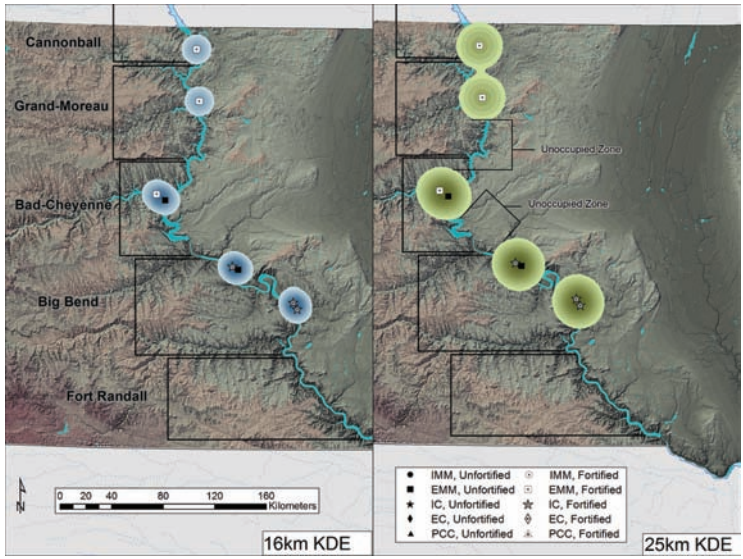

Figure 12.6. *Results of the 16-km (left) and 25-km (right) KDEs for Period 4 (AD 1300–1400). Shaded relief map courtesy of the SD DENR.*

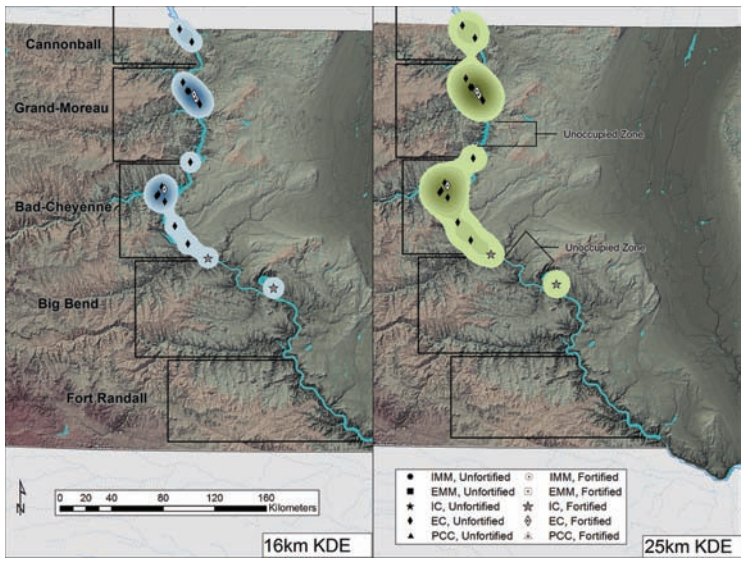

Figure 12.7. *Results of the 16-km (left) and 25-km (right) KDEs for Period 5 (AD 1400–1500). Shaded relief map courtesy of the SD DENR.*

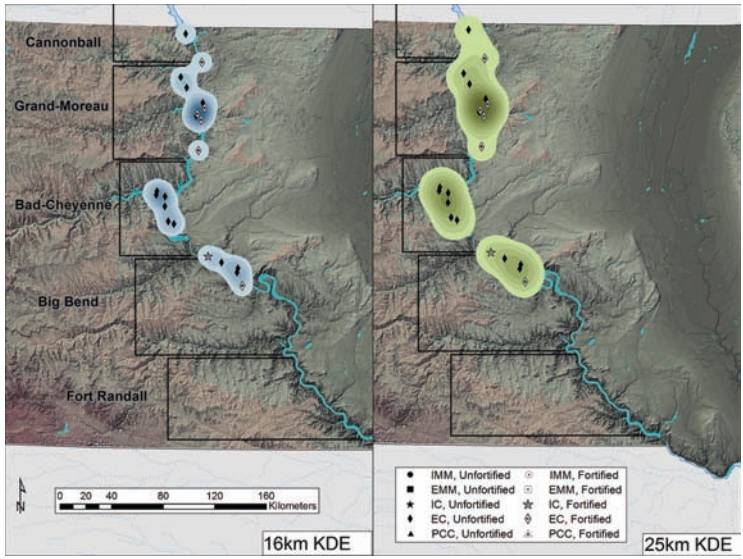

Figure 12.8. *Results of the 16-km (left) and 25-km (right) KDEs for Period 6 (AD 1500–1550). Shaded relief map courtesy of the SD DENR.*

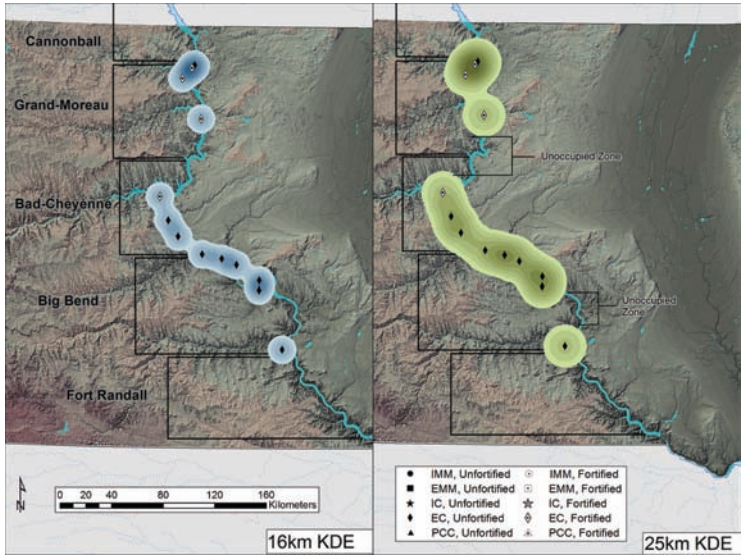

Figure 12.9. *Results of the 16-km (left) and 25-km (right) KDEs for Period 7 (AD 1550–1600). Shaded relief map courtesy of the SD DENR.*

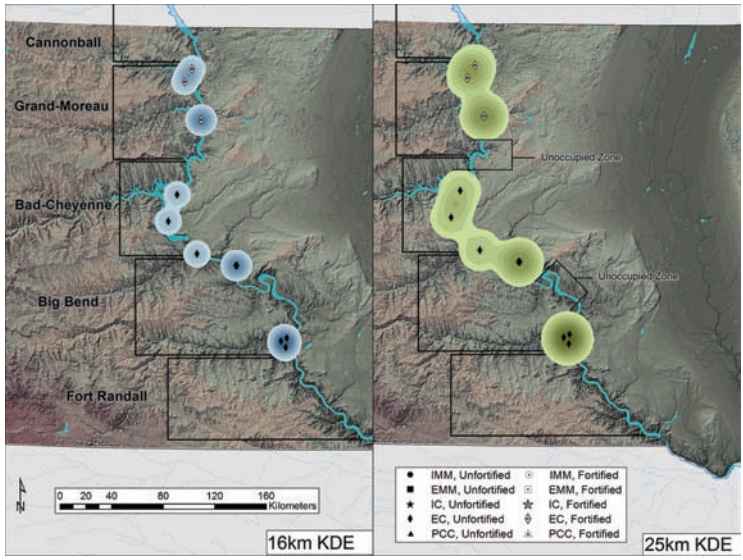

Figure 12.10. *Results of the 16-km (left) and 25-km (right) KDE for Period 8 (AD 1600–1650). Shaded relief map courtesy of the SD DENR.*

Big Bend/Bad–Cheyenne group (figure 12.10). Local clustering is evident within the northern Grand–Moreau/Cannonball area and the only fortified villages are located within these northern groups. Period 8 marks the end of the Extended Coalescent and the beginning of the Post-Contact Coalescent in North Dakota.

Marking the beginning of the Post-Contact Coalescent in South Dakota, there is a florescence of occupation during Period 9 (AD 1650–1700) throughout all geographic divisions of the Missouri River. Clustering is evident locally (figure 12.11) and regionally, and unoccupied areas are present in the Grand–Moreau, Bad–Cheyenne, Big Bend, and Fort Randall areas. All of the northern villages of the Grand–Moreau and Cannonball divisions remain fortified, while fortifications in the other divisions are centrally located within the clusters.

Settlement patterns in Period 10 (AD 1700–1750) exhibit regional dispersion with local clustering (figure 12.12). The unoccupied zone in the Grand–Moreau division is maintained while the Fort Randall division is abandoned and site locations move northward, beginning a trend of movement out of South Dakota. Fortifications are spread broadly throughout the region, except at the southern cluster of sites.

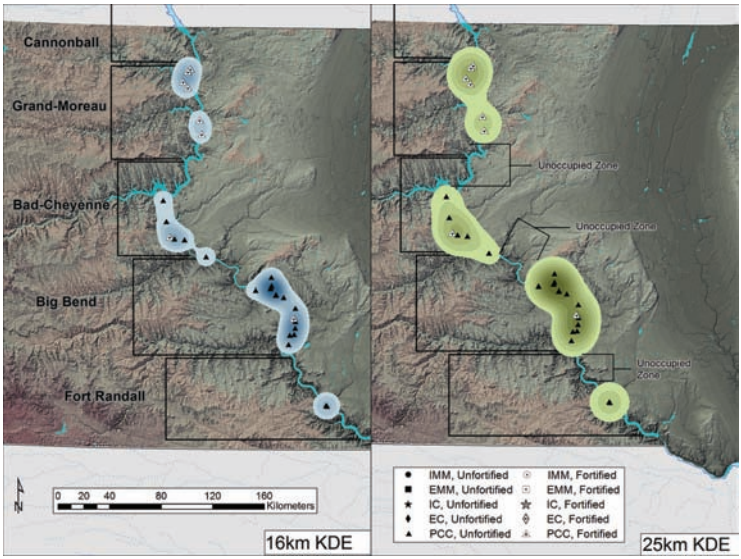

Figure 12.11. *Results of the 16-km (left) and 25-km (right) KDEs for Period 9 (AD 1650–1700). Shaded relief map courtesy of the SD DENR.*

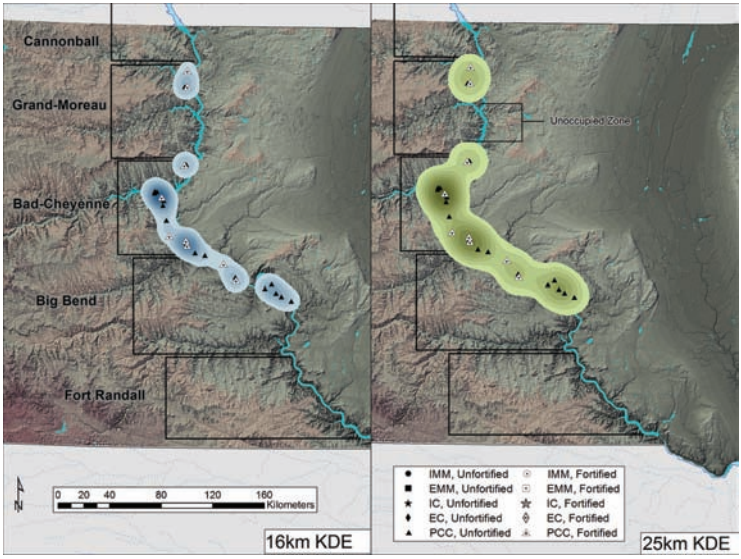

Figure 12.12. *Results of the 16-km (left) and 25-km (right) KDEs for Period 10 (AD 1700–1750). Shaded relief map courtesy of the SD DENR.*

Discussion

Though the results of the Ripley's *K* and NN analysis seem to be conflicting at points, this can be attributed to scalar issues. Ripley's *K* is inherently multiscalar, but it relies heavily on the definition of the study area. With the study area defined by the minimum enclosing rectangle, clustering has a simple cause, the location along the Missouri River. But, upon closer inspection, other patterns exist that are significant at different scales (see Periods 5, 6, 9, and 10). Alternatively, the reduced study area of the NN analysis shows a pattern of more-dispersed settlement. But even within the NN analysis, the results shift through time. Taking both analyses into account, the results show dispersal at the regional scale, with clustering locally, and the intensity of this pattern shifts throughout time. The upper and lower scalar limits of the Ripley's *K* results indicate that the upper limit of clustering (i.e., distance where the populations fall back into the random envelope) ranges from 16 km (Period 5) to 60 km (Period 10). These upper limits may indicate the geographical extent of the political alliances during those periods.

The results of the KDE visualize when and where the alliances were located. While KDE results, in general, are influenced by researcher-defined parameters, in this case we reduced this influence by using scales informed by the Ripley's *K* results. The larger-scale KDE (25-km parameters) may be overly inclusive; the smaller-scale results (16-km parameters) may be overly exclusive. Using the two scales, comparing the results to each other and comparing the result to the NN and Ripley's *K* results is the best way to understand the nature of the clusters. Generally, clusters are located in each of the predefined geographical subdivisions in South Dakota. Throughout time these clusters expand and contract and, at some points, are defined by a northern group (Cannonball and Grand–Moreau divisions) and a southern group (Bad–Cheyenne and Big Bend) group. For instance, in Period 3 at the 16-km and 25-km scales (figure 12.5), there are clusters in four of the geographical divisions while in Period 7 (figure 12.9) the clusters consolidate and there are no longer significant clusters at these scales.

Fortification strategies also vary throughout the settlement clusters. Frequently, fortifications are dispersed across the region, as they are in Periods 3, 4, 5, and 6. In Periods 7, 8, and 9 sites are fortified in northern South Dakota, but not frequently in the south. Fortified villages can be placed at the edge of clusters, as they are in the Bad–Cheyenne/Big Bend cluster in Period 5, whereas the Bad–Cheyenne and Big Bend clusters of Period 9 show a centralized fortified village with unfortified neighboring villages.

When not associated with a larger cluster, a village may pair with another village, with at least one being fortified (see Periods 3 and 4). An interesting

example of this strategy can be found during Period 4 (figure 12.6) with the Durkin Village, an unfortified Extended Middle Missouri village, and Whistling Elk, a fortified Initial Coalescent village. This may indicate an alliance between communities belonging to different taxonomic variants, which have sometimes been interpreted as representative of different ethnic groups. Even if there were no formal alliance, the lack of fortification at Durkin Village indicates that the Extended Middle Missouri village did not fear attack from their potentially ethnically different neighbors, at least in this instance. This type of relationship may contradict the traditional view of a hostile relationship between Middle Missouri and Coalescent villagers. While the exact timing of the Crow Creek massacre cannot be identified (Bamforth and Nepstad-Thornberry 2007a), this unorthodox pairing is contemporaneous with the Initial Coalescent component of the Crow Creek village. This does not disprove that the massacre was perpetrated by Middle Missouri villagers; however it does call into question assumptions concerning pan-regional hostilities between Middle Missouri and Coalescent peoples.

A similar situation occurs during Period 3 (figure 12.5) with Stony Point, a fortified Initial Middle Missouri village, in close proximity to Ketchen Village, an unfortified Extended Middle Missouri village. Depending on the unresolved ancestral origins of the Extended Middle Missouri, this potential alliance has significant implications for intergroup warfare. If the Extended variant is directly related to the Initial, then the pairing may simply be the result of continuity between the variants during a transitional period. If the Extended Variant does indeed represent an incursion of ethnically similar yet distinct immigrants from North Dakota, then the potential alliance suggests greater complexity of intergroup social relations. Again, while it is difficult to say that these two villages were definitively allied, the fact that the Ketchen villagers traveled into IMM territory and did not feel the need to fortify indicates that the EMM people did not fear attack.

Conversely, just as there are intertradition and variant pairings and clusters, there are unoccupied zones, or no man's lands, separating villages of the same tradition and variant. The unoccupied zones are between IMM sites present in Period 1 (figure 12.3) and this pattern persists until Period 3 (figure 12.5), when the IMM abandon the Cannonball and Grand–Moreau and the northern no man's land separates EMM villages. These unoccupied zones are present at times when there is only one tradition throughout the Missouri River in South Dakota, suggesting internecine warfare, while less-dramatic, unoccupied zones are present in Period 4 (AD 1300–1400; figure 12.6) during the first appearance of the IC. If ethnic warfare was the only applicable

model, the no man's land would be found between EMM and IC clusters. In reality, there is no clear division between EMM and IC sites and, when there is separation, the unoccupied zones occur between EMM sites or between an EMM cluster and a mixed EMM/IC pairing. It is obvious that the nature of these relationships can be better understood with more precise chronological data. However, the settlement patterns within the currently established village chronology show territorial clustering and dispersal within these 100-year time frames.

The pattern of fortification building is also informative as it pertains to the nature of warfare. Frequently, where no man's lands are present, Middle Missouri–tradition villagers fortify the frontiers. All of the IC sites included in this study are fortified. While the Middle Missouri–tradition villagers were enhancing some of the unoccupied zones with palisades, IC villagers protected all sites, or at least all sites included within Johnson's (2007a) chronology.

Ultimately, archaeologists need to consider four scenarios while discussing the combatants of Missouri River warfare: (1) Plains Village versus Late Woodland and/or nomadic hunters, (2) external village warfare, (3) internecine village warfare, and (4) interregional warfare. While external village warfare is the most commonly argued scenario, there is growing evidence for other scenarios as well. For instance, at the fortified Fay Tolton village there are indications of site burning and osteological evidence for interpersonal conflict (Hollimon and Owsley 1994). Also, Fay Tolton is occupied during the same period (Period 2) as the Late Woodland Charred Body Complex occupations, suggesting the possibility of conflict between Late Woodland and IMM along with the cooperative interaction that Ahler (2007) shows. Others have noted that the personal conflict at Fay Tolton may indicate internecine warfare (Krause 2012:130). There is similar debate concerning the Crow Creek massacre with some hypothesizing that it may have been the result of internecine war (Zimmerman and Bradley 1993; Zimmerman and Stewart 1991) and others arguing that the massacre may be the result of Oneota expansion (Hollinger 2005; chapter 10, this volume).

CONCLUSIONS

Archaeologists may discover that every scenario will not be present at all times, but it is likely that they are not mutually exclusive. This study shows the importance of understanding warfare at different scales, in both the methodological and interpretive frameworks. The relationship of settlement, landscape, and warfare will also be furthered by addressing some key issues.

In the Middle Missouri, the idea of ethnic warfare as the sole model of warfare among village farmers is called into question. Violent conflict certainly had an ethnic component, but looking at the Middle Missouri through a lens of a segmented society is informative to understanding village politics. That the band is the base political level has implications in both war and peace. These ties can be implied by studying the clusters and fortification strategies in the Middle Missouri.

Although there is temporal variation in fortification strategy, there is a need for better chronology of fortification building. At what point in the occupation were the fortifications built? This is important at sites like the Arzberger village, where it was occupied in parts of two centuries. For sites that have multiple concentric fortifications, such as the Stony Point village, in what order are fortifications built? Do multiple fortifications represent expansion or contraction of village size? Is this consistent in all villages with multiple fortifications? Finally, to strengthen the relationship of settlement patterns with warfare, archaeologists should attempt to identify and test other reasons for clustering and thus potentially exclude competing models.