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CHIPPING THROUGH TIME: THE EVOLUTION OF LITHIC SPATIAL ORGANIZATION AT THE BRIDGE RIVER PITHOUSE VILLAGE, BRITISH COLUMBIA

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ABSTRACT

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Chipping Through Time: The Evolution of Lithic Spatial Organization at the Bridge River Pithouse Village, British Columbia

Chairperson: Dr. Anna Prentiss

Archaeological investigations at Housepit 54 within the Bridge River site have, to date, exposed 15 discreet floors primarily dating to ca. 1500-1000 cal. B.P. In this thesis, the spatial distributions of lithic artifacts from every floor are examined. Questions will be addressed specifically towards formation processes and the potential relationships between the patterning of lithic distributions as they relate to hearth-centered activity areas or domestic areas and fluctuations in estimated population. In addition, this thesis explores spatial organization as a cultural trait or concept that can be transmitted through time. Using the same methodological and theoretical approach for each floor, we examine feature form and function, lithic tool production and maintenance, and spatial relationships of lithic distributions. From these studies, we draw conclusions regarding the spatial continuity of artifact distributions between subsequent floors. GIS software was used to display and analyze lithic artifact distributions on each individual floor. Results of this research permit us to develop a range of implications regarding household occupational history and sociality.

Chapter 1: Introduction

This study is in conjunction with the Bridge River Archaeological Project (BRAP) which has been ongoing since 2003. The research resulting from field investigations has pushed the methodological and theoretical limits of household archaeology and has the potential for a countless number of other ground-breaking studies. Research has allowed for the development of a range of implications regarding household occupational history and sociality including studies of social stratification and inequality, cultural transmission processes, and socio-economic/political change. The research has also been completed in close collaboration with the Xwisten, Bridge River Indian Band of British Columbia whose ancestors originally occupied the site. The Band has provided valuable insight and interpretation that has aided the project and have assisted in the excavation efforts over the past few years. The results from the Bridge River project have added to the existing indigenous knowledge of the region, which contributes to the growing cultural tourism program that has been successfully established in the community. The specific purpose of this thesis is to study the evolution of household spatial organization among complex hunter-gatherer-fishermen and women of the Mid-Fraser area of interior British Columbia. Excavations of Housepit 54 of the Bridge River Pithouse Village site have revealed 17 distinctly occupied floors containing an exhaustive dataset that includes lithics, faunal remains, fire cracked rock (FCR), and a variety of features. The lithic dataset is used in this study to track changes over time in the spatial organization of technology on the housepit floors. Specific attention will be given to the potential effects that population has on the spatial makeup of a household.

Two different scenarios will be tested to look at the determining factors for spatial organization of lithic technology within the housepit. The first scenario will pull from the household and site structure literature to review the concept of the households as analytical units, and how these units are organized by the individuals who reside within them. Ethnographic and archaeological examples of households from the Northwest Coast and Canadian Plateau will be used to draw conclusions about the spatial organization of the inhabitants' domestic space. The site structure literature will contribute to the study of how big of a role cultural formation processes and spatial contingencies played in the final resting place of cultural materials. This literature pulls from ethnographic as well as archaeological examples will also contribute to understand the reasons why residential spaces are organized the way they are. The second scenario in this study is framed by Neo-Darwinian evolutionary models, specifically pulling from the principles of Cultural Transmission theory in an attempt to determine if concepts of space are transmitted as a cultural trait.

Geographic Information Systems (GIS) will be used to map the specific patterning and spatial distribution of lithic artifacts on each of the 17 house floors. The lithic tool types contained within distinct distributions can will also be mapped to examine where specific activity areas and lithic production are occurring. Feature data such as hearths and cache/storage pits will be mapped alongside the lithic material to better understand the evolution of spatial organization. Visualized distribution patterns of each floor will be directly compared to quantify the change over time in the organization of lithic artifacts. In order to ensure that the cultural materials being studied are relatively undisturbed by cultural formation processes, size grade distributions of the smallest lithic material will be compared to larger materials to see if sweeping or cleaning has occurred in areas of the house.

There will be six chapters total in this thesis, along with an appendix which will contain additional figures, maps, and tables pertinent to the study. Chapter 2 will be an overview of the

Mid-Fraser region of interior British Columbia where this study takes place. A brief summary of the archaeological record of the region, major pithouse villages of the Mid-Fraser, the Bridge River village, and a summary of investigations at Housepit 54 will be discussed to provide context to this study.

Chapter 3 will involve a theoretical discussion of household archaeological theory, the theory behind site structure studies, as well as the relevant principles of cultural transmission theory. This three-pronged theoretical approach creates a framework that allows for the construction of hypotheses and expectations to be tested by this study's multi-methodological approach.

The methodology will be discussed in chapter 4 and includes brief explanations of the excavation and laboratory techniques and will also include an in-depth discussion of the GIS methods. Each GIS tool that is utilized in this study will be described in addition to the parameters included in the operation of the tool. The choice to use a specific GIS tool will also be explained.

Chapter 5 will include the results of the analyses, which will lead to a discussion of how they relate to the hypotheses referenced earlier. The beginning of this section will look at the results of the effects that formation processes had on the dataset that is used. Following this, it will be organized floor by floor starting with the oldest floor, IIo, with descriptions of the distribution of total lithic material, debitage, tools, and features, in addition to the comparison of distributions between subsequent floors (when applicable).

Chapter 6 will conclude the study and summarize the findings from this study by either accepting or rejecting the defined hypotheses and discuss some areas of future research and how this project can benefit other similar studies.

Chapter 2: The Mid-Fraser and the St'át'imc

The Middle Fraser River Canyon is a culturally rich area along the Fraser River with an extensive prehistoric and historic archaeological record. The region is home to dozens of small and medium sized sites in addition to almost 10 large villages of at least 30 housepits (Figure 1). These sites and villages were left behind by the ancestors of the St'át'imc Nation, a group of Salish-speaking people who have lived in this area the longest (Prentiss and Kuijt 2012). Ethnographic observation from early anthropologist James Teit estimated that the population of the St'át'imc could have been up to 4,000 people at contact with Westerners (Teit 1906). In the same series of observations, Teit described that almost all the St'át'imc and surrounding groups of people lived in round, semi-subterranean structures, or pithouses, during the winter months (1906). Teit's ethnographies of the Middle Fraser and surrounding area (1900, 1906, 1909) describes the subsistence patterns of the complex hunter-gatherers organized by "moons" or seasonal events starting in November. During the cold moons, the St'át'imc would remain in their houses, relying on food caches and work to prepare for the spring months when they emerged from their

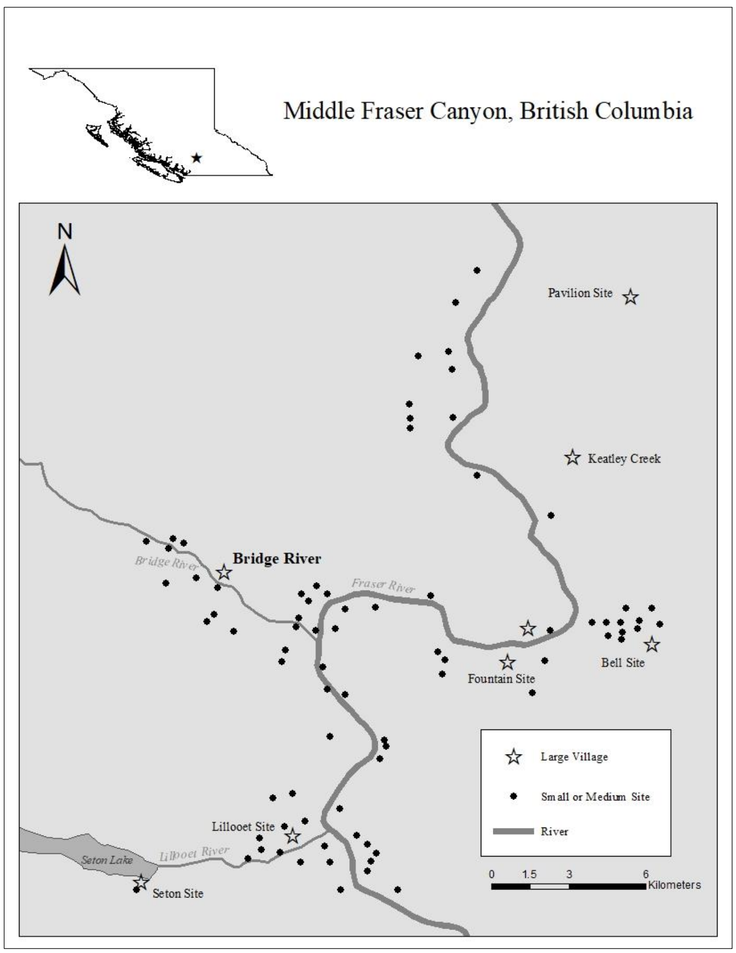

Figure 1. Locations of archaeological sites and large villages in the Middle Fraser Canyon.

dwellings in search of food. After this time, they began to gather ripening berries and fish for smaller fish species in addition to hunting small and large game native to the Rocky Mountain ecosystem. During the tenth moon, the salmon would run up the rivers in great numbers and provide perhaps the most important resource to the people of the region (1906). Interviews with living St'át'imc people combined with early ethnographic observations have shown that the social organization of the bands were centered around the family unit (Prentiss and Kuijt 2012). Individual families organized into larger units called clans, each with their own chief, and identified by their clan's descent from ancient human or animal beings (Teit 1906). Clans had their own individual fishing rights along various stretches of the Fraser and surround rivers in addition to specific root digging grounds and hunting trails or areas that were the "property" of the clan (Teit 1906). Clans would come together for large festive displays called potlatches. Individuals other than chiefs could give a potlatch to another but during a chief's potlatch, the event was equivalent to a potlatch given by all members of one clan to another (Teit 1906). The historical accounts and interviews of living St'át'imc people of the Middle Fraser Canyon have proven to be invaluable to the interpretation of the regions' archaeological sites.

The Bridge River Village and Housepit 54

The site that is the focus of this study is the major pithouse village of Bridge River (Figure 2) located at the joining of the Bridge and Fraser rivers. The St'át'imc people whose ancestors lived at this site are the Bridge River Band (Xwísten) or Bear Clan who have worked closely with the University of Montana since investigations began in 2003. The Bridge River village has been the subject of archaeological investigation since the mid-1970s (see Stryd 1972; Stryd and Baker 1968; Stryd and Lawhead 1978), but the village occupations weren't well understood until the most recent studies initiated in 2003. The investigations within the past decade have explored the geophysical properties of the village which lead to initial test excavations of a handful of the housepits (housepits 11, 16, 20, 24, 25 and 54; see Prentiss et al. 2008). Radiocarbon dates from these excavations revealed four distinct occupations of the village which were from approximately 1800-1600 cal. B.P., 1600-1300 cal. B.P., 1300-1000 cal. B.P., and 500-100 cal. B.P. (Prentiss et al. 2008; Prentiss et al. 2018) These occupations are known in chronologic order as Bridge River (BR) 1, BR2, BR3, and BR 4. After the testing of these houses, Housepit 54 became the focus of large-scale block excavations that have revealed 17 intact occupational floor surfaces and five roof deposits. Radiocarbon samples taken from all floors and several roofs over the course of the research project using the AMS technique revealed that Housepit 54 was occupied during the BR 2, BR 3, and BR 4 time periods (Prentiss et al. 2018). Floors were designated with “II” and a corresponding letter indicating which strata is referenced, starting with IIa for the most recent floor and ending with IIo at the deepest. Floors were discerned from one another from macroscopic and microscopic scales and contain many small lithic and faunal artifacts. All floors will be examined in this study, however between floor comparisons will only be made during stratum with similar house shapes. During early BR 2 (floors IIo-IIm) the housepit shape was small and circular and only was found in one

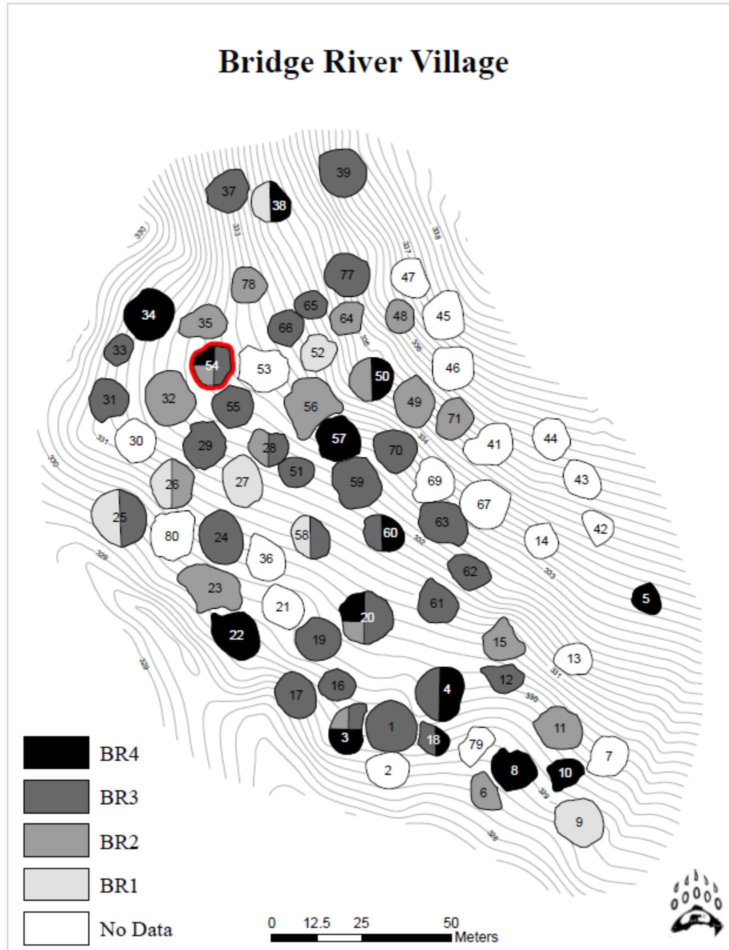

Figure 2. The Bridge River pithouse village with HP 54 highlighted.

excavation block, floors IIl-IIf contained a rectangular shaped house only found in two excavation blocks, and floors IIe-IIa contained the entire circular shaped house in all excavation blocks after the transition to BR 3 (Figure 3).

The Bridge River 2 occupation of Housepit 54, starting in floors IIm-IIo, contained mean radiocarbon dates ranging from 1415-1461 cal. BP (Prentiss et al. 2018). These floors have been interpreted as small, single-family houses constructed in a similar manner for each floor which can be referred to as the “small house”. We see a major shift and increase in space at floor IIL where the house almost doubles in size to a rectangular shape cutting through the entire length of the excavations. The dates of what can be called the “rectangle house” (IIl-IIf) have mean dates from 1129-1458 cal. B.P. (Prentiss et al. 2018). The size of the house has been interpreted as having at least two families living within it. The transition to the Bridge River 3 occupation leads to the establishment of floor IIe, where the house again expands to a large circular or oval shape that is thought have contained at least four different family units. The “big house” as it is known, has a mean date range of 1115-1312 cal. B.P. according to the most recent C14 dates (Prentiss et al. 2018). Given the ethnographic average for the standard lifespan of a housepit roof (Alexander 2000) and the total mean date range of 1461 to 1115 cal. B.P., each floor is

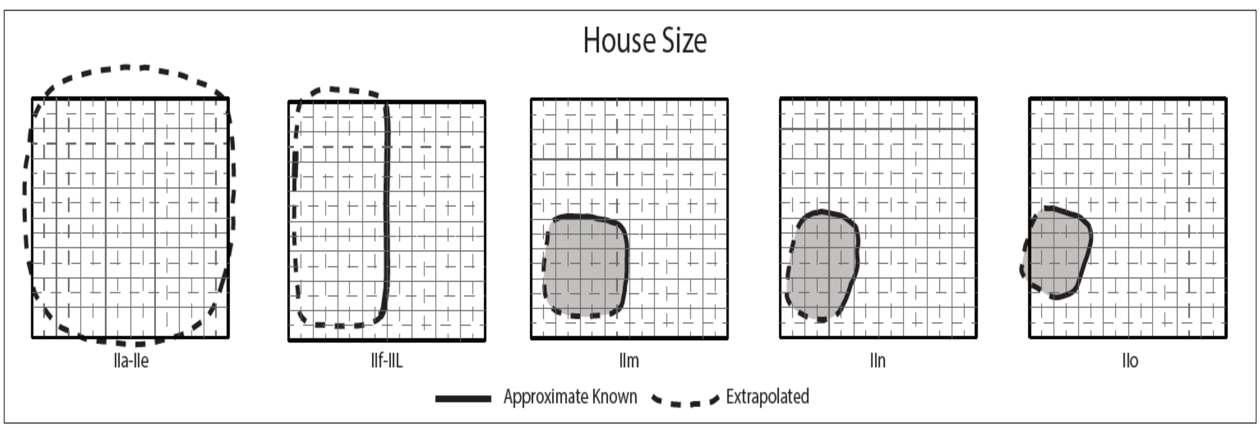

Figure 3. House size at Housepit 54.

projected to have been occupied for 23 years (Prentiss et al. 2018). The floor sequence reflects an ever-growing pithouse where more and more space was created to occupy a growing number of household residents.

Demography

Population estimates at Housepit 54 have been calculated via two different methods; meters per person and Fire Cracked Rock (FCR) volume (Table 1). The meters per person estimates are based on Hayden et al. (1996) who determined an average of 2.2m^2 per person drawing from ethnographic examples in colder climates from both North America and Siberia (see Nastich 1954; Hill-Tout; 1899; and Teit 1900). The floor area in square meters was divided by this average to create population estimates which shows that the population doubles every time the house increases in size.

Table 1. Taken from Prentiss et al. 2018. FCR counted in cobble/pebble sizes.

Square meters per-person			FCR model				
Floor	Square meters	Population estimate	FCR count	Excavated floor volume	FCR count/ floor vol.	NH	Population estimate
IIa	64	32	1736	1.3	1331	4	33
IIb	64	32	1415	1.24	1142	4	29
IIc	64	32	1199	0.93	1292	3	24
IId	64	32	1303	1.07	1220	3	23
IIe	64	32	1460	0.83	1756	4	44
IIf	32	16	1229	0.72	1704	3	32
IIg	32	16	623	0.6	1038	3	19
IIh	32	16	1153	0.92	1249	2	16
IIi	32	16	373	0.57	650	2	8
IIj	32	16	322	0.39	819	3	15
IIk	32	16	534	1.31	409	2	5
IIl	32	16	338	0.52	650	2	8
IIm	16	8	148	0.23	646	1	4
IIn	16	8	82	0.15	535	1	3
IIo	16	8	90	0.15	588	1	4

NH = number of hearth-centered activity areas.

The FCR population estimate assumes that more cooking occurs when there are more people within a household and were calculated by comparing FCR counts to floor volume (Prentiss 2018). The results of this measure show a similar but more nuanced population estimate compared to the first technique. The nuanced estimate also shows that there are increases in population that generally correspond with house size expansion mentioned above. Floors IIa-IIe however show unstable numbers when compared to the rest of the floors. There is a drastic population increase from IIf to IIe followed by an even more drastic decrease between IIe and IId. The house is capped with a slight rise in population in most recent prehistoric floors (IIa and

IIb). The dramatic increase and decrease in population has been described by Prentiss et al. as the entire village reaching a "Malthusian ceiling" (2014). The spike in population can possibly be explained by a measured increase in marine productivity that lead to increased numbers of anadromous salmon (Finney et al. 2002; Tunnicliffe et al. 2001). However, this was soon followed by the over-exploitation of resources by the larger population and a decline in salmon populations which lead to dispersal and loss of members of the Bridge River village and other surrounding villages (Kuijt and Prentiss 2004; Prentiss et al. 2007). It has been argued that a fallout from reaching this ceiling could have been the development of household, wealth-based inequality within the region. This topic will not be explored in this study, but a series of publications discuss this topic in depth (Prentiss et al. 2012, 2014, 2018).

Chapter 3: Theoretical Framework, Hypotheses, and Test Expectations

The main research questions in this study will address the evolution of the spatial organization of lithic technology and pulls from three separate theoretical frameworks: household archaeology, site structure/activity area research and cultural transmission theory. Household archaeology and site structure studies provide important descriptions and concepts defining the "household" which are especially useful given the persistent occupation of Housepit 54 and the village as a whole. Cultural transmission theory provides the definition of the mechanisms and avenues to view how the household changes over time. These frameworks work together to first establish the principles of how a household operates and is organized in addition to how these concepts of are passed down through the generations.

Household Archaeology

Houses and households of the Northwest and across the world have been a major focus of archaeological research now for almost half of a century (Gahr et al. 2006). The term "household" has been defined many ways by scholars during this time and has been known as the physical structure of a "house" (Chesson et al 2012), a socializing agent for its inhabitants (Carsten and Hugh-Jones 1995), basic socio-economic units of society (Foster and Foster 2012), and the household as the product of the needs of those that form it (Wilk and Rathje 1982). These definitions show that anthropologists and archaeologists alike have moved beyond thinking of the household only in terms of nuclear family units. The household as we know it is a dynamic entity which is defined by many intertwining factors (Foster and Parker 2012). Ethnographic observation on the Northwest Coast have recognized the household as the basic unit of economic production and the determinate of the ownership of material and non-material property (canoes, hunting/fishing rights, songs, etc.) (Gahr et al 2006). The ownership of property by a household can be transmitted through generations, based on kinship ties and household membership (Ames 2006; Brown 2007: Gillespie 2007). The household is a fluid concept and is not necessarily tied to a physical, residential structure as we think of in today's western society. In fact, households can contain multiple kin groups or contain a single kin group that occupy more than one household (Adams 1973; Coupland 1996). In the Mid-Fraser, ethnographic information from the St'át'imc point to multi-house or village-wide household membership due to the organization of village residents into a single clan (Kennedy and Bouchard 1978, 1998; Teit 1906). Membership in the clan-sized household entitled members to the right to fishing, hunting, and root-digging grounds (Teit 1906).

Given the discussion above, it is apparent that the household does not just apply to a single house or residential unit. However, archaeologists frequently justify the characterization of the household as a co-residential group within a house due to the material remains and spatial dimensions of such a group and structure (Gahr et al. 2006). Archaeologists since the beginnings of processual archaeology have approached the household as an analytical unit, combining features and material remains with the socio-political complexities gathered from ethnographic observations like those mentioned above (Coupland 1985; Horne 1982; Wilk and Rathje 1982). The household as a socioeconomic analytical unit is of great interest to archaeologists given its sensitivity to pressures such as fluctuating demographic trends and its responsiveness to shifts in ecological trends affecting subsistence organization (Bawden 1982; Netting et al. 1984). The house structure itself is also susceptible to evolving social and ecological conditions (Ames 2006; Netting et al. 1984). Housepit 54 provides some of the best evidence of this given the correlation between an upward demographic trend and an increase in house size (Prentiss et al. 2018).

In this study the household is defined as all the residents living and operating within the spatial confines of a housepit, with Housepit 54 as the analytical unit. If this social framework of this house society reflects the organization of Bridge River villagers before European contact, Housepit 54 should serve as an accurate representation of the history of the village household. This assumption is supported by the stability of Housepit 54 and the village as a whole, as noted in the dating sequence in chapter two showing village occupation from around 1800 B.P. up to the Fur-Trade era.

Site Structure

Understanding the processes that create, affect and influence the archaeological record is crucial to learning how people of the past used and managed space. This type of research is of great interest to archaeologists working in a variety of different regional and archaeological contexts. Archaeologists have been concerned with site structure and activity area research in the context of open camps (Bartram et al. 1991; Binford 1978a; O'Connell 1987; O'Connell et al. 1991) as well as constrained spaces such as rock shelters, caves and houses (Gorecki 1991; Nicholson and Cane 1991; Flannery and Winter 1976; Snow 2012; Ullah 2009, 2012; Ullah et al. 2014). These studies are successful because of the way human nature revolves around patterns. Kent says it best by saying:

> Humans are creatures of patterns- our cultural material is patterned, our behavior is patterned, our culture is patterned, and the interrelationship among cultural material, behavior, and culture is patterned… our use of space is patterned [1987: 3].

With these studies, archaeologists seek to delineate patterns in space to answer questions of site function and organization of technology. Site structure can be defined as, "the spatial distribution of artifacts, features, and fauna on archaeological sites" (Binford 1983: 144**).** However, the study of structure and activity areas can also examine the minutiae of spatial organization and how these patterns relate to aspects of behavior and culture including social stratification, division of labor, sex roles and inheritance (Kent 1987). A large part of what is known about the socioeconomic organization of activity areas stems from ethnoarchaeological studies (see Binford 1978a, 1983; Gould 1968; Schiffer 1972, 1976; Yellen 1977). The seminal works mentioned here gathered information from camps of modern-day hunter-gatherers, experimented with simulated archaeological distributions, and recorded valuable information on the natural formation of the patterning of bones or stones (Kroll and Price 1991). Ethnoarchaeological studies have lead to the theory building of site structure, centered around a series of constants, the first of which is the way people consistently use space as an individual, in a group, or when completing a specific activity (Schmader and Graham 2015). Another constant is the size of human bodies and mechanics as well as the distinctive, organized signatures and patterns that are created from repeated activities over time (Binford 1983**;** Schmader and Graham 2015). Binford (1978a, 1978b, 1983) has argued that spatial organization of a site revolves around solving practical problems such as access to heat or light, avoiding debris heavy activities, and changing group size. In Binford's ethnographic observation of an Inuit hunting stand, he saw that the more debris (or odor) an activity produced, the more it inhibits other activities which leads to the separation of debris-heavy activities (1978a). Archaeologically speaking, remains of something such as tool manufacture and maintenance, via flint knapping, would be found separate from other activities. In the same study it is also noted that when a group size increased, "craft-related tasks" occurred at a special location away from the main areas of activity where socializing and eating occurred (Binford 1978a). In the Mid-Fraser, winter houses were most likely very crowded and there is some evidence in the archaeological record of solutions to these problems. On the Fur Trade period floor at Housepit 54, spatial patterning was shown to have spatially discontinuous activity areas indicating tool maintenance and manufacture, cooking, socializing, and areas for sleeping (Barnett and Frank 2017; Williams-Larson et al. 2017). There are obvious cleared areas in the center and the east side of the Fur Trade period floor at Housepit 54 indicating the possibility of maintaining spaces by clearing debris by entrances in the roof and from the side (Williams-Larson et al. 2017). The Fur-Trade floor at the site also appears to have had empty spaces along the north boundary of the house which could potentially have been sleeping spaces (Barnett and Frank 2017). House residents would maintain and clean these areas or avoid them altogether in order to create more comfortable sleeping arrangements. At Keatley Creek, Prentiss (2000) and Spafford (2000) describe the large amounts of debris near the margins of the house, potentially resulting from the designation of messy tasks to these areas near the bench zone to avoid interference with other activities. In other words, site structure is contingent on the solutions to these practical issues which make domestic tasks and daily life easier. This argument reflects the possibility that various groups with different cultural conceptions of how space is to be used could still potentially organize themselves to solve spatial dilemmas in similar ways (Schmader and Graham 2015).

Ethnoarchaeological studies however, have pointed out specific issues with the interpretation of site structure and activity areas at archaeological sites. Reconstructing past activities from an archaeological assemblage is difficult because the remains from individual activities are often mixed or overlapping, not disparate or separate from one another (O'Connell 1987; Yellen 1977). In addition, ethnoarchaeological studies have shown that the remains of an activity may not be found in the same place that the activity occurred due to discard practices that create "toss" or "drop" zones where debris is flung away to avoid hindering an individual or groups task (Binford 1978; Stevenson 1991). Formation processes resulting from cultural and natural activities also have great effect on the final resting places of cultural material. Natural erosion and deposition of sediments at an archaeological site can lead to mixing of soils and alter the specific location of the archaeological record. In addition, tree roots, rodent burrows and even earthworms can disturb archaeological remains over time (Schiffer 1983). Clean-up activities at an archaeological site can move or remove large amounts of cultural material from where they were originally deposited (O'Connell 1987**;** Samuels 2006; Schiffer 1983). This is especially prevalent in constrained spaces such as houses given the presence of public spaces and specific, culturally defined structuring of a houses interior (Coupland 2006; Coupland et al. 2009; Samuels 1983, 2006). Finally, site structure studies can run into difficulties from the fact that at some archaeological sites, activities may not have left distinct signatures or preservation conditions were too poor for material remains (Binford 1978a, 1991).

Despite these issues, this order of research has thrived as archaeologists have found ways to cope with these issues. For example, to cope with issue of cleaning activities, archaeologists have creatively devised ways to identify the original areas in which activities have occurred by studying the “micro-sized” artifacts that are frequently left behind (Healan 1995). It has been shown that large quantities of microartifacts accumulate where a certain activity or activities are regularly performed (Hodder and Cessford 2004). These microartifacts are much less susceptible to cleaning and remain behind as larger artifacts are swept or otherwise removed from an area (LaMotta and Schiffer 1999; O’Connell 1987). With this approach Ullah has identified potential activity areas in the Late Neolithic site of Tabaqat al-Buma in northern Jorden solely relying on micro-artifacts (Ullah 2009, 2012; Ullah et al. 2014).

Ethnographic accounts of houses along the Northwest Coast also provide archaeologists with assistance when solving site structure puzzles. These ethnographies provide complete floor plans of traditional houses identifying where hearth rows, platforms, and sleeping spaces occur as well as *who* is occupying those spaces (de Laguna 1972; Emmons 1991 [1916]; Oberg 1973). These ethnographies point to interesting sociopolitical structuring of a typical Northwest Coast longhouse floor, based upon rank or status. Sleeping spaces were determined by the social hierarchy or residents in the house to constantly remind members of the household of the existing hierarchy (Blanton 1994; Coupland et al. 2009). The rear of the house was a place of honor, only suited for the most important members of the house, while the slaves slept near the entrance (de Laguna 1972). Archaeologists use these kinds of observations as frameworks to interpret excavated houses and where they find remarkable consistencies with ethnographic description. Excavations have revealed clearly defined floor, hearth and bench zones along with habitually occupied domestic areas at Ozette (Samuels 1983; 2006) and Northwest Coast long houses (Coupland 2006; Coupland et al. 2009) along the periphery from the door to the back of the house. These studies have proved analogous to research in the Mid-Fraser which has benefited from the studies at Ozette. At the Keatley Creek site, similar hearth and bench zones, open spaces and perimeter hearth groups were identified by multiple investigators (Hayden 1997; Hayden and Spafford 1993; Prentiss 2000). Similar to Northwest Coast houses, Hayden and Spafford (1993) also noted what could possibly be a hierarchical array of domestic units at the Keatley Creek site based upon the uneven distribution of archaeological remains such as non-local raw materials and a disproportionate distribution of food remains. This sort of spatial patterning in houses of the Pacific Northwest suggests that site structure is *culturally* constructed rather than organized around solutions spatial contingencies as described by Binford. If cultural conceptions of space and protocols dictated spatial organization as ethnographic and archaeological investigations have hinted, then perhaps these concepts were passed down through the generations along with the other cultural practices.

Cultural Transmission Theory

The analyses exploring cultural transmission among human subjects have led to a crucial understanding of human behavior and how cultural concepts and processes are passed down through the generations (e.g. Boyd and Richerson 1983, 1985; Bettinger and Eerkens 1999; Mesoudi and O'Brien 2008a, b). These studies examine the transmission or inheritance of culture using the basic principles and properties of genetic inheritance. The choices that humans make resemble to some degree the evolutionary process of natural selection, innovation and invention is analogous with genetic mutation, and shifts in stylistic markers of human culture can sometimes look like genetic drift (Bettinger et al. 2015). Although anthropologists and archaeologists use the lessons learned from genetic evolution and transmission, the cultural transmission process has one major difference; the source of information. In genetic evolution, there are two different individuals that provide genetic information (parents). Cultural evolution on the other hand has the capacity for more than two sources for information. The cultural information pool is filled with knowledge from the ideals, values, and other behaviors that exist in the communities of individuals, all of which can come from non-parental sources (Bettinger et al. 2015). Culture can be transmitted vertically (parent to offspring), obliquely (older but not biologic parents to younger generations) and horizontally between individuals (peer learning within the same generation) and additionally can be transmitted from one to many (teacher and class) or many to one (elders to a youth) **(**Jordan 2015).

Given the large pool of knowledge stemming from a community of individuals who are responsible for the transmission of culture, one would expect a great deal of variability, which is required for a process like natural selection to occur given that cultural evolution is Darwinian in nature. Greater variability occurs more with vertical to horizontal transmission given that an individual is learning from another individual, leaving room for variation by the pupil within their population. However, given that a single cultural trait can be acquired or learned from many different sources, individuals tend to learn and reproduce the "average" of the trait acquired from many different sources (blending), which at times can lead to suppressed variability over time (Jordan 2015). This especially is the case in "one to many" transmission scenarios such as when an instructor teaches a large group since there is only one source of the information being taught/learned. Variability is at its lowest during a “concerted” or “many to one” transmission scenario where a group, such as an old group of elders, teaches a single younger individual a certain cultural trait. Given the dynamic of a group of elders, a member of a younger generation is much less likely to vary from the lessons instilled upon them (Shennan 2002: 50). There are other processes that are at work that may additionally reduce variability in an individual’s learned behaviors besides “one to many” or “many to one” scenarios. These other processes may additionally reduce the selective *importance* of culture if they are strong enough. Boyd and Richerson (1985) call these processes *guided variation*, which deals with individual invention and learning and *biased transmission* (direct, indirect and frequency-dependent bias), which deals with abilities to rationally evaluate cultural behaviors.

Content or direct bias can be described as when a cultural variant of a trait is transmitted simply because it is more attractive to the recipient of that trait. Content-biased transmission therefor is a selective process because an individual receiving information is biased in favor of some cultural variant and against other cultural variants, selecting them out of the information pool. As cultural transmission of a particular trait is selected for via content-bias, then a population becomes a biased sample of the population that existed before transmission (Jordan 2015). Content bias needs variation in behavior to operate, but the process works to reduce it in the end by selecting out or establishing a sole cultural behavior or trait for an entire population. Frequency-dependent bias is biased transmission of traits not because of their advantages or disadvantages, but because of the influence of what everyone else is doing. This can also be phrased as “conformity” because decisions about copying are based fitting in and doing what everyone else is doing, or conversely “anti-conformity” where decisions are based on the opposite of what everyone else is doing (hipsters) (Mesoudi 2011). The advantage of frequency dependent bias is that it is a cheap, cost-effective way to avoid the trial and error for individuals learning something new. Indirect bias on the other hand is the replication of a behavior or trait by one individual based on the success of another individual. This form of bias can be the result of varying sociocultural contexts that influence what traits or behaviors are transmitted within a population. Context-based or model-based bias can further be broken down into categories including "prestige" bias, copying behaviors or traits based on prowess of another individual, "similarity" bias or copying based on similarity of an individual to ones' self, and "age" bias where copying is based on individuals of a certain age (Bettinger et al. 2015).

Guided variation is a model of learning that is combined with a model of inheritance and looks at how learned traits and behaviors are changed after the initial learning process (Bettinger et al. 2015). In essence, guided variation is the subsequent modification, via learning, of a trait from its initial transmission that increases the number of variables that are favored by the learning process (Boyd and Richerson 1985). The process of learning after the transmission of a trait or behavior follows a descent-with-modification path that leads to cumulative and adaptive change which links one generation to another (Richerson and Boyd 2005). Guided variation differs from the various forms of biased transmission because it does not select one trait over another, it instead modifies traits and behaviors based on individual learning which are then transmitted to others within a population. This sort of learning or modification of traits acts as a non-random source of new variation within a population. The rate of the transmission of modified traits by an individual depends on the rareness of a trait, meaning that the rarer a trait is, the more likely it is that it will be successfully transmitted (Mesoudi 2011). Guided variation is unique to cultural transmission because in genetic evolution, there is no avenue for genes to change on their own before reproduction. The influence of guided variation ends up pushing a culture towards a trait or behavior is favored by the individual learning process (Mesoudi 2011). An example of guided variation by Jordan paints a picture of how it works:

> For example, a hunter might initially learn from his father how to haft knives with bone which he initially followed for a few years, but after trying many different materials, eventually realized that willow was better because it had a superior grip and was easier to work into the required handle form. He then started to use willow-handled knives and eventually taught his sons to haft knives the same way [2015: 27].

Given that this study is concerned with evolution of spatial organization within the confines of a housepit, there is a distinct possibility that guided variation may be at work. The residents of the house are all part of an extended kin network and live in close proximity all winter long so there is less contact with peers and others outside the close family unit. That means that there is a greater possibility for a controlled transfer of behaviors or cultural traits from older to younger generations (vertical or oblique transmission). The organization of space on the house pit floor could possibly be one of these traits.

Hypotheses

The archaeological record at Housepit 54 lends itself to test the concepts of site structure and activity area research to determine how and why space is organized the way it is. Given the extensive collection of lithic artifacts that have been recovered and analyzed, it is possible to discern cleaning and maintenance activities, activity areas, and domestic areas. The large lithic assemblage and the sensitivity of household organization to changes in group size and change in subsistence strategies as discussed above (Bawden 1982; Binford 1978b; Netting et al. 1984) allows for a detailed look at how population influences the spatial order of lithic technology**.**

1) The spatial organization of technology within the housepit is determined by the population of residents residing inside the house. A fluctuating population over time will lead to spatial variability in the positioning of lithic artifacts and their final deposition.

In this situation, shifting demographic trends in Housepit 54 will lead to the alteration of the spatial layout of the house floor to compensate for increases or decreases in available space. The locations of lithic production, maintenance, storage, and specific activity areas will change more drastically with larger fluctuations in population estimates. When the population of the house pit is more stable, there will be less change. As more residents move into Housepit 54, it will become more crowded and create more spatial contingencies that need to be solved. Activities such as tool manufacture, maintenance, butchering, and plant food processing will be found in inconsistent locals from floor to floor when the estimated population changes.

H1) Test Expectations

- The difference in the distribution of lithic artifacts will be greatest between floors that experience the biggest population fluctuations.
    - Spatial reorganization or relocation of lithic artifacts will be more widespread and less concentrated on subsequent house floors with the greatest changes in population.
    - The percentage of lithic artifacts redeposited will be greater between subsequent house floors with the greatest population change.
- There will be a stronger correlation and higher correlation value between tools and debitage when population is higher, given that space is more constrained.
- If specific activity areas such as lithic production/maintenance, butchering, hide-work, heavy duty (i.e. woodworking), and plant processing can be identified, they will experience a greater change in location on consecutive floors with the largest increase or decrease in population. This will be the result of shrinking spatial availability due to crowding, forcing reorganization of individuals to compensate for the lack of space.
- If domestic areas can be identified, they will experience a greater change in location on consecutive floors with the largest increase or decrease in population.

- Features such as hearths, storage/cache pits, postholes, and large rocks (site furniture) will experience a greater change in location on consecutive floors with the largest increases or decreases in population.

Since the floors at Housepit 54 are estimated to be occupied every 25 years, there is the unique opportunity to see cultural transmission processes at work. Based on the frequent occupations, there are snapshots of the lithic organization strategies from generation to generation that could potentially show how the learning process changed strategies over time. As discussed in hypothesis one and the site structure literature mentioned previously, it has long been thought that spatial organization is almost always determined by the need to solve spatial contingencies due to crowding, access to heat/light, and debris accumulation. However, the question of whether "use of space" is a behavior or cultural trait that is transmitted between generations has not been asked. Housepit 54 provides a perfect case study to ask this question and test whether or not guided variation is at work with the spatial organization of lithic technology.

2) The spatial organization of lithic technology on housepit floors gradually changes over the lifespan of the housepit. Subsequent floors time will be organized in a similar manner despite demographic fluctuation.

Hypothesis two argues that population does not affect spatial organization and instead it is a product of gradual change over time. Under this scenario, spatial organization is determined by inter-generational cultural transmission of ideas and practices and therefore space would not be affected by the changing population of residents within the house. Cultural protocols dealing with household organization in this instance will be vertically transmitted from generation to generation with minimal variation via guided variation (Boyd and Richerson 1985). Culture reigns supreme over behavior in this scenario and behavior then will be subject to the transmission of ideas of how space and technology is used and produced within the house. The organization of lithic production, maintenance, tool storage, and specific activity areas and/or domestic areas will change gradually over time despite fluctuations in population. These specific features will be expected to generally stay in the same areas of the housepit floors over time. Under this scenario, even when the housepit changes shape (IIm-IIL and IIF-IIE transitions) we will see a similar pattern of organization, only slightly changing due to the different architectural constraints. Floors that are more closely related in time will have much more similar spatial layouts than those that are farther apart.

H2) Test Expectations

- The spatial distribution of lithic technology will gradually change over time; consecutive floors will be much more similar than floors that are farther apart in time of occupation.
    - If any spatial reorganization or relocation of lithic artifacts occurs, it will be more concentrated and less widespread on subsequent floors.
    - The percentage of lithic artifacts removed or deposited will be consistent between subsequent house floors.
- If specific activity areas such as lithic production/maintenance, butchering, hide-work, heavy duty (i.e. woodworking), and plant processing can be identified, they will remain in similar locations on consecutive house floors.
- If domestic areas can be identified, they will remain in similar locations on consecutive house floors.
- Features such as hearths, storage/cache pits, postholes, and large rocks (site furniture) will remain in similar locations on consecutive house floors.

- The correlation values between locations of debitage and tools will be similar for all floors in the house, with only slight variation.

Chapter 4: Laboratory, Statistical and GIS Methods

This section reviews the methodology of the lithic, GIS and statistical analysis of lithic tools and debitage on each floor of Housepit 54. The analytical methods are specifically tailored to compare the spatial distributions of lithic artifacts.

Lithic Analysis

All debitage and tools were examined for a variety of attributes in the archaeological laboratory of The University of Montana. During debitage analysis lab technicians recorded raw material type, size, and evidence of thermal alteration (Prentiss 1998, 2001), presence and type of platform initiation (e.g. cone, bend, or wedge see Hayden and Hutchings 1989), amount of original cortex (see Mauldin and Amick 1989), and completeness of flake determined by a modified Sullivan and Rozen (1985) typology (see Prentiss 1998, 2001). This debitage analysis protocol allowed for the identification of specific lithic reduction stages and activity areas, giving insight to the separation of space and tasks. Lithic tools were identified as lithic artifacts that have a retouched or otherwise used margin or surface. Each margin or surface identified as being used was considered a separate employable unit (EU) and recorded separately from all other EUs (see Knudson 1983). Attributes recorded from each tool included raw material type, thermal alteration, size (length, height, and thickness measured with standard calipers), retouch, use wear, and edge angle. The form of retouch was recorded as scalar, hinge, or step and the invasiveness of retouch will be recorded by how far flaking activity intrudes on a tools surface in either an abrupt, semi-abrupt, or invasive manner. Use wear was analyzed using 50x power microscopes to look for polish, rounding, parallel or perpendicular striations, crushing, abrading, pecking, incising, chipping (step, scalar, or oblique), and battering. Edge angle of tools was measured using a Wards Contact Goniometer. Lithic tools were drawn in both profile and plain views to scale, unless tool exceeded the size of a standard letter sized page in which case tools were drawn and noted that they were not to scale. Lithic tools were then assigned to one of seven categories of use (see table A.4).

GIS and Statistical Methods

GIS is useful in archaeology for both the visual display of geospatial data in addition to powerful spatial and statistical analyses. Previous research at Housepit 54 has shown that GIS studies are particularly useful in the context of household archaeology (Barnett and Frank 2017; Bobolinski 2017; Williams 2013; Williams et al. 2017). The carefully controlled nature of excavations at Housepit 54 allow for the fine-grained recordation of the spatial locations of artifacts. Artifacts were individually point plotted in-situ for their exact locations within the excavation units. Artifacts discovered during the screening of soils excavated from the housepit were mapped to the centroids of 50 cm quadrants inside one-meter excavation units. Excavation units existed in one of four blocks; block A (southwest block), block B (southeast block), block C, (northwest block), and block D (northeast block). The mapped locations of lithic artifacts allow for the interpretation of formation processes such as cleaning and for the identification of activity or domestic areas mentioned above on each individual floor. GIS software then allows for the empirical and mathematical comparison of lithic artifact distribution on each subsequent floor. The following paragraphs outline the specific tools and methods employed in this study using ArcMap 10.6 by ESRI.

All maps below were based on point data located at the centroid of each unit quadrant spaced 50 cm apart. Each point location contained data fields with excavation unit and quadrant, debitage size, tool category (hide-work/sewing, heavy duty, hunting/butchery, groundstone, ornamental, knapping and miscellaneous), total tool count, total debitage count, total lithic artifact count, and each centroid's amount of total lithic artifacts based on percentage of the total floor. The first tool used to display the distribution of lithic data was the "spline with barriers" tool which interpolates a continuous raster (image) surface based on the counts of artifacts in each quadrants centroid spaced 50 cm apart (ESRI 2017). In other words, this tool takes point data with numeric values and turns it into a smooth, colored image, interpolating the spaces in between points that contain no data. The barriers used in the spline interpolation was the extent of the excavation blocks to ensure that no interpolation occurred outside areas that had been excavated. When the sample size was less than 10 (IIo tool map), graduated symbols were used. Graduated symbols are proportional symbols that are sized based on the quantity of data that's being displayed. For all other maps in this study, if artifacts are more densely distributed on certain parts of a house floor, the color of the spline raster surface becomes much more dark and vivid in color, displaying various clusters of lithics. To calculate a smooth surface displaying the distribution of cultural materials, the spline tool requires that all points (or in this case quadrant centroids) have a numeric value, including the locations that have no data which were replaced with a value of '0'. These zeros made sure that no data was displayed in areas in which no lithic artifacts were excavated. All spline surfaces were displayed using 'stretched' option for how to display the information and the stretch type was set at 'Minimum-Maximum' which displays the minimum and maximum values of the interpolated surface. This method was found to be the most smooth and intuitive way to display the distributions of lithic data. Using these methods, four different maps were made displaying various lithic artifacts. Maps displaying the total lithic artifacts (debitage and tools) and another displaying just tools found on each floor (artifacts from features were displayed by the nearest quadrant centroid) were displayed from the least (zero) to largest concentration of artifacts with a color ramp white to black. Another map was created to display on the debitage on housepit floors and was visualized by displaying extra-small sized debitage (XSM) versus all other debitage sizes (small, medium, large, extra-large) to determine how much cleaning occurred on the floor. XSM debitage is more likely to be left behind given its size (>1 cm) than the other sizes of debitage as discussed above (Hodder and Cessford 2004; Ullah 2012). The two categories of debitage were compared on the same map by symbolizing the "Other Debitage" surface with a color ramp from white to blue and set as 50% transparent, which was then layered on top of the "XSM Debitage" surface that was symbolized with a white to red color ramp. The transparency of the blue surface allowed to see what was underneath which allowed for a "purple" color to occur when the two surfaces (red and blue) overlapped. When they did not overlap, the colors of each surface were preserved.

The final map that was made was a spline raster surface of the difference between floors that first started with the "minus" tool (ESRI 2017). This map compares the percentages of lithic artifacts covering subsequent floors by converting the amounts of artifacts at each quadrant centroid to percentages of the total lithics on the house floor. An interpolated raster surface displaying the distribution of lithic artifacts by percentage was created for each floor using the spline method discussed above. Starting with floor IIn, floors were then subtracted from one another (for example, IIn – IIo, IIm – IIn, etc.) to compare the change in lithic organization as percentages from one floor to the next. The minus tool (figure A.62) subtracts the interpolated values of each pixel in the spline raster surface and creates a new raster surface showing the values from the arithmetic function. This new raster was duplicated to display the negative values, where materials were removed from areas between floors, and the positive values, where materials were deposited in areas between floors, side by side. Negative values were displayed in a color ramp from blue (lowest negative value) to white (zero) and positive values were displayed in a color ramp from white (zero) to red (highest positive value).

The spline tool is used to visualize the distributions of lithic artifacts on house floors as they relate to the features that exist on the same floor. However, features from neighboring floors above frequently intruded through the surfaces of floors below, removing part of the lower floor and potential artifacts. Additionally, previously excavated trenches from 2008 and unexcavated areas have also withheld potential data, making datasets on each floor incomplete. For this study, the spline tool is used as a model to interpolate between areas where actual data was recovered. As mentioned above, areas with 'no data' in such as where there was no excavation, previous trenches, and intruding features, a value of '0' was also given to avoid data being displayed. A value of zero was given instead of displaying these types of no-data areas which impeded the purpose of maps made for this study. This study is not a "predictive" model of where artifacts may be, it is a study of the distributions of artifacts that actually exist. This study does not include lithic data recovered from features such as hearths or pits because the focus here is on the spatial organization of the house floor. In addition, the large amounts of debitage and tools found in pits would skew the interpolation method and only show clusters of artifacts within features; clusters appearing on the actual living surface would be masked by this one-sided distribution. At times it may appear as if data is interpolated inside of various features, but this is representing artifacts found on the features' margin. The spline interpolation method is responsible for the appearance of data inside these features.

Pearson's-R correlation statistics and significance values (p-values) were calculated for two separate sets of variables. The first correlation was calculated to test the correlation between the counts of extra-small debitage with all other debitage sizes in order to determine if a significant amount of cleaning occurred. Each pair of debitage counts were taken from each centroid of the 50 cm quadrants of excavation units. The correlation and p-values were calculated in Microsoft Excel. Another correlation statistic was calculated to observe the relationship between debitage and tools. As discussed above, in crowded spaces messy, debris-heavy activities such as flint knapping are done out of the way of other activities. The relationship then will determine whether or not tools were used in the same areas they were created or if they were made and then used in other specific parts of the house. This correlation was also calculated in Microsoft Excel. All correlations were calculated to the .05 confidence interval.

Chapter 5: Results and Discussion

The following results section will individually examine each floor and describe the locations of features, artifact distributions, and the locations of activity or domestic areas (if applicable). The correlation values will be listed for the relationship of debitage size classes (xsm vs other sized) and the relationship between debitage and tool location. Each transition between subsequent floors will also be described. The section ends with a discussion of how these results relate to the hypotheses outlined above.

Floor IIo Results

IIo is the deepest occupational floor at Housepit 54 and is one of only two floors where there is an identifiable boundary of the house. The house during this time was a small circular structure that was only found in excavations of block A. There was only one feature that was found on the floor, a single hearth near the eastern wall of this little house. The total lithic artifact distribution (figure A.4) shows one major concentration of artifacts directly to the west of the small hearth which becomes generally less dense as it gets farther from the hearth. Of the total lithic artifacts (n=137) only nine were identified as tools. Given that the sample size of lithic tools was below 10, the distribution was displayed as graduated symbols instead of a spline surface. Four tools were found directly associated with the hearth while the remaining five were found elsewhere on the limited floor space of the little house (figure A.5). The distribution of lithic debitage mirrors the distribution of all lithic artifacts and when broken down by size, the xsm debitage aligns with the other sized debitage (figure A.6). This is backed up by a significant, strong correlation value (r^2= .61, p= .047) calculated between these two categories of debitage. The correlation of locations between debitage and tool locations however do not exhibit a significant correlation (r= .38, p= .25), most likely due to the small sample size of tools (n=9).

Floor IIn Results

IIn is the second occupational floor with an identifiable house boundary and is also a small, circular shaped house. There are three hearth features located on the IIn floor; one in the southwest corner, one along the western edge, and one in the north-central part of the house. There are also two pit features on the floor in the northwest and east-central part of the house. The total lithic artifact distribution displays a half-circle shaped cluster around the southwest hearth (figure A.7). A less distinct cluster, also in a half-circle lies between the two remaining hearths. The lithic tool distribution shows two different concentrations of tools (figure A.8). The first concentration is located in the northwest area of the excavation block associated with a small hearth. The second concentration of tools falls in the southeast area of the house, also associated with a hearth. There isn't any single tool category that dominates either of the clusters suggesting that these may be domestic areas and not specific activity areas. The distribution of debitage mimics the total lithic artifact distribution given that there is a greater amount of debitage than tools (figure A.9). However, it is clear that xsm debitage overlaps quite closely with other sized debitage. This is backed up by a strong, significant correlation statistic of .63 ($p= .02$). Similar to IIo, there is no significant correlation between the locations of tools and debitage ($r= .14$, $p=.64$).

The transition from IIo to IIn shows that floor IIn (figure A.10) had a maximum of 14.81% less materials in some areas and a maximum of 17% more lithic artifacts in others. There is one specific area where materials were removed located near the west part of the house. The areas where materials were deposited was more dispersed in a curvilinear pattern. This curvilinear pattern may be explained by the expanding house size and follows the expanded house boundary that appears in IIn. The transition between IIo and IIn is marked by a minor house expansion despite population staying consistent (IIo= 4, IIn= 3). The total spatial change between floors is difficult to interpret given the expansion of the house boundary in IIn. Given this, the figure displaying the percent change between floors should be interpreted cautiously since the house size was not consistent. Empirical and visual comparison of how artifacts relate to features however, shows that each floor contains what appears to be a single domestic area given the clusters of artifacts around hearths that do not carry the signature of any specific activity. The northern most hearth occurring in IIn is in a similar location as the single hearth in IIo possibly indicating a similar use of space in the northern areas of the house. It should also be noted that the areas in which domestic areas are located have changed position between floors;

but, although this change in location occurs, the overall spaces appears to be functionally organized in a similar manner.

Floor IIm Results

IIm is the last floor of the little house that is only found in excavation block A and contains three pit features, a single hearth, one post hole, and one large rock that could potentially be a piece of site furniture given its proximity to the hearth feature. Two pits are clustered in the northwest corner of the excavation blocks and one is located along the southern, central boundary. The single hearth is located along the north-central boundary of the block while the single posthole falls along the eastern edge of the block. There are two clusters of artifacts on this living surface near the posthole and along the east margin of the southern-most pit (figure A.11). There is one major cluster of lithic tools (nine tools) near the only posthole found on the floor, comprised of seven tools (no single tool category dominated the cluster) (figure A.12). Similar to the two previous floors, debitage distributions mirror the total lithic distribution, and the xsm debitage mostly overlaps with other sized debitage (figure A.13). The cluster of debitage near the southern-most hearth however, appears to have more xsm debitage than other sizes. Despite this, there is a strong correlation coefficient between xsm and other sized debitage ($r= .9$, $p=.00$). Similar to the previous two floors, there is no significant correlation between tools and debitage ($r= .27$, $p= .11$).

Between IIn and IIm there again appears to be a shift in position or an expansion of the house for the house boundaries are no longer identifiable in the excavation block. It appears that there was major change from IIn to IIm (figure A.14) which shows floor IIm having maximum of 12.3% less materials in some areas and 23.04% more in other areas. However, it should be kept in mind that the boundary of the small house visible in excavation block A on floor IIn is no longer visible in floor IIm which could account for this apparent change. The areas where materials were removed and deposited during the transition between floors is dispersed and not concentrated in any one specific area. Despite the expansion, there again is a hearth situated at the northern edge of the excavation block which is also associated with a pit feature similar to IIn. IIm is also similar to IIn for the fact that there is a curved cluster of artifacts in the southeast of the block. However, this cluster is now associated with a pit feature instead of a hearth. Unlike IIn, IIm also shows an additional cluster of artifacts along the eastern margin of the block between a hearth and the single posthole. This area also contains the highest density of tools on the floor and can be interpreted as a possible domestic area given the even distribution of tool types and association with a nearby hearth. Overall, we see some consistency in spatial organization of artifact distributions between these two floors even though the domestic area and features in IIm have changed positions since the previous floor.

Floor IIL Results

Floor IIL marks the transition from the small, round house to a larger rectangle shaped house that encompasses blocks A and C. This floor has three pit features, two of which are in the north-central part of block C and one in the northwest corner of block A. There is a probable hearth feature on the western edge of block A below the pit feature. There was also some scattered charcoal found between two large rocks in the northern part of block A. There was only one large posthole found on this floor and located in block C above the pit features. The total lithic artifact distribution (figure A.15) shows one major concentration of artifacts in the southwest of block C, away from any features. Other artifacts are thinly distributed across other parts of the floor. The distribution of lithic tools form four distinct clusters on the house floor and there are two in each block (figure A.16). In block C, one concentration of tools is directly west of the two pit features and the other concentration is located in the southwest corner. The concentration near the pit features has mostly hide working and sewing tools, followed by heavy duty and hunting/butchery tools. The other cluster in block C isn't dominated by any one tool category. In block A, one concentration is directly associated with the two large rocks and scattered charcoal and the other is located in the southwest corner. Neither tool cluster is dominated by a single tool category. The distribution of debitage (figure A.17) has one major concentration in the southwest portion of block C which shows extensive overlap of xsm and other sized debitage. The correlation coefficient calculated also shows a moderately-strong relationship in locations between these two debitage size classes ($r = .56$, $p = .00$). We also for the first time see a statistically significant and moderate correlation between the locations of debitage and tools ($r = .49$, $p = .00$) hinting at the possibility that tools are being used in the same locations as they are being created.

Since the house changed from a small, circular shape in block A to a rectangular shape in both blocks A and C, there was no map comparing spaces showing areas containing more or less artifacts than the previous floor. However, visually we see quite a dramatic change of how space was used. There are no large hearths on floor IIL and where there are small hearths, there is no dense cluster of artifacts. There is, however, a cluster of tools located near flecks of charcoal that may have been a hearth. Furthermore, IIL has the first cluster of tools so far that point to a specific activity area (hide-work/sewing mentioned above) which is spatially segregated from other tool clusters which appear to be domestic areas.

Floor IIk Results

IIk has three major hearths, two of which are in block A along the western edge and in the north central area of the block (this one has extensive charcoal scattering along its margins).

The hearth in block C is located in the southwestern corner and has charcoal scattered outside the hearth on the eastern side. There are also three different major pit features, two in center of block C and one in the southwest of block A. The total lithic distribution is mostly located in block C with a large concentration between the hearth and large pit feature (figure A.18). There are surprisingly few lithic artifacts in block A and the lithics that are there are associated with the north-central hearth. The tool distribution on the other hand does not reflect that of the overall artifacts (figure A.19). There is one major concentration of tools in block A, surrounding the north-central hearth. Of the nine tools located in this cluster, four of them were associated with flintknapping activities. Block C has a dispersed distribution of tools surrounding the pit features but there is no concentration as dense as the cluster in block A. The debitage on floor IIk is densely distributed in block C between the hearth and pit features (figure A.20). It appears that xsm and other sized debitage overlap most of the time except a small area directly north of the pit features where there is a concentration of xsm debitage. However, the correlation statistic for this floor shows an overall correlation between the debitage size classes ($r= .74$, $p= .00$). There is also a fairly moderate correlation between the locations of debitage and tools on this floor ($r= .43$, $p= .01$).

The transition from IIL to IIk displays a smaller amount of change than the transitions between floors in the little house (figure A.21). There are a few specific areas of IIk that have 5.35% less lithics than IIL, and other areas that have a maximum of 8.81% more artifacts. The areas of IIk that contain less artifacts than the floor below are dispersed across both blocks. The areas where more artifacts occur however, mostly are concentrated in the center of block C. These areas of change highlighted by figure A.21 are in similar areas to one another showing that even though some change did occur, lithic artifacts were not completely reorganized. Each floor displays a surprising amount of similarity in both locations of artifacts and features. Both floors exhibit densities of overall artifacts in the southwestern portion of block C and have pit features near the center of the same block. The only major difference between floors in this block is the appearance of a hearth in the southwest of IIk. In block A the small hearths and scattered charcoal on the western edge and northcentral areas of IIL turn into larger hearths in the same locations in IIk. The north-central hearths/charcoal scatter in block A of both floors both contain a high density of tools. However, in block IIL it appears that this may be a domestic area given the more even distribution of tools while the cluster of tools in IIk seem to be specifically related to flint knapping activities. Overall these two subsequent floors have been the most similar in the spatial organization of lithic artifacts.

Floor IIj Results

IIj contains two hearths in each block; hearths in block A are in the northeast and northwest corners, while the hearths in block C are in the north and south-central areas of the block. There are two pit features on this floor, one in each block near the northeast corners of the respective blocks. Each block contains a single posthole in the north-central area of each floor. The total lithic distribution (figure A.22) shows the majority of lithics in block C where two major concentrations of artifacts are located near a large hearth feature. There is one major concentration of tools near the large hearth in block C (figure A.23). In this area, six of 11 tools are groundstone tools. Although it is less dense, the hearth in the northeast of block A is also associated with a concentration of groundstone tools (seven out of eight tools are groundstone). The debitage are mostly distributed in block C which contains one major concentration to the west of the large hearth (figure A.24). Xsm and other-sized debitage overlap at this concentration but elsewhere on the floor, there is apparent separation. The hearth in the northeast of block A is surrounded by mostly other-sized debitage, not including xsm sized debitage. The Pearson's R statistic supports the overall correlation of debitage size categories ($r= .58$, $p= .00$). The tools and debitage on this floor do not appear to have a statistically significant correlation ($r= .26$, $p=.09$).

The change that occurred between the transition for IIk to IIj visually appears to be widely dispersed across the floor but when quantifying the change (figure A.25) shows that little change actually occurred. IIj has a maximum of 3.04% less artifacts in some areas where lithic materials no longer are distributed and 3.93% more artifacts in areas where lithics were added. In block C we see remarkably consistent distributions of artifacts between each floor and the only major difference between these distributions is the sample size of lithic artifacts beings displayed. The two major concentrations of artifacts in this block occur in the same areas of both floors (southwest corner and south-central area). There are distributions in the same areas of block A for both floors, specifically around the hearth features that are located in the northeastern portion of each respective floor. IIk has a clear groundstone based activity area in block A near the cluster of small hearths which is not the case with the IIj hearth in the same location. IIj instead has a domestic area in block C near the big hearth that is not located in IIk. There is also some apparent consistency in the location of features between these two floors, especially in block A where each floor has a hearth along the western edge of the block and in the northeastern area of the block. The pit features on each floor of this block are located in opposite corners. The features in both floors in block C are also fairly similar. Each floor has a hearth in the southern portion of the block, although they are not exactly spatially contiguous. The small pit feature in floor IIk is in a similar location to the single pit feature in IIj, but IIj no longer has a similar large pit feature as well. IIj also has a small hearth and scatter of charcoal in an area that IIk does not. Despite these minor differences, both floors show similar patterns of lithic distribution.

Floor IIi Results

IIi contains two hearths in the center of block C and one hearth in the northeast of block A. Two large rocks border one of the hearths in block C where there are also two postholes in the northwest of the block. Block A has two pit features in the northeast corner which is associated with a cluster of three postholes. A small pit feature is located farther south along the eastern wall. The distribution of all lithic artifacts form multiple clusters on the house floor, a few of which are associated with hearths (figure A.26). A cluster of artifacts in block A is located directly to the west of the hearth feature. In block C, there are multiple clusters of artifacts to the north of each of the hearths. There is one major concentration of lithic tools between the two hearths in block C where five of the 10 tools were associated with heavy duty activities (figure A.27). The debitage of IIi is dispersed across both blocks and appears to be clustered around the hearth features (figure A.28). Similar to most floors, the xsm debitage and other-sized debitage appear to be distributed in the same areas which is reflected by a moderately-strong correlation ($r = .58$, $p = .00$). The locations of tools and debitage do not appear to be congruent however for this relationship has a weak correlation ($r = .39$, $p = .01$).

The transition from IIj to IIi is marked by spatially dispersed change between floors (figure A.29). IIi has a maximum of 8.84% less artifacts, specifically in the southeastern and south-central part of block C than IIj. In addition, there was a maximum 5.59% more artifacts in the north-central portions of both blocks where more materials were deposited. The overall lithic artifact distribution in IIi seems to shift from the southeast to the north-central part of the block and cluster near hearth features. However, the tool distribution remains very similar between floors especially in block C where tool clusters are centered around hearth features. Interestingly, each of these tool clusters are associated with individual activity areas; the IIj cluster is dominated by groundstone tools while the IIi cluster is comprised of mostly heavy-duty tools. Each floor also has a cluster of tools associated with a hearth located in the northeast of the block. Neither concentration points to any specific activity and more closely resemble domestic areas. The location of features on each floor are found in very similar locations. The large hearth in IIj block C corresponds to the same location as the cluster of hearths in block C of IIi. IIj also has a hearth, posthole, and pit feature in the northeast corner of block A, similar to the feature pattern in IIi. There is again apparent congruity between floors during this particular transition.

Floor IIh Results

Floor IIh is the only floor that had multiple levels mapped within its occupation making it difficult to visualize. Features from levels 1 and 2 were mapped together while level 3 was mapped separately (figure A.32). Block C of IIh level 3 is filled with four large hearths and three postholes. Block A contains one hearth in the northwest corner and no other features are present. This level of IIh could represent a single feasting event given the large hearths that occupy most of the floor space. IIh level 1 and 2 in block C contains five smaller hearth features, three of which are clustered in the south-central portion of the floor. Two more hearths are located in the east-central portion of the house along with two small pit features. Block A contains one large pit feature in the northwestern portion of the floor. Four hearths are also located in block A in the north-central, eastern, and southeastern areas of the block. The multiple levels of features were most likely formed during different events that occurred on the housepit floor. Despite the fact that there are multiple levels making up floor IIh, it appears that the artifacts from this floor are from the same occupation event and lithic data are combined from all levels for analysis. The overall lithic distribution (figure A.30) shows a series of related clusters in block C near the middle hearth of level 1 and 2 in the same block. The lithic tool distribution also shows one large cluster in block C near the two, southern-most hearths (figure A.31). The large tool cluster contains 64 tools, including 36 groundstone tools. The debitage distribution also shows a dense cluster in the same areas as the tool distribution (figure A.33). The densest part of the debitage cluster shows a large amount of overlap between xsm and other sized debitage. Farther away from the dense part of the cluster there is less overlap and more other-sized debitage. The correlation statistic reflects the large amounts of overlap of these size classes in the densest areas of debitage distribution with a strong correlation of r= .71 (p= .00). This is the first floor in this study where we see a statistically strong correlation between the locations of debitage and tools (r= .73, p=. 00) suggesting tools may have been used in the same areas they were manufactured.

The transition from IIi to IIh (figure A.34) shows specific areas of change on the house floor. There are two specific areas of IIh that have a maximum of 5.95% less lithic artifacts in each block. One area is in the north-central part of block C and the other is in the same location in block A. Conversely, IIh has an area in block C that contains a much greater quantity of artifacts than the lower floor showing a 7.84% increase in materials in the south-central part of the floor. In both floors, block C has large clusters of artifacts in similar locations in the west-central part of the floor. Each of the clusters is also associated with multiple hearth features. Although IIh has artifacts distributed in block A, they are not as clustered as the artifacts in the same block in IIi. Both floors also have a cluster of tools located near hearths in block C which are associated with specific activities; heavy-duty tools make up the cluster in IIi and groundstone tools make up the large IIh cluster. There are no identifiable domestic areas or activity areas elsewhere on either floor. The hearth features in block A are in similar locations on both floors except for an extra hearth that has appeared in the southeast of IIh. IIh also has a pit feature in the cluster of hearths in block A while IIi has no pit. Although the single hearth in block A of IIi corresponds with locations of hearths in IIh, the latter floor has three additional hearths in the block. The pit features of this block are drastically different sizes and are on opposite sides of the floor. IIh and IIi share some similarities in artifact distribution but show a greater amount of change than previous floors.

IIg Floor Results

Floor IIg has two hearths in block C, one large and one small, located in the south-central and north-central areas of the block. This block has one large posthole near the southern edge of the larger hearth. This posthole was lined with FCR and large rocks, most likely to support a large supporting post. Directly north of the large hearth, there is a cluster of over 15 postholes. There is also a large rock associated with the smaller hearth in this block. There are two small hearths and a small pit in block A along the eastern edge of the excavation block. One large pit feature is also located at the southern edge of block A. The total lithic distribution shows only one large cluster which is directly associated with the large pit in block A (figure A.35). There are dispersed amounts of lithic artifacts elsewhere on the floor. The lithic tool distribution shows two distinct concentrations in block C near the large hearth and in block A near the large pit (figure A.36). The first hearth-centered cluster is dominated by groundstone which comprised 21 of the 30 artifacts. The other cluster of tools located in block A is not dominated by any specific tool use category. A large cluster of lithic debitage is located around the large pit in block A and is more widely dispersed throughout the rest of the house (figure A.37). Xsm debitage and other debitage overlaps in this large concentration as opposed to the rest of block A which shows small distributions of xsm debitage without other sizes present. The overall correlation between debitage classes is strong with a value of r= .80 (p= .00). In IIg there is also a strong correlation between the locations of lithic tools and debitage (r= .66, p= .00).

The transition from IIh to IIg shows significantly less artifacts in block C while block A has one small area that saw a dramatic increase in artifacts (figure A.38). The areas of IIg with less artifacts than the previous floor have a maximum of 6.3% fewer lithics, dispersed over block C. The area in block A that shows an increase in artifacts shows a dense cluster which has 16.84% more artifacts than the previous floor. A large cluster of artifacts comprising most of the lithics on the floor appears in IIg at the southern edge of block A that did not exist in floor IIh. The cluster of artifacts in block C of IIh is no longer found in IIg except for a thin distribution of artifacts below a big hearth. In both floors, there are clusters of tools in the central area of Block C near hearth features which both are dominated by groundstone tools. The charcoal and hearth features in block A of IIg are in similar locations to hearths in the southwest and west of IIh. IIg however does not have a large pit feature and north-central hearths like the previous floor. In block C, both floors have a hearth in the southwestern and north-central areas of the house. What is unique to IIg is a large cluster of postholes in the north-central area of block C overlapping the large hearth. Although features are located in similar areas, it appears that artifacts are concentrated in different areas between these two floors.

Floor IIf Results

Floor IIf has two hearth features in block C; one in the northeast corner and another near the southwest corner. This block also contains a similar posthole pattern and posthole locations to floor IIg. There is only one small pit in block C located at the southwestern boundary of the block, next to a large rock. A single large hearth is located in the north-central area of block A which also contains a small and large hearth in the west and southwest of the block. The overall lithic artifact distribution for the first time displays a great number of individual concentrations on the house floor (figure A.39). The highest density of artifacts on this floor occurs near the largest hearth in block A in the southwest corner. There is another concentration in this block to the west of the hearth. Block C shows one large continuous cluster located in the east-central portion of the block. The lithic tool distribution has two major clusters, one near the large pit in block A and another near the large posthole in block C (figure A.40). Both of these tool clusters are made up of a variety of tools from different tool category types. Debitage are widely distributed across the house floor in both blocks and a high concentration near the large pit in block A contains almost all sizes of debitage other than xsm (figure A.41). This uneven distribution of size classes is reflected by a weak correlation of r= .4 (p= .00) and is the first (and only) floor where xsm and other sized debitage are not consistently found in the same places. There also is a weak correlation between the locations of tools and debitage (r= .43, p= .00).

In block A, there is a single concentrated area of the floor that has a maximum of 15.27% fewer artifacts that the previous floor (IIg) (figure A.42). There are other small areas that have slightly fewer artifacts than the previous floor. Across the floor of IIf, there are many areas that saw increased deposition of lithic artifacts. In the southwest corner of block A there is a concentrated area that has 4.78% more artifacts than the previous floor. The lithic distribution in IIf is overall much more widespread than it is in IIg. There is no overall concentration of artifacts that aligns with the single cluster found in IIg (block A). However, each block contains a small cluster of tools in the north-central area of block C. Other than that tool cluster, the major tool clusters of both floors occur in different areas of the house floor. There are only a few features that occur in similar areas in each floor. The first feature is a cluster of postholes that occur on both floors in the north-central area of block C, each near a large hearth features. The other feature in the same location on both floors is in the southwest of block A and is a hearth with a large rock associated with it. Otherwise, floor IIf contains a large hearth and multiple pit features that did not exist in floor IIg.

Floor IIe Results

IIe marks the first floor of the “big” house in which occupational floors are found in every excavation block. Block A has limited number of features and contains two small hearths in the southwest corner and two small pit features. One pit is along the western edge of the block and the other is near the eastern edge of block A. Block B has four large pit features and three small pit features. Two of the large pit features are in the southwest corner of the block which are surrounded by four postholes and three smaller pits that overlap with one of the larger pits. The largest pit in this block is in the northeast corner and is capped by a large hearth. A smaller hearth is directly east of these associated features. Block C contains one large hearth in the north-central area and another in the northeast corner. Each hearth is associated with two large rocks and the larger hearth also has a large posthole on its southern margin. Block D has the most features on the floor including four pit features in the southeastern area of the block. There are also four hearth features clustered in the same area, two of which overlap a pit. The southern most pit has a ringed cluster of postholes around its margins. The total lithic distribution (figure A.43) shows the least amount of lithics in block A and the most in block D where there is a dense concentration of artifacts near where the hearths overlap a pit feature. There are other less-dense clusters associated with the pits in block B and the large hearth feature in block C. The tool distribution mirrors the clusters of the total lithic distribution (figure A.44) and none of the clusters are dominated by any one tool category. The debitage distribution is most dense around hearth and pit features (figure A.45) and it appears that xsm and other sized debitage overlap in these areas which is supported by a strong correlation value of r= .82 (p= .00). There also is a strong correlation between the locations of tools and debitage (r= .75, p= .00).

Since the house expands to its largest size in IIe, there is no "percent change" map that was created for the transition from IIf to IIe. However, one can empirically see that there was a significant reorganization of space with the larger area. Blocks A and C no longer contain a large quantity of artifacts for clusters now are located near hearth and pit features in block B and D. The only feature that overlaps in both floors is a hearth in the northeastern corner of block C. The greatest change appears to be in block D which contains a large quantity of features and artifacts and is one of the "busiest" areas of the housepit up to this point.

Floor IId Results

IId has fewer features than the previous floor especially in block B where there are no features. Block A has two small pit features on the western part of the block and a single hearth in the north-central area. Block C has two narrow hearths and a small pit feature in the north-central and southwestern areas of the block. The features in block D are all located along the eastern part of the block. One pit feature is located in the northeast corner while two more are in the southeast corner; in between the pit features is one hearth. The total lithic artifact distribution (figure A.46) shows one major cluster of artifacts in block D near the southeastern pit complex. There is a more minor cluster of artifacts directly north of the hearth feature in block D. Elsewhere on the floor, there is a limited distribution of artifacts. The tool distribution (figure A.47) shows a single dense concentration of tools in block D in the southeast corner associated with a pit feature. The concentration contains 55 tools, 27 of which are associated with heavy duty or hunting/butchery activities. There are two concentrations of debitage on the floor, both in block D (figure A.48). One is associated with the southeastern pit feature where xsm and other-sized debitage overlap. The other debitage concentration is north of the hearth in block D and appears to mostly contain xsm debitage. The correlation according to the Pearson's R statistic is the strongest correlation of debitage size classes in the house ($r = .92$, $p = .00$). Coincidently, this floor also has the strongest correlation between the locations of tools and debitage ($r = .91$, $p = .00$).

The transition from IIe to IId shows that artifact distributions changed from all other blocks to concentrate in block D (figure A.49). IId has a maximum of 6.14% less artifacts in specific locations in block D and B. On the other hand, there is a specific area in the southeast corner of block D that shows a 17.16% increase in lithic artifacts. This percentage of change is high given that the specific area has a cluster of over 500 artifacts. However, the location of this cluster did not move very far from the cluster in block D of the previous floor, moving only slightly south. In addition, there is still a minor cluster of artifacts still located in the same spot as the major cluster in IId (block D). Elsewhere, IId appears to have less artifacts in every block but block D when compared to the previous floor. The major cluster in IId is associated with specific activities (heavy-duty and hunting/butchery) unlike the previous floor where clusters appear to look more like domestic areas. IId has less features overall than the previous floor, but there are some similarities between the two. Block A in both floors each contains a series of small pit features and at least one small hearth, although they are not located in the same areas. Block B shows the biggest change for IId has no features in it, unlike the previous floor which had large pit features, postholes, and hearths. Both floors have a hearth feature in the north-central portion of Block C. Block D of floor IId has significantly fewer features, but the single hearth located there lines up with a hearth from the previous floor. Each floor in block D also contains a pit feature in the southeastern area although IId no longer has postholes surrounding this pit as the previous floor's pit did. It appears that overall on this floor, artifacts are located in similar areas despite the disappearance of features.

Floor IIc Results

Most features on floor IIc are found in blocks C and D while block B only has one feature (hearth) and block A has none. Block C has one small hearth and two small pit features in addition to several large rocks. Block D has two hearths, one large hearth in the south-central area and another to the north. There is a cluster of postholes and a small pit feature also in block D in the northeastern corner. The lithics on floor IIc are distributed in all blocks but the most significant concentration is in the southeastern part of block D (figure A.50). There is a less concentrated cluster in block D above the northern hearth and near the hearth in block B. Block A has concentration of artifacts along its northern margin. The tools distribution (figure A.51) shows clusters around both hearths in block D, near the hearth in block B, and a concentration in the north of block A. The clusters of tools in block D and A have an even distribution of tool categories. The tool cluster in block B however has more heavy-duty tools than any other tool type. The debitage is mostly concentrated in block D but the other blocks also contain small, even distributions (figure A.52). Overall it appears that that xsm sized debitage is in the same locations as the other sized debitage and this is supported by a strong correlation statistic of $r = .68$ ($p = .00$). There is a very weak correlation between the locations of tools and debitage ($r = .26$, $p = .00$).

IIc appears to have a much more dispersed distribution of lithic artifacts than IId (figure A.53). Only in a very specific area of block D do we see fewer materials (maximum of 13.98% less) in IIc than IId. The high percentage is due to the decrease in the overall lithics located in the clustered area. Otherwise, there are more artifacts in many areas of all of the blocks in IIc, and has a maximum of 3.98% more artifacts in one area in the southeast of block D. Although the highest percentage of change occurred in the southeast of block D, the location of this cluster of artifacts did not change very much. Both floors exhibit a cluster of artifacts in this area and the only major difference is that the cluster in IIc expanded slightly, becoming less concentrated than the previous floor's cluster. There are also congruent minor clusters in each floor in block D in the northeast area of the block. Elsewhere on the floor however, IIc has a much more widespread distribution of lithics, specifically in Block A and B. Each floor contains a cluster of tools in the southeastern area of block D although IIc appears to be a domestic area while the cluster in the previous floor is more than likely an activity area. IIc also has possible domestic areas in the northeast of block D, in block B associated with a hearth and a possible heavy-duty activity area in block A, each of which has no equivalent in the previous floor. There are no features in block A of IIc and a hearth in block B, both unlike the previous floor. The only similarity between floors in block C is a small hearth that exists in IIc that is close to the area of a larger hearth in the previous floor. Block D shows the most similarity between floors given the matching pits in the northeast corner and hearths in the east-central area. IIc has a large hearth in the southeast of this block that is not found in the previous floor. Block D is most similar between floors but overall the organization of these two floors is quite different.

Floor IIb Results

In block A there are five pit features, three of which along the western margin, one in the southeast corner, and one in the northeast corner. There is a hearth near the largest pit feature in block A and some scattered charcoal indicating a possible hearth in the southwest corner. Block B has a cluster of a hearth, pit, large rock, and flecks of charcoal in the southwestern area. Block C has a cluster of large rocks, postholes, and a hearth along the northern edge. The only features in block D are two large rocks, a posthole, and a scatter of charcoal flecks. The overall lithic distribution in this floor is heavily concentrated in block D, specifically around the area where flecks of charcoal were discovered (figure A.54). There is also a cluster of lithic material in block C near the hearth, postholes, and large rocks. In blocks A and B there are lithics associated with the pit and hearth features though not as dense as elsewhere in the house. The densest concentration of tools is in block D near the single posthole and near the large rocks (figure A.55). No single tool category stands out in these concentrations of tools. The debitage is mostly found in heavy concentrations in block D but also is found in a dense concentration near the hearth in block C (figure A.56). Most of the xsm debitage visually co-occurs in the same areas with other sized debitage and is confirmed by a strong correlation ($r = .69$, $p = .00$). There is also a strong correlation between tools and debitage on this floor ($r = .62$, $p = .00$).

When comparing IIb to IIc, it appears that during IIb the lithic distribution becomes more concentrated in areas in block C and D (figure A.57). We see a shift of materials from the southeastern corner of block D to the northeastern corner. The southeast corner of block D has a maximum of 3.23% less material and the northeast corner sees 3.41% more material in IIb than IIc. IIb also has a concentration of artifacts in the northwest of block C which does not exist in the previous floor. Block A of IIb has more artifacts along the western edge of the excavation but does not have as many artifacts in the northern part of the block as IIc. The tool distribution shows that each floor may have a domestic area in the northeast of block D although the cluster of tools in IIb is not associated with a hearth. This appears to be the only major similarity between the two floors in terms of tools distribution. The features also point to major differences between floors, starting in block A, which now has four pit features and a hearth in IIb unlike the previous floor, which had no features in this block. There is a small hearth in the southwestern area of each floor in block B, but in IIb there is now a pit feature that was not present in the previous floor. Block C appears to be the most similar given that there is a hearth feature on each floor in the northeast in addition to a cluster of large rocks. In block D, IIb has no hearths or pit features which were present in the previous floor. Overall there are some similarities in artifact distribution and features, but other floor transitions have shown a greater degree of similarity than this one.

Floor IIa Results

IIa is the most recent prehistoric floor in Housepit 54 and only contains evidence of a living surface in blocks A, B, and C. Block A has a cluster of three small pits and a hearth in the southwestern corner and a small hearth in the southeastern corner. Block B has a ring of four hearths and a single pit feature near the western-most hearth. Block A has one large hearth in the northeastern part of the block and two small pit features to its south. There is one major concentrated area of lithic artifacts in the southwest of block C and more minor concentrations near hearths in block A and B (figure A.58). There is a concentration of lithic tools in each of the three blocks represented in IIa (figure A.59). In block A tools are concentrated near two small pit features along the western edge of the block. In block B, there is a concentration of tools in the southeastern area of the block. Block C has a dense area of lithic tools in the southwestern corner of the block. None of these concentrations of tools are represented by a single tool category. The debitage in IIa is mostly concentrated in a cluster in the southwestern corner of block C and more thinly distributed elsewhere on the floor (figure A.60). This dense concentration and the rest of the distribution of debitage shows that xsm and other sized debitage are located in the same areas and is supported by a correlation value of r= .66 (p= .00). There is also a moderately strong correlation between the locations of tools and debitage (r= .53, p= .00).

The change from IIb to IIa (figure A.61) obviously shows a large amount of change in Block D because no household existed in this block during IIa. Elsewhere in the house however, we see less materials in the northern part of block C (maximum of 4.06% less). There are more artifacts in blocks A and B in IIa than the previous floor in addition to the southwest corner of block C where there is a maximum increase of 10.35% of materials. The clusters of tools in IIa are in very different locations than the previous floor except for block A where there are congruent tool clusters along the western margin. Neither floor exhibits any special activity areas and artifact concentrations mostly represent potential domestic areas. When looking at the features, there are quite a few similarities between the floors. Block A contains charcoal flecks or a hearth and pit features in the southwest corner. Block B also shows a similar pattern in both floors of an associated pit and hearth in the western part of the block. There is however, a cluster of hearths in the northeast of this block in IIa that is not present in the previous floor. Block C in each floor contains a hearth in the northeast corner in almost the exact same location. Although the distribution of artifacts is different between these two floors, the features are in very similar locations between floors.

Discussion

Table 2 synthesizes the correlation values mentioned above in the results of each floor. As the table shows, all values are statistically significant with p-values falling between .04 and .00. Additionally, all but one of the floors exhibit strong positive correlations between extra-small and other debitage with values ranging from .54 in IIi and .92 in IId. Given these values and the visual distributions of debitage, it can be concluded that the artifact distributions that are on these floors are almost all in-situ distributions that haven't been subject to intensive cleaning.

Since this is the case, we can interpret the change over time of actual lithic artifact distributions as they were originally deposited.

Table 2. Debitage correlation values.

Strat	R	P-value
IIa	0.66	0.00
IIb	0.69	0.00
IIc	0.68	0.00
IId	0.92	0.00
IIe	0.82	0.00
IIf	0.40	0.00
IIg	0.80	0.00
IIh	0.71	0.00
IIi	0.54	0.0002
IIj	0.58	0.00
IIk	0.74	0.00
IIL	0.56	0.0002
IIm	0.90	0.00
IIn	0.63	0.02
IIo	0.61	0.047

The little house is difficult to interpret, especially in terms of the percent changes maps and tool/debitage correlation given the expansions and changing of shape occurring in each of the three floors. The visual interpretation of features and lithic distributions however, shows a similar trend through all floors (IIo-IIm). All three of these floors have hearths located in the northern part of the floor and in IIn/IIm there is a large pit feature associated with this hearth. Each floor also has a cluster of lithic artifacts associated with a hearth in what appears to be evidence of domestic areas. This is especially interesting given that the estimated population is consistent (IIo= 4, IIn= 3, IIm= 4). Even though these domestic areas appear to be in different locations in each floor it appears space is being used in the same way. Also, the entire extent of the house is unknown and floors IIo and IIn only represent what is most likely the eastern part of the little house given where the boundary is located. In IIo, there is no boundary to exactly gauge where in the house the subset of the floor is. If the whole extent of the house was visible, these domestic areas might be closer in spatial proximity than they currently appear. Not much can be gathered from the correlation between tools and debitage during these floors because none of the values were statistically significant, most likely due to the sample size. Given the consistency of population and the similar patterns of features and domestic areas, the little house appears to be more closely associated with the predictions of hypothesis two.

Through the duration of the rectangle house, there is an overall rise in the estimated population throughout the seven floors. From IIm to IIL there is an increase in population from four to eight individuals and a dramatic change in the organization of space due to the house expansion to two excavation blocks (A and C) instead of just block A. From IIL to IIk the estimated population again remains stable (n= 8 to n= 5) but spatial organization stays quite similar. Lithic concentrations and features are found in very similar areas of the floor. One difference is that what used to be a domestic area in IIL shifts to a specific flint knapping activity area in IIk. The next transition from IIk to IIj shows a possible increase in estimated population from five to ten individuals. Despite this population increase however, we again see remarkable stability between the two floors. The biggest difference between the sample size between the two floors which accounts for the change displayed in the percentage map comparing the two floors (figure A.25). Features and artifact distributions on this floor are similar just like the previous transition of floors. The next floor transition from IIj to IIi is marked by a possible decrease in estimated population, from 15 to eight household residents. Even though the estimated population changes, there is remarkable consistency between both floors. The debitage distribution is slightly different in each floor, but the tool distribution and features occupy similar locations. There are even activity areas located in the same spot on the floor, though the activities differ. Large hearths and pit features are also found in the same spots during this transition. The IIi to IIh transition is difficult to interpret given the multiple levels of IIh that have different patterns of features within them. However, if we assume that IIh level 3 is represents a feasting event and IIh levels 1 and 2 represent a living surface, we can compare the distributions of IIi with IIh levels 1 and 2. During this transition, the estimated population doubles from eight individuals to 16. IIh does contain an activity area in the same location as the previous floor but the activities are different. The overall distribution of lithic material and features also differs between floors and does not align as well as distributions from previous transitions. The transition from IIh (levels 1 and 2) to IIg also shows a difference in the spatial layout of the floor as the previous transition, although this time the estimated population remains mostly stable (n= 19). The features between the floors appear to be located in fairly consistent areas but the artifact distributions are quite different. Tools and debitage are located in clusters inconsistent with those of the previous floor although IIg also contains a groundstone activity area like IIh. The transition from IIg to IIf is the last one before the house expands again and is associated with a large increase in estimated population from 19 to 32 house residents. During this time there are more differences in spatial organization of the floor than there are similarities. Only a select number of features and artifact clusters on the floor can be related in space to one another between floors. IIf has more pit features and a large hearth that are not represented in IIg and has a much more widespread distribution of materials across most blocks. The differences in lithic distribution can also be attributed by a large difference in samples size. It makes sense that IIf would have more artifacts than IIg given the large increase in population where more people would be involved in more activities. There does not appear to be an obvious relationship between tool/debitage correlation and population estimates. The hope was to determine if tools and debitage were in the same areas of the floor when population was high, resulting from a crowded space. The rectangular house starts out with similar but slightly modified spatial layouts between floors, but as the population grows and changes more dramatically, there appears to be greater change in the use of space. It is interesting that when overall estimated population is low (below 16), space is organized consistently despite an overall increase in estimated population during this time. It isn't until population is above 16 that we see great amounts of change during demographic increases. This might suggest that there is an overall population threshold that needs to be reached for the space in the rectangle house to be crowded enough to require reorganization during demographic changes. It seems this time, that the trends during the lifespan of the rectangular house support the predictions of hypothesis one in the first few floors, and hypothesis two in the last of the floors.

With the expansion to the large house between IIf and IIe there is a drastic reorganization of space that occurs with a significant jump in estimated population (32 to 44 individuals). Block D and B appear to be the hubs of most activity rather than the blocks utilized in the previous floors. Since the population saw such a big increase, the “empty” block (A) of IIe may have been used as sleeping spaces to accommodate the crowding given the limited number of artifacts and features. From IIe to IId there again is a dramatic population change except for this time, the estimated population decrease by almost half, from 44 to 23 estimated individuals. However, there is not as dramatic of a reorganization in space. In fact, there are quite a few similarities between the two floors involving distribution of features and artifacts, with the only major difference being the quantity of these things. This empirically makes sense given the decrease in population, for there already was a large space that was previously used. It would take more work to shrink the house instead of using the space that is already there, given that IId is the next occupation after expansion. The same space would be used and there are most likely less features because there are less people depending on them on a daily basis. There is a surprisingly significant amount of change that occurs between IId and IIc despite the estimated population staying stable (from 23 to 24 individuals). Lithic artifacts are much more spread out than in the previous floor, despite sharing a cluster in the southeastern area of block D. Block D shows the most consistency, but elsewhere there are less features and more artifacts in IIc than the previous floors. The questions asked by the test expectations of both hypotheses in this study do not account for this kind of change. This transition shows that the population is consistent and large change occurs. There may be another variable at play that is not accounted for in this study that could possibly explain this transition. The transition from IIc to IIb sees a small increase in estimated population from 24 to 29 estimated residents and the floors see moderate change in organization but are more alike than the previous transition. More features appear which may be explained by a greater number of individuals present, but block D for this first time in the big house does not contain a hearth or pit, though it does contain a dense distribution of artifacts. The last transition from IIb to IIa shows another small increase in population from 29 to 33. Besides the absence of block D in IIa, these floors are quite similar in the distribution of features and to a lesser extent, artifacts. Pit features and hearths are in congruent locations in each block that is represented in both floors. The population change was similar to the previous floor but this one shows more consistency which is expected based on the hypotheses mentioned above.

The results from this study have added a level of complexity in the answers to the questions from the hypotheses and test expectations outlined earlier. Overall however, there seem to be two different trends in how spatial organization on the house floor changed and evolved over time and are summarized in table 3. The first trend from IIo to IIi appears to follow a pattern of "descent with modification" as explained by the concept of guided variation in hypothesis two. In this trend, subsequent floors show a surprising amount of similarity. During these deeper floor transitions there is overall continuity between the locations of artifact distributions especially including domestic areas and to a lesser extent, activity areas. There is remarkable continuity in the locations of features during this phase of Housepit 54. During this time, it is possible that the force of guided variation is at work. There are incremental changes between each floor which keep subsequent floors from being identical, but the overall structure looks and is organized in a similar manner. It appears as if the organization of space at this time is a cultural behavior or trait that is learned by a new generation and is altered before it is transmitted to the next, leading to the slight variability that has been observed. However, the population estimates should be interpreted with caution, for they are only estimates based on FCR counts where sample size may not completely represent actual household population. The minor fluctuations noted most likely do not represent major population shifts unlike later floors. Though this group of floors looks like descent with modification, it can't be fully accepted for there were no drastic population changes to test whether spatial organization was resistant to crowding. After this group of floors, we see a different pattern of change over time that is centered around large population fluctuations. During the following time the population is also larger on average which means that there is a possible total population threshold in which transmitted behavior is overridden.

From IIi to IIa, it appears as large population fluctuations led to the reorganization of lithic artifacts and features found on house floors. Distinct spatial reorganization and change happens in five out of the eight transitions during this time and where population ranges from eight to 44 individuals. Lithic artifacts are found largely in different areas between floors in addition to features that change position or disappear altogether during transitions when population changes drastically (except for when it decreases as discussed above). However, during this time when population stabilizes or slightly increases, there is continuity in spatial organization between floors. The IId to IIc transition is the only one that does not adhere to this pattern and as mentioned above, could be explained by an unknown variable that is not accounted for during this study. During this time, the site structure of these floors is heavily influenced by population as predicted by hypothesis one.

Table 3. Summary of spatial change between house floors.

Transition	**Population Change**	**Feature locations**	**Total Artifact Distributions**
IIo-IIn	-1	Fairly Consistent	Consistent
IIn-IIm	1	Fairly Consistent	Fairly Consistent
IIm-IIL	4	Inconsistent	Inconsistent
IIL-IIk	-3	Consistent	Consistent
IIk-IIj	10	Consistent	Consistent
IIj-IIi	-7	Consistent	Consistent
IIi-IIh	8	Inconsistent	Inconsistent
IIh-IIg	3	Consistent	Inconsistent
IIg-IIf	13	Inconsistent	Inconsistent
IIf-IIe	12	Inconsistent	Inconsistent
IIe-IId	-21	Consistent	Consistent
IId-IIc	1	Inconsistent	Inconsistent
IIc-IIb	5	Consistent	Consistent
IIb-IIa	4	Consistent	Consistent

Chapter 6: Conclusions

This study has comprehensively examined the spatial organization of each living surface from Housepit 54 of the Bridge River site for the first time. Research described in this thesis has attempted to test the long-term belief that the structure of a site is based purely on spatial contingencies. It has also sought to examine whether the concepts of spatial organization in a constrained space are transmitted between generations as a cultural trait of behavior. The findings of this study have pointed to two major trends in the data as they relate to these specific hypotheses. The first finding is that it appears as though descent with modification occurred through the first seven floors of Housepit 54's existence. Each subsequent floor shares a great degree of similarity in the ways in which the features and lithic artifacts are distributed in space. However minor changes in space, location, or existence of features and clusters of artifacts are visible, which hints at the possibility of evidence of alteration to learned techniques by each generation. Hypothesis one can therefore be partially accepted given the continuity in site structure of subsequent floors over time.

The second major finding from the study is that when the population reaches an estimated 16 total house residents, population fluctuations are much more influential to the house's spatial organization. Given that there are more people living within the confined space than the previous seven floors, crowding appears to have caused significant reorganization of lithic artifacts and features. Subsequent floors no longer appear to show continuity in spatial organization when population significantly increases (IIg-IIf and IIf-IIe). When the population remains fairly stable or decreases between floors, there is more stability which indicates the influence of crowding in the confined space. Therefore, during this phase of the house (IIi-IIa), hypothesis two can be mostly accepted given the correlation between reorganization of space and population increases, which appears to align with other findings about solutions to spatial contingencies such as crowding.

This study was only able to use the lithic and feature location data to test the hypotheses discussed above which meant that a significant amount of data from faunal and botanical remains was not used. A future study is crucial to test the findings from this study to determine whether the discussed conclusions are valid. Lithic artifact data recovered from *within* features should be examined for further insights to spatial organization, specifically in terms of discard, caching, and abandonment practices. This study also did not take into consideration the distribution of artifacts based on the assorted lithic raw material. This would provide a more nuanced understanding of not only where artifacts are located but where different individuals were located in terms of their social status, given the implications of non-local raw materials and prestige items. This study was able to point to possible domestic areas and potential activity areas which can serve as a starting point for future studies examining these sorts of locations. To further explore the effects of cultural transmission and guided variation, the individual artifacts located within domestic areas could be studied in greater detail to determine specific stylistic markers that may represent individuals or nuclear family units that persist through time. Faunal and botanical data can test whether or not lithic artifacts can accurately depict how space was used by the past peoples of Housepit 54 or if the lithic data only paints part of the picture. These additional types of data would also be extremely helpful in the clearer definition of domestic and specialized activity areas noted in this study. Overall, this thesis has provided a new methodological and theoretical angle for the study of space as a cultural trait or behavior and how site structure evolves over time.

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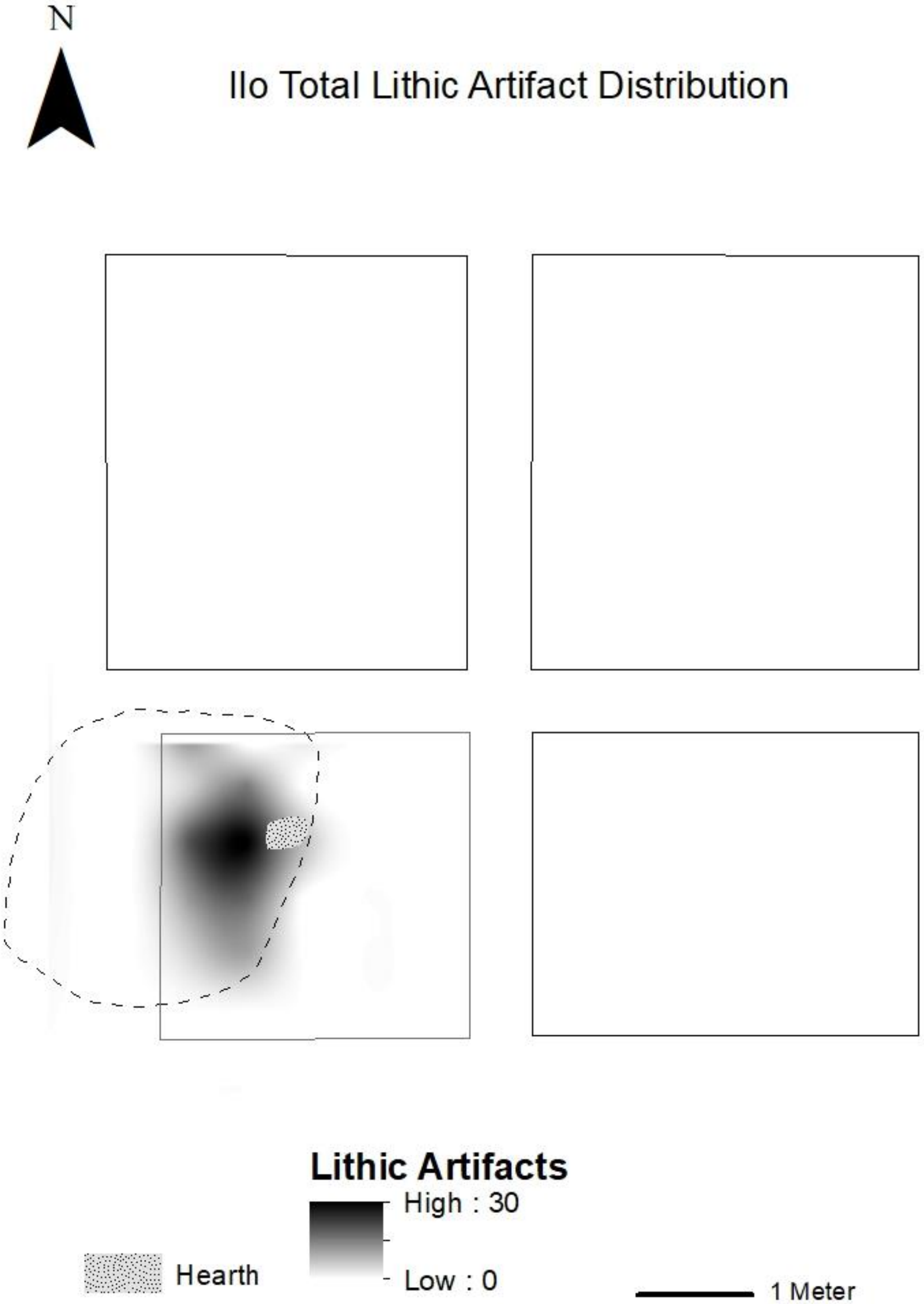


Figure A.4: Spline map of the total lithic artifact distribution from floor IIo.

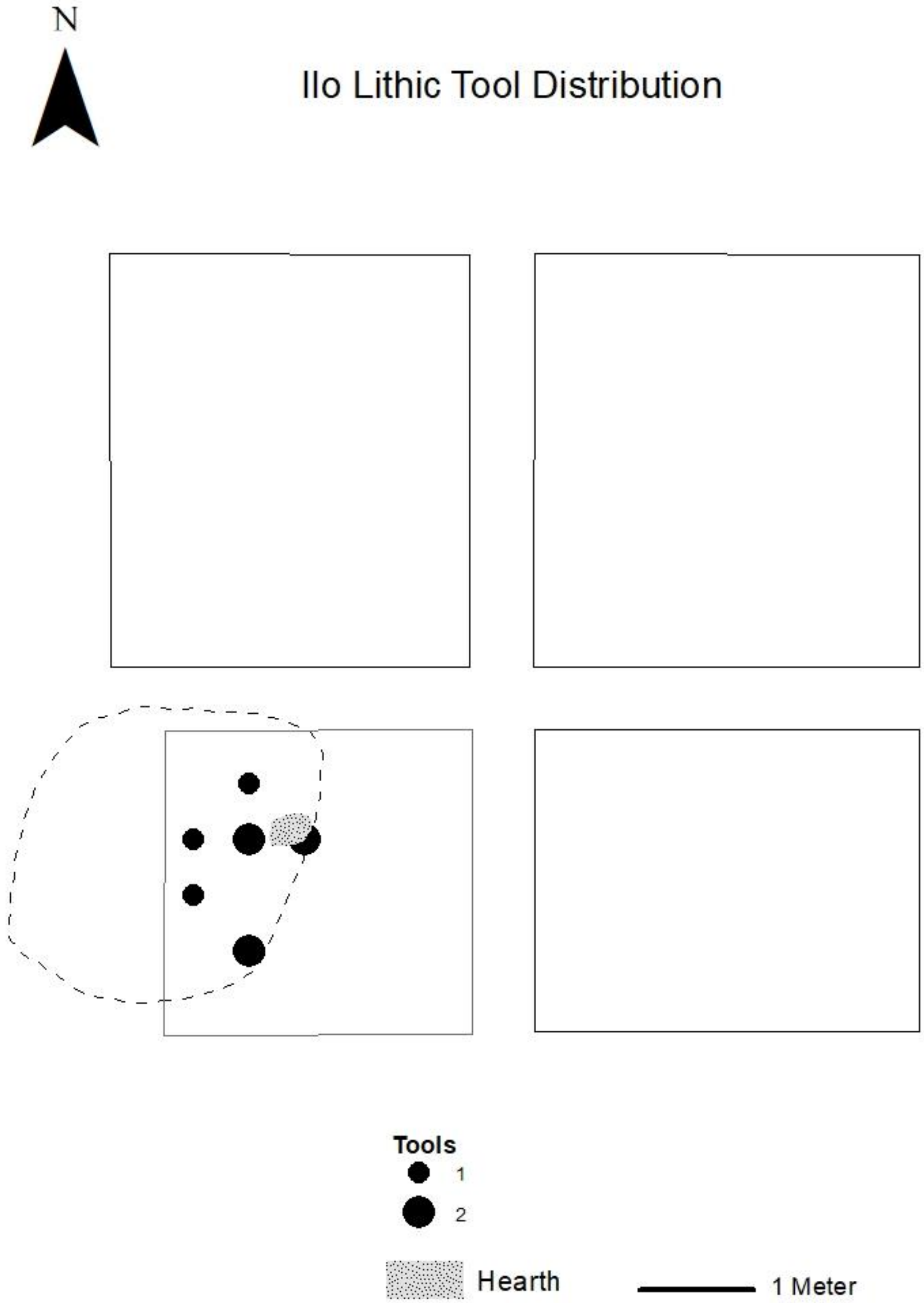


Figure A.5: Graduated symbol map of lithic tools from floor IIo.

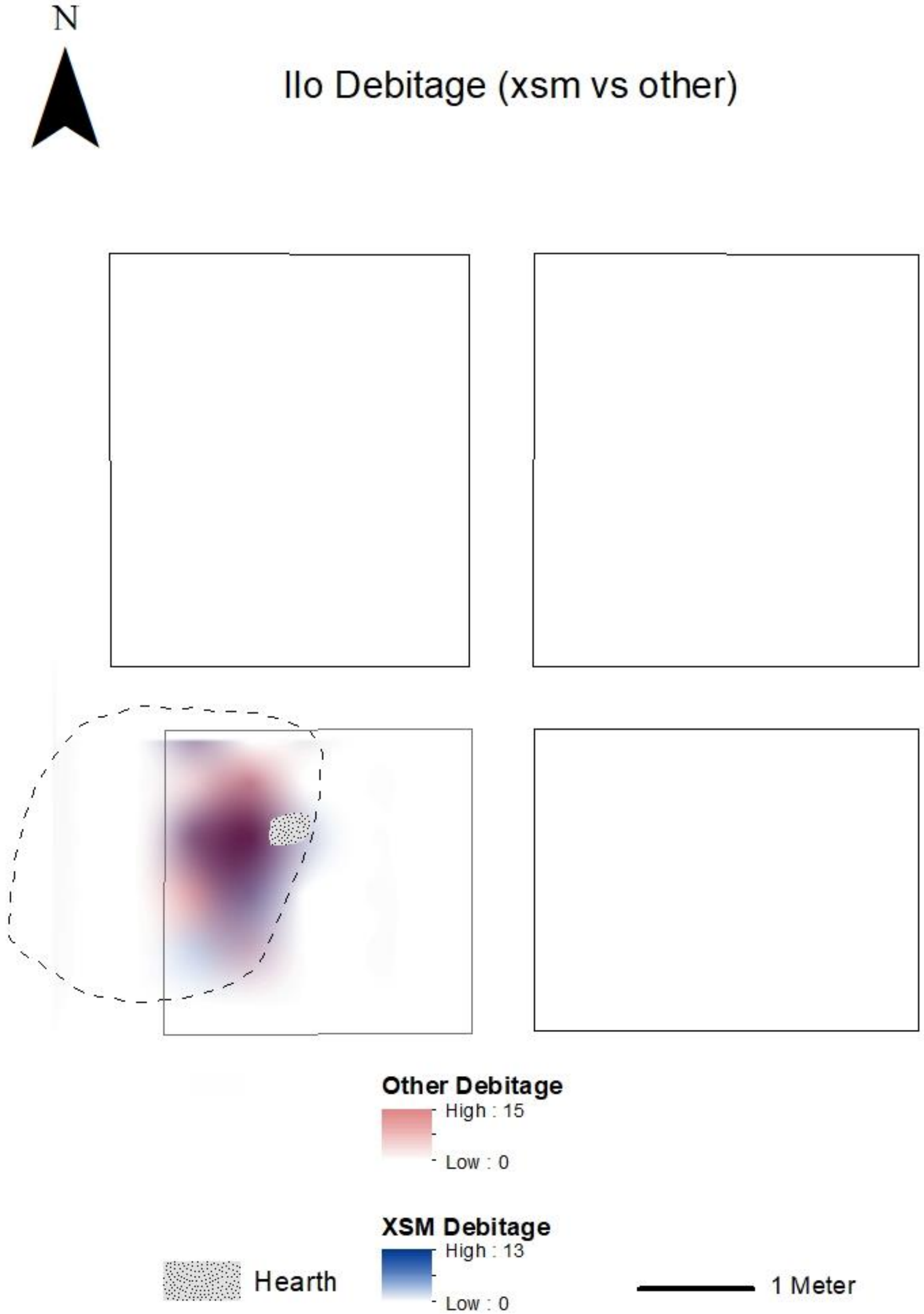


Figure A.6: Spline map of the debitage distribution, broken down by size class on floor IIo.

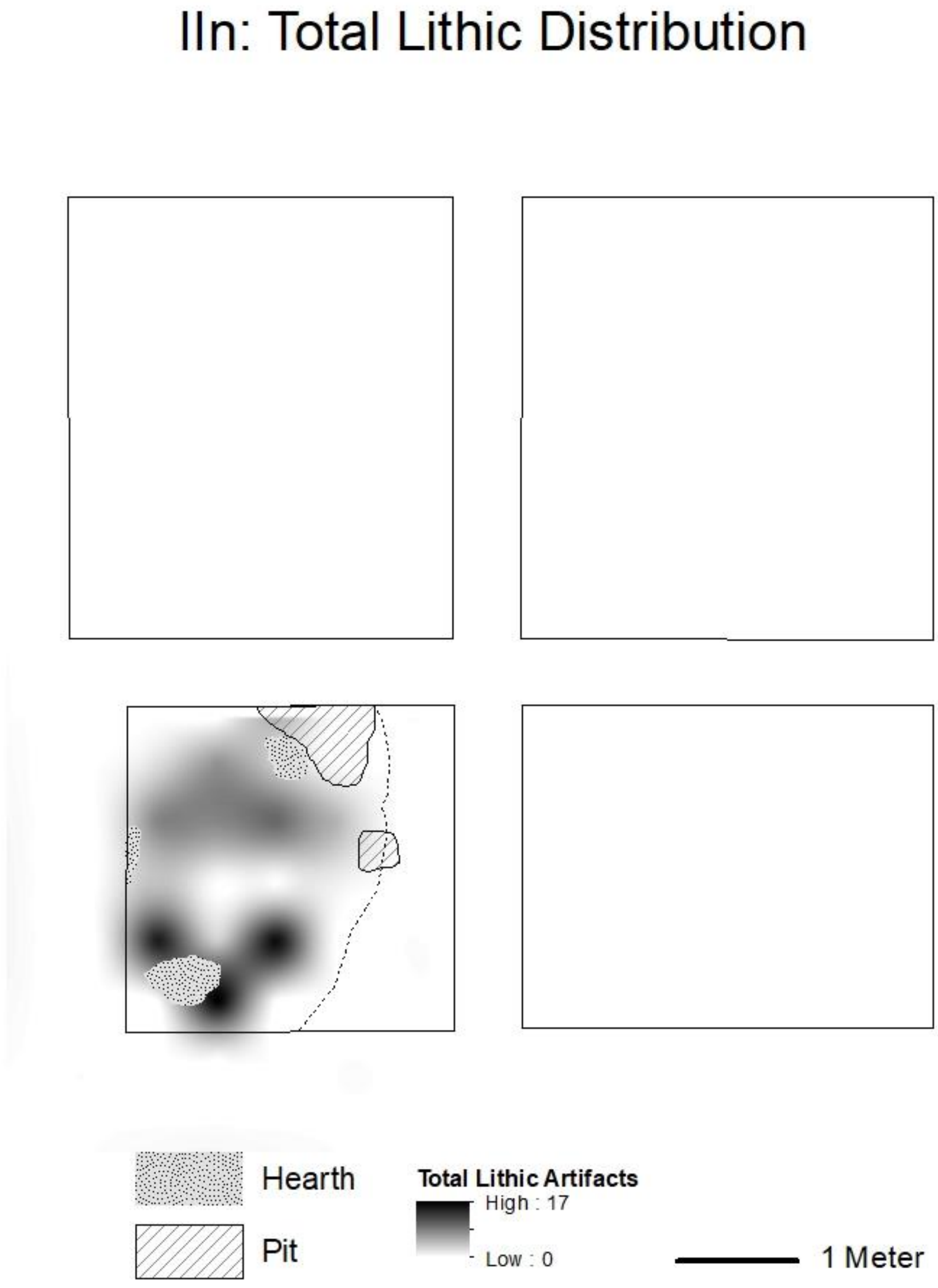


Figure A.7: Spline map of the total lithic artifact distribution from floor IIn.

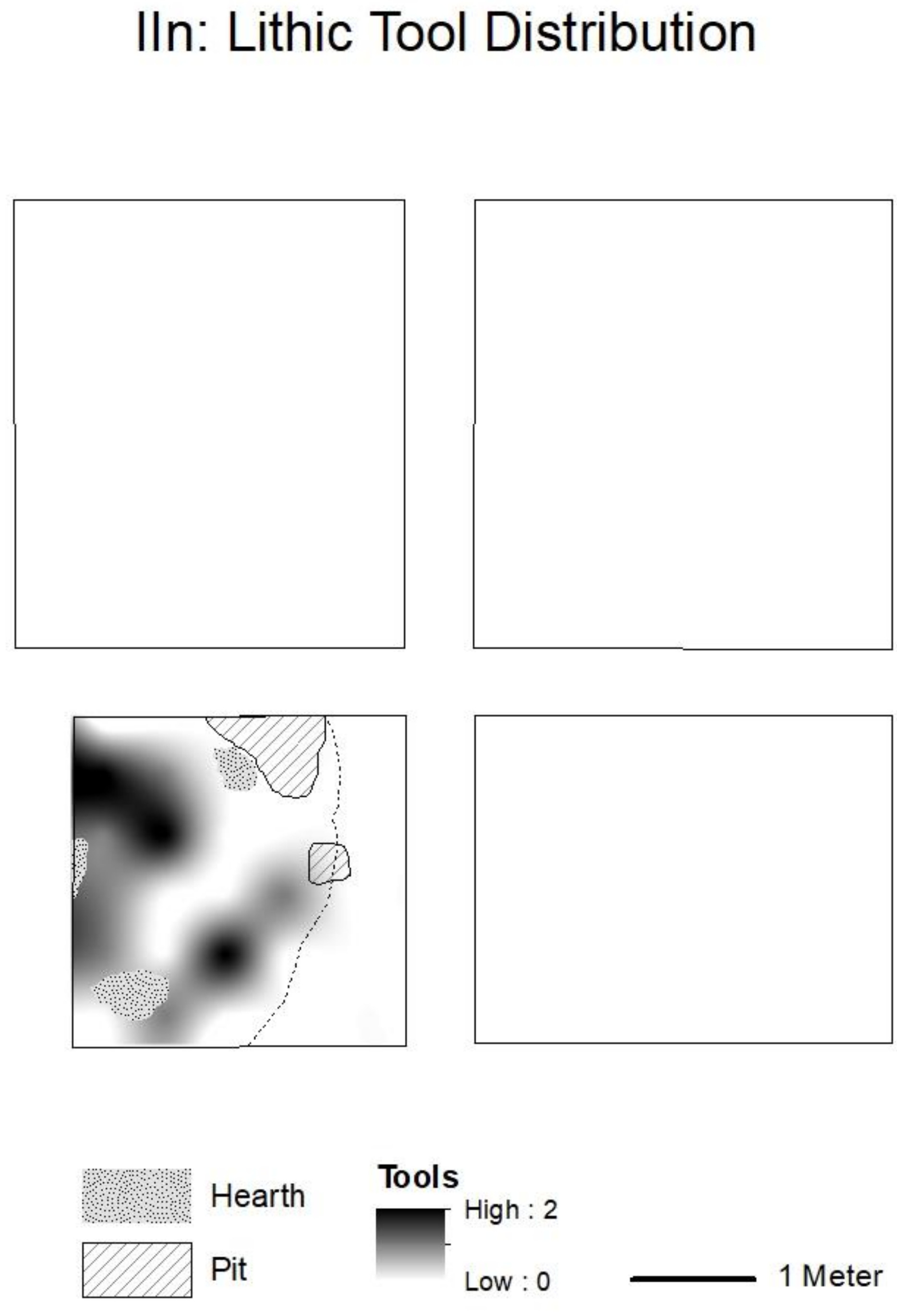


Figure A.8: Spline map of the lithic tool distribution from floor IIn.

Figure A.9: Spline map of the lithic tool distribution from floor IIn.

Percent Change from IIo to IIn

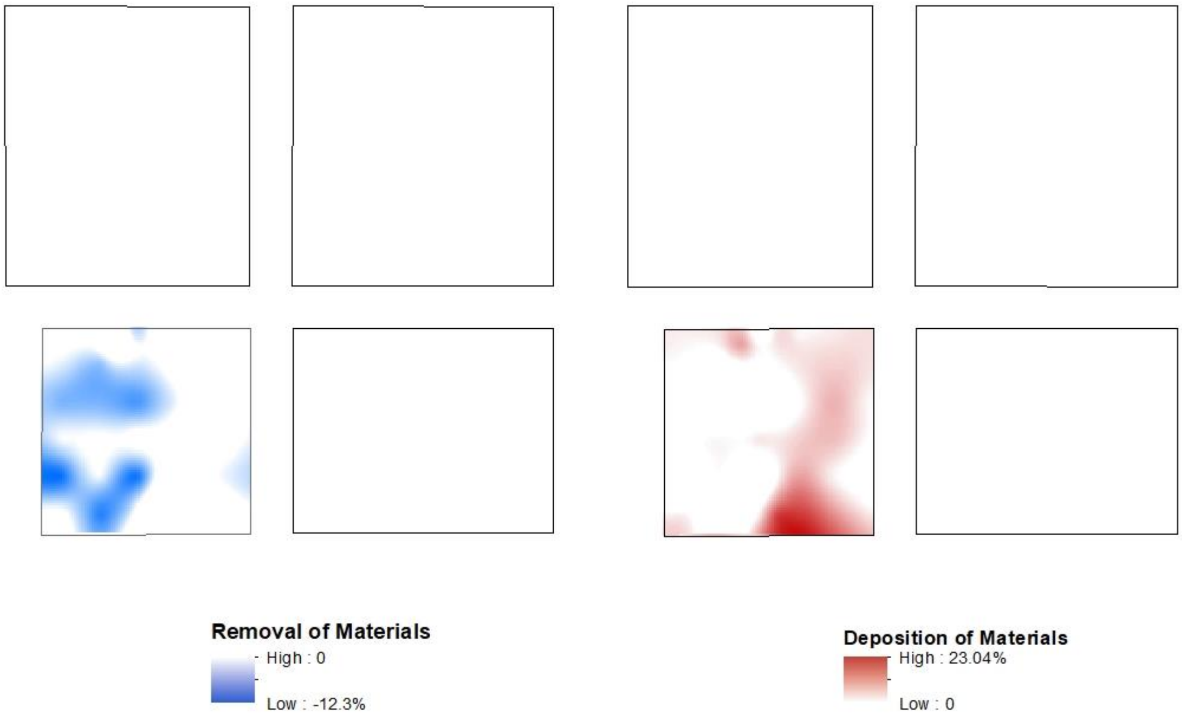


Figure A.10: Spline map showing the difference of total lithic distribution from IIo to IIn

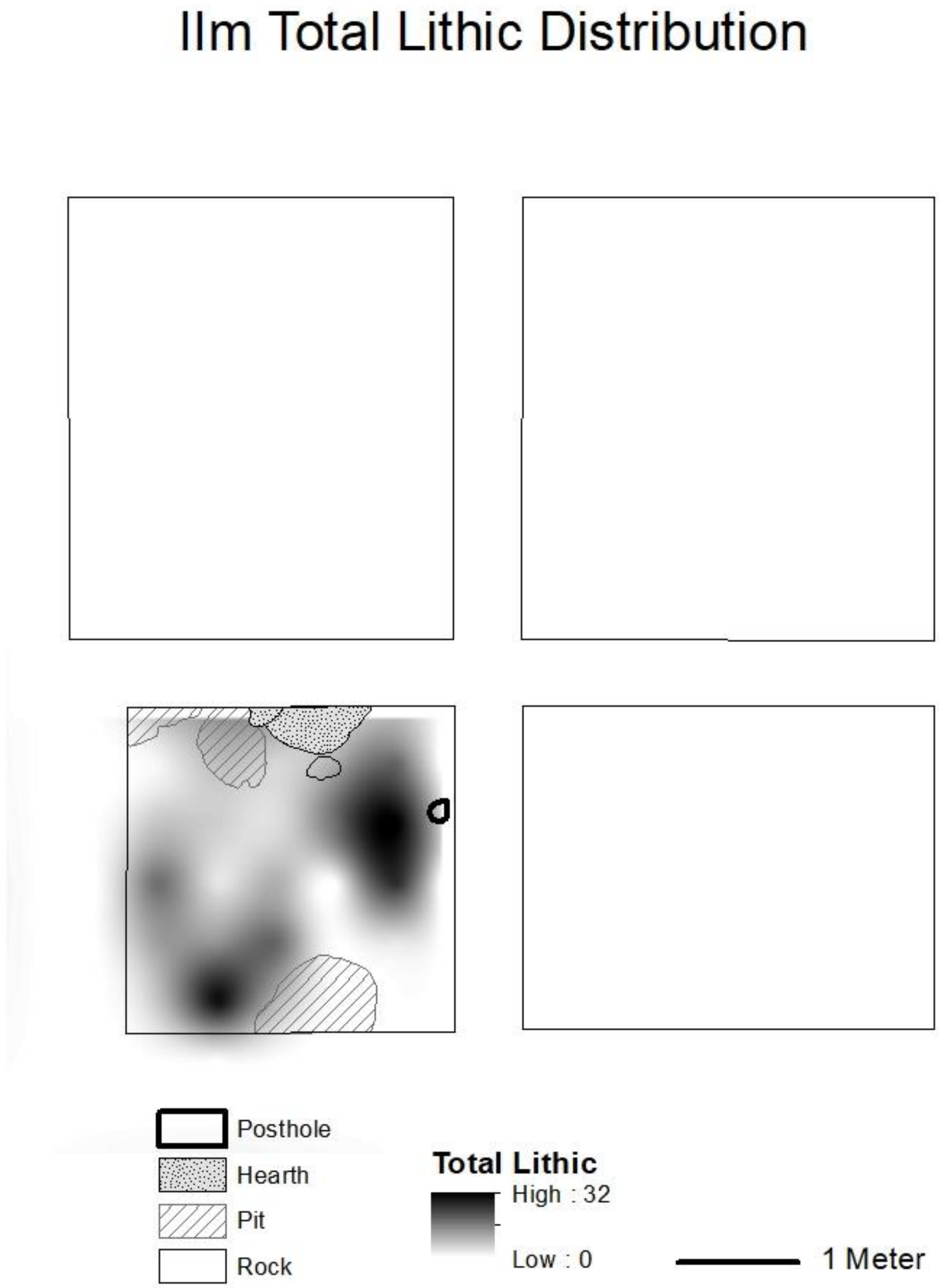


Figure A.11: Spline map showing the total lithic artifact distribution from floor IIm.

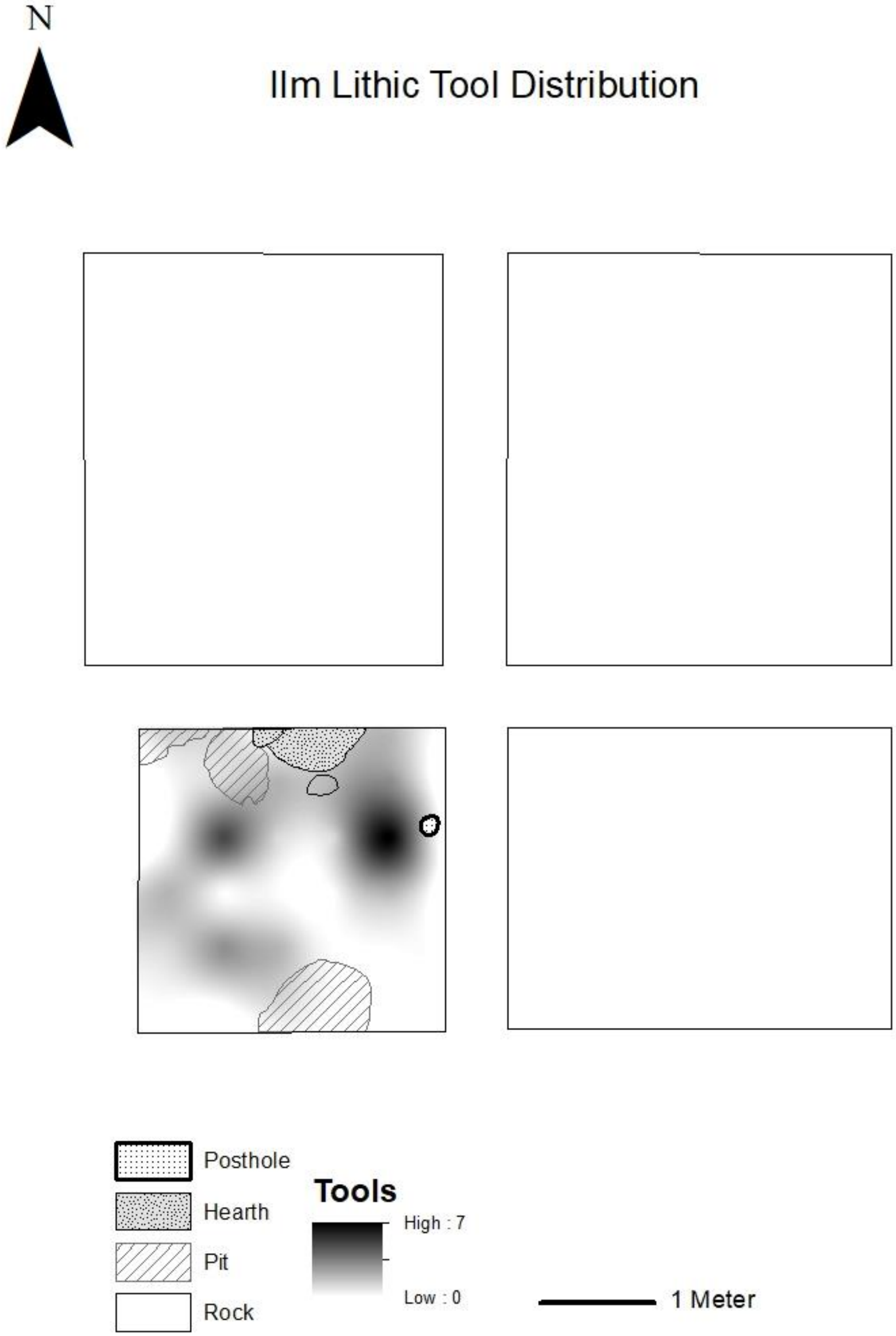


Figure A.12: Spline map showing the lithic tool distribution from floor IIm.

IIm Debitage (xsm vs other)

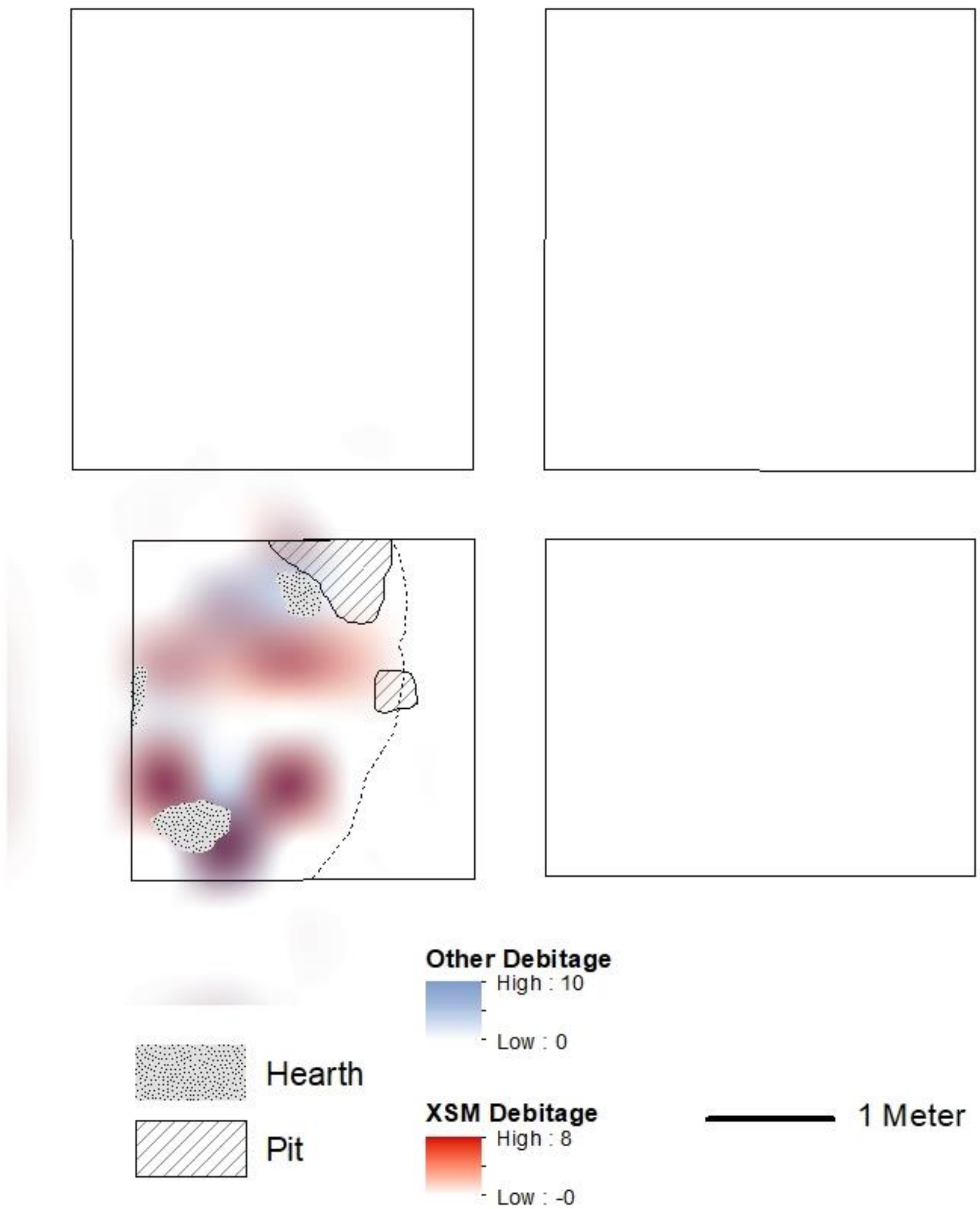


Figure A.13: Spline map showing the lithic debitage distribution from floor IIm.

Percent Change from IIn to IIm

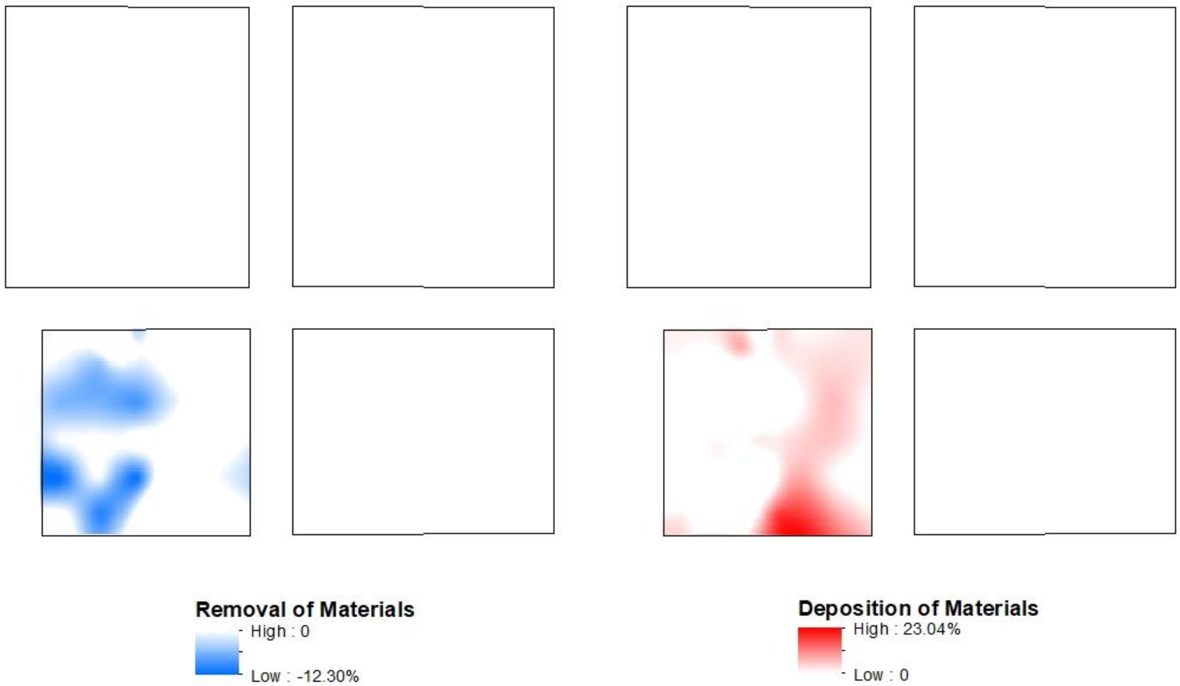


Figure A.14: Spline map showing the percent change of the total artifact distribution from IIn to IIm.

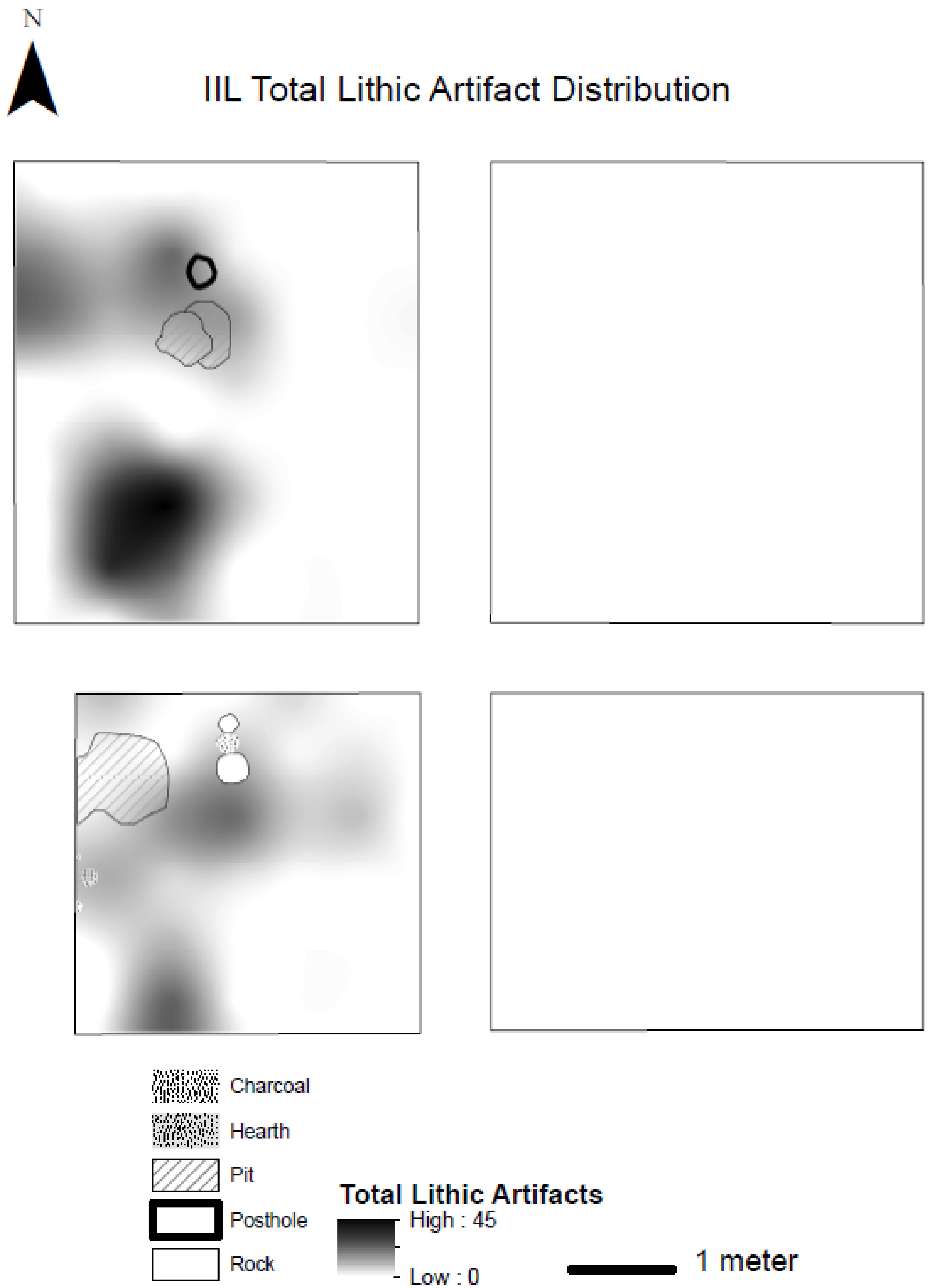


Figure A.16: Spline map showing the total lithic distribution from floor IIL.

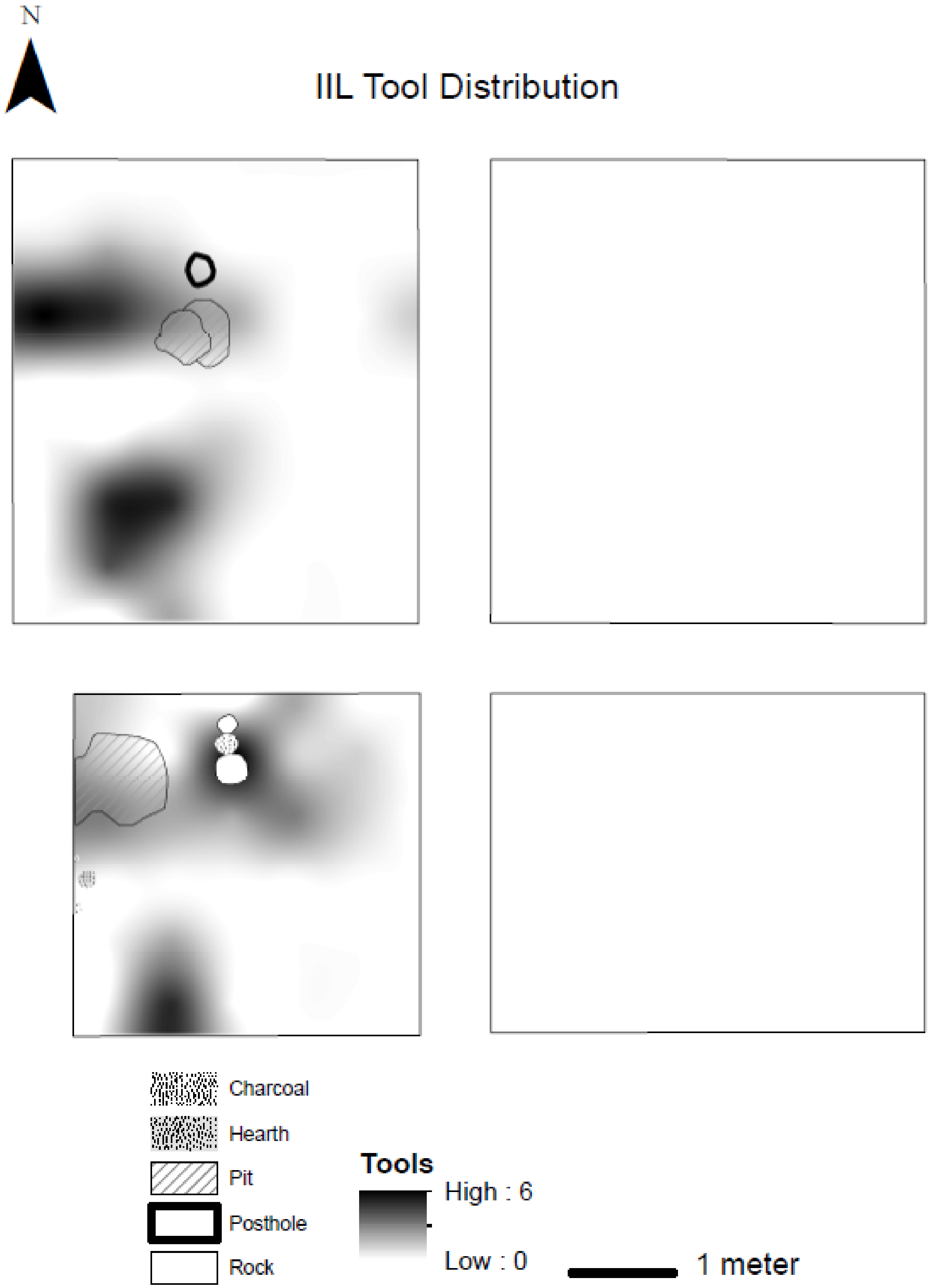


Figure A.17: Spline map showing lithic tool distribution from floor IIL.

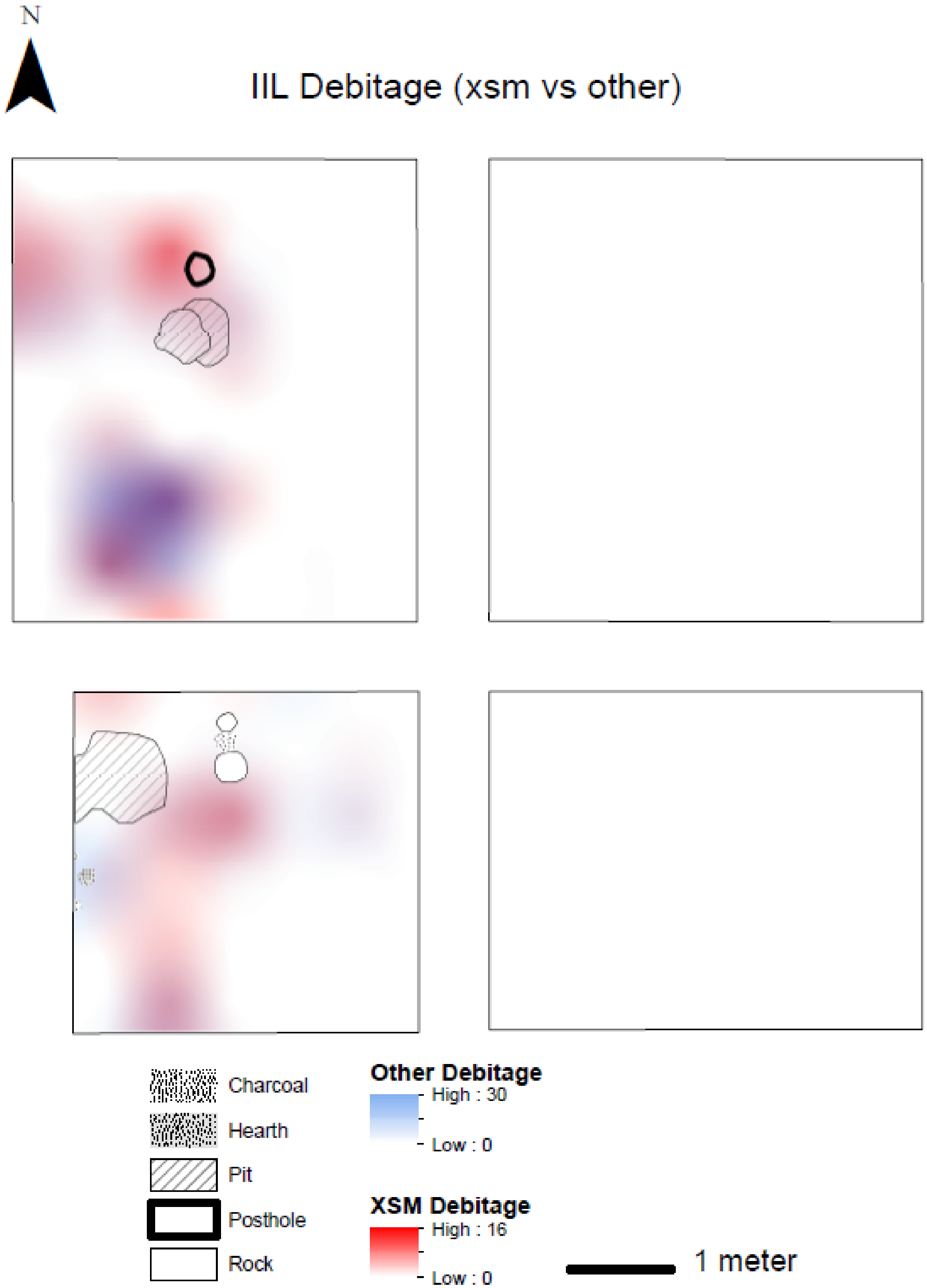


Figure A.18: Spline map showing debitage distribution separated by size class from floor IIL.

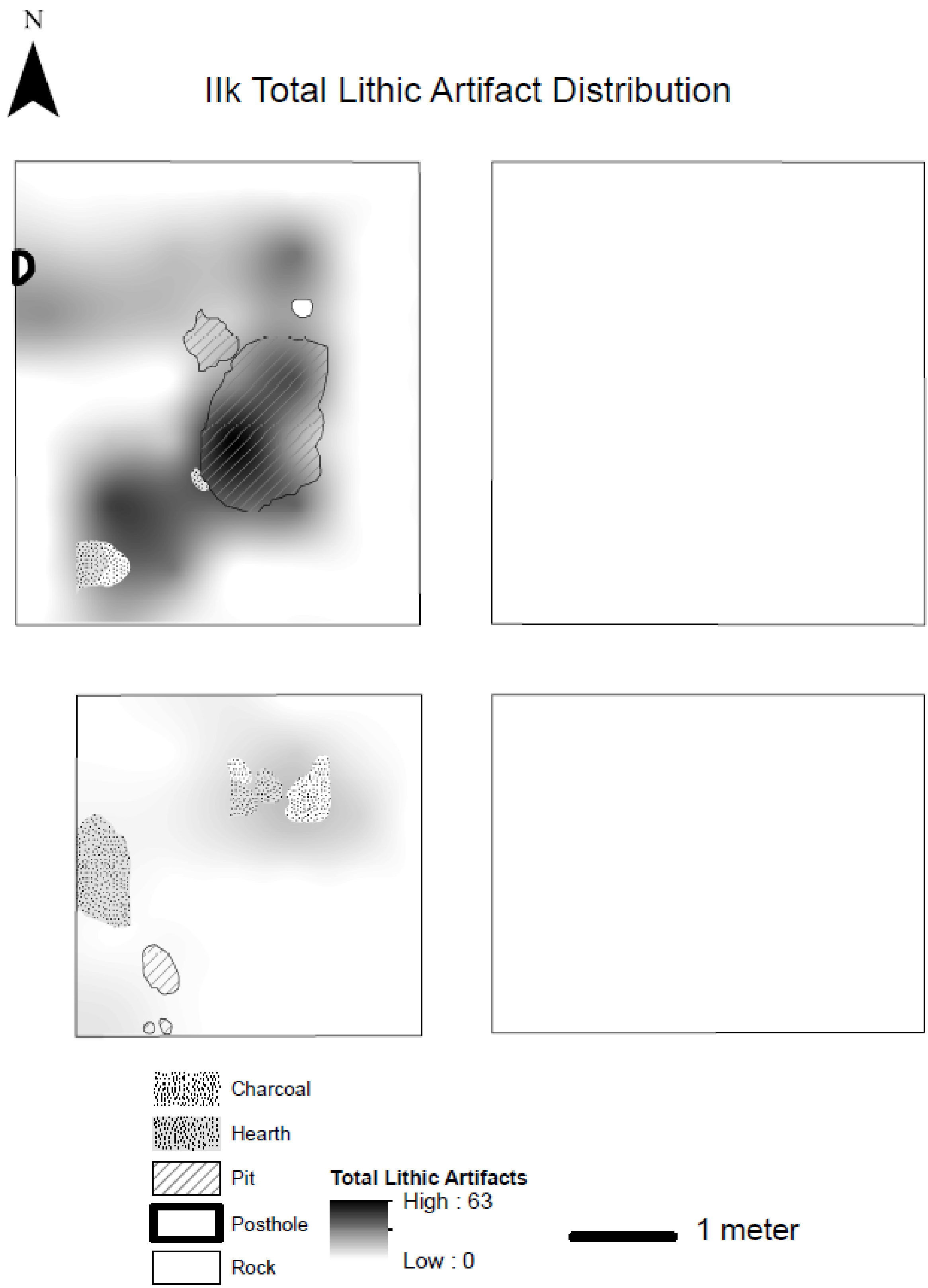


Figure A.19: Spline map showing total lithic artifact distribution from floor IIk.

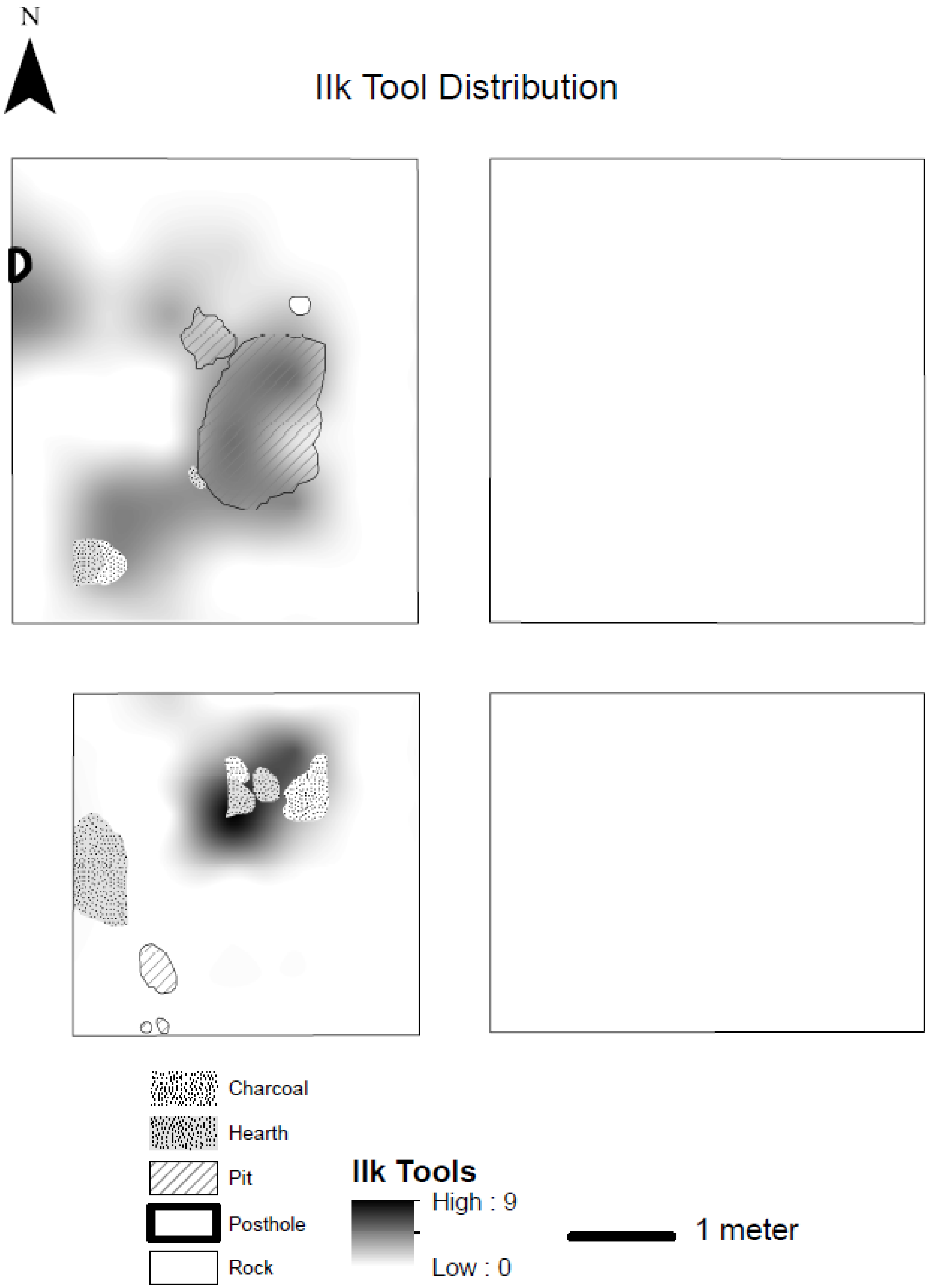


Figure A.20: Spline map showing lithic tool distribution from floor IIk.

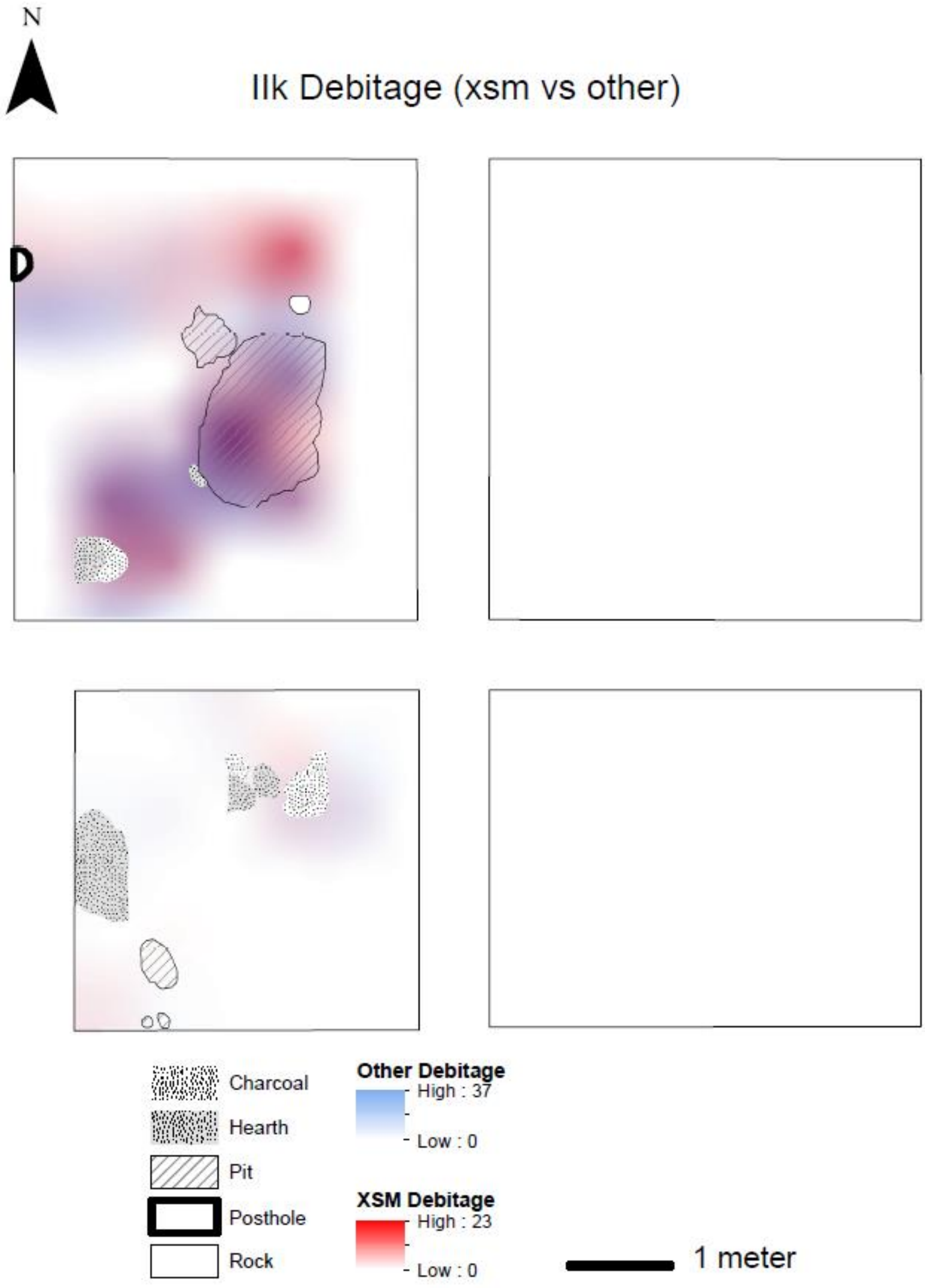


Figure A.21: Spline map showing debitage distribution separated by size class from floor IIk.

Percent Change from IIL to IIk

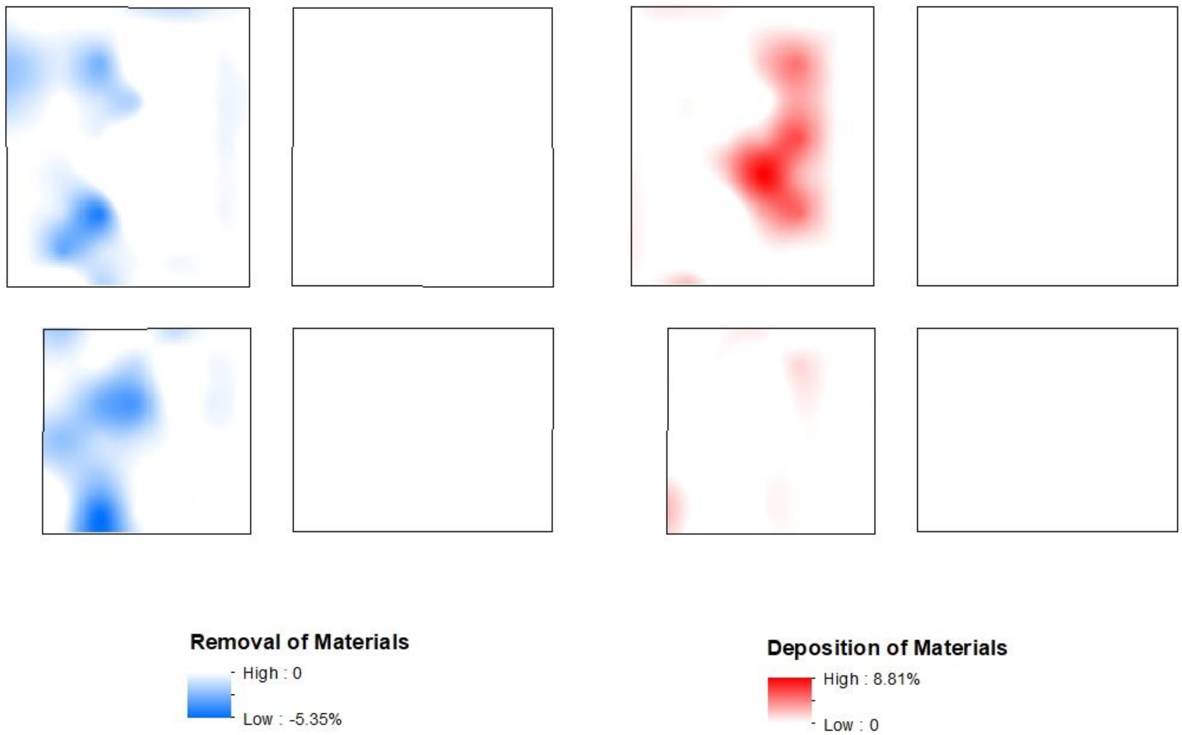


Figure A.22: Spline map showing the percent change of total lithic distributions between floors IIL and IIk.

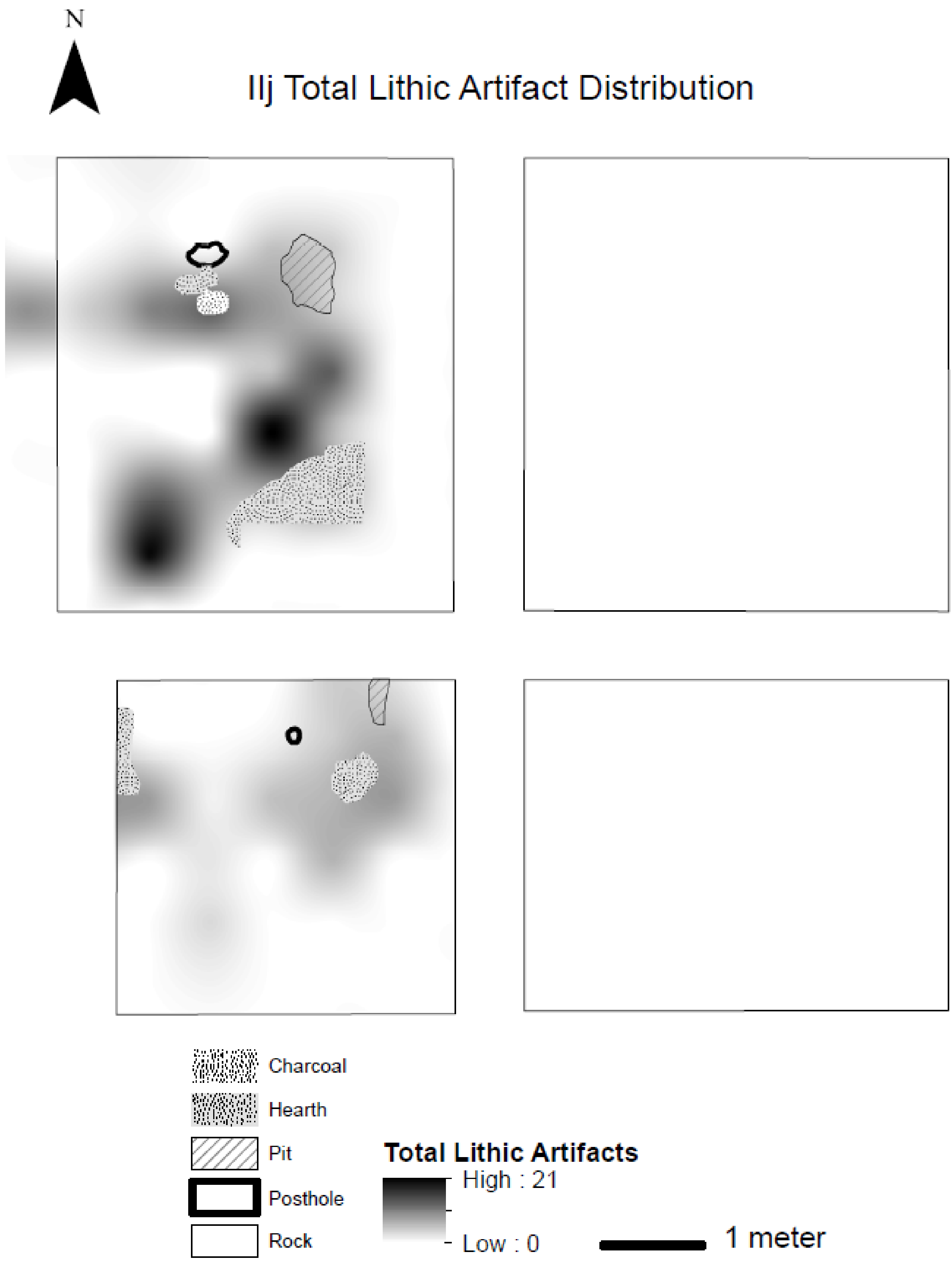


Figure A.23: Spline map showing the total lithic distribution from floor IIj.

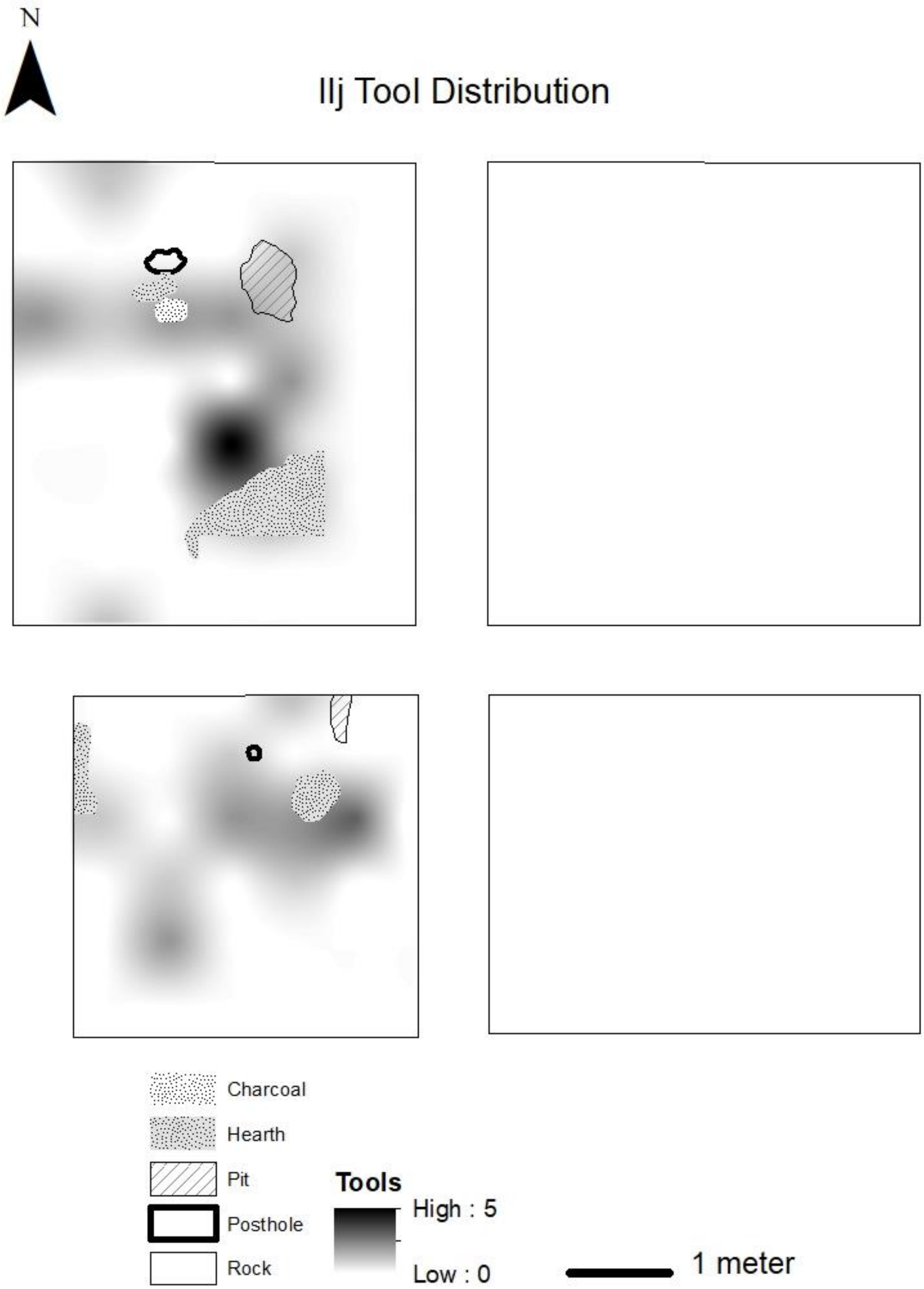


Figure A.24: Spline map showing the lithic tool distribution from floor IIj.

Figure A.24: Spline map showing the debitage distribution separated by size class from floor IIj.

Percent Change from IIk to IIj

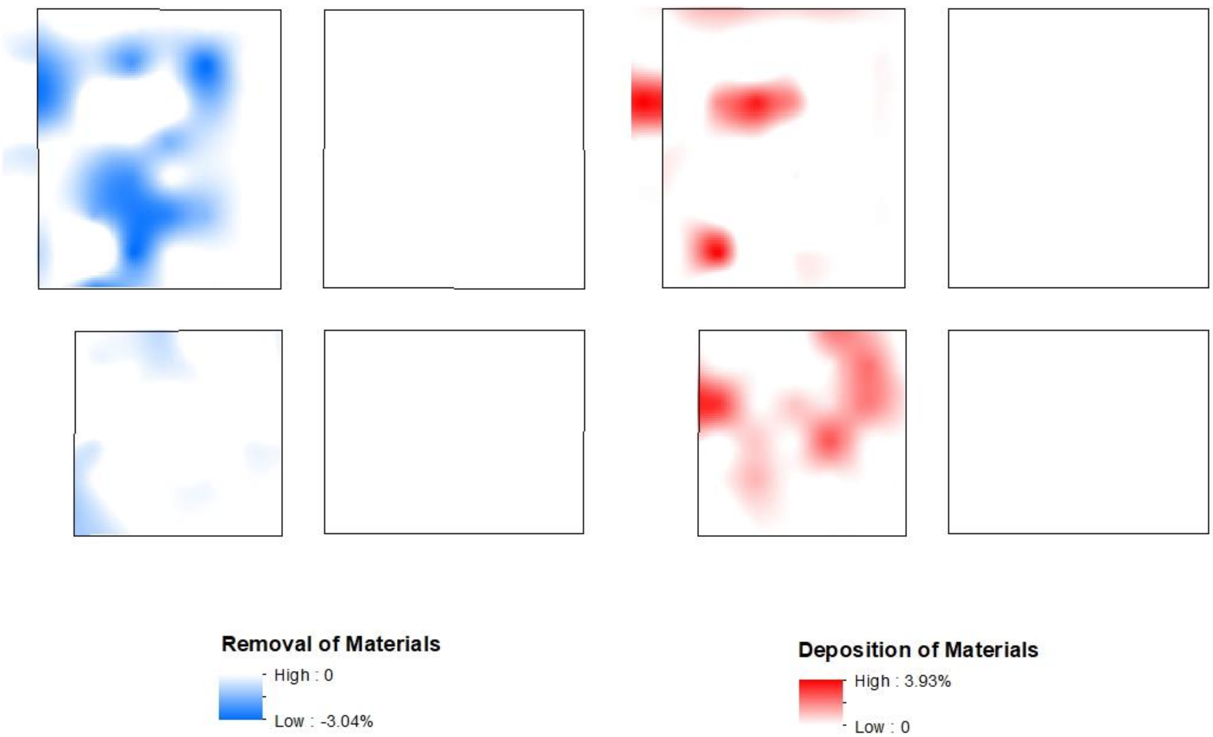


Figure A.25: Spline map showing the percent change between IIk and IIj.

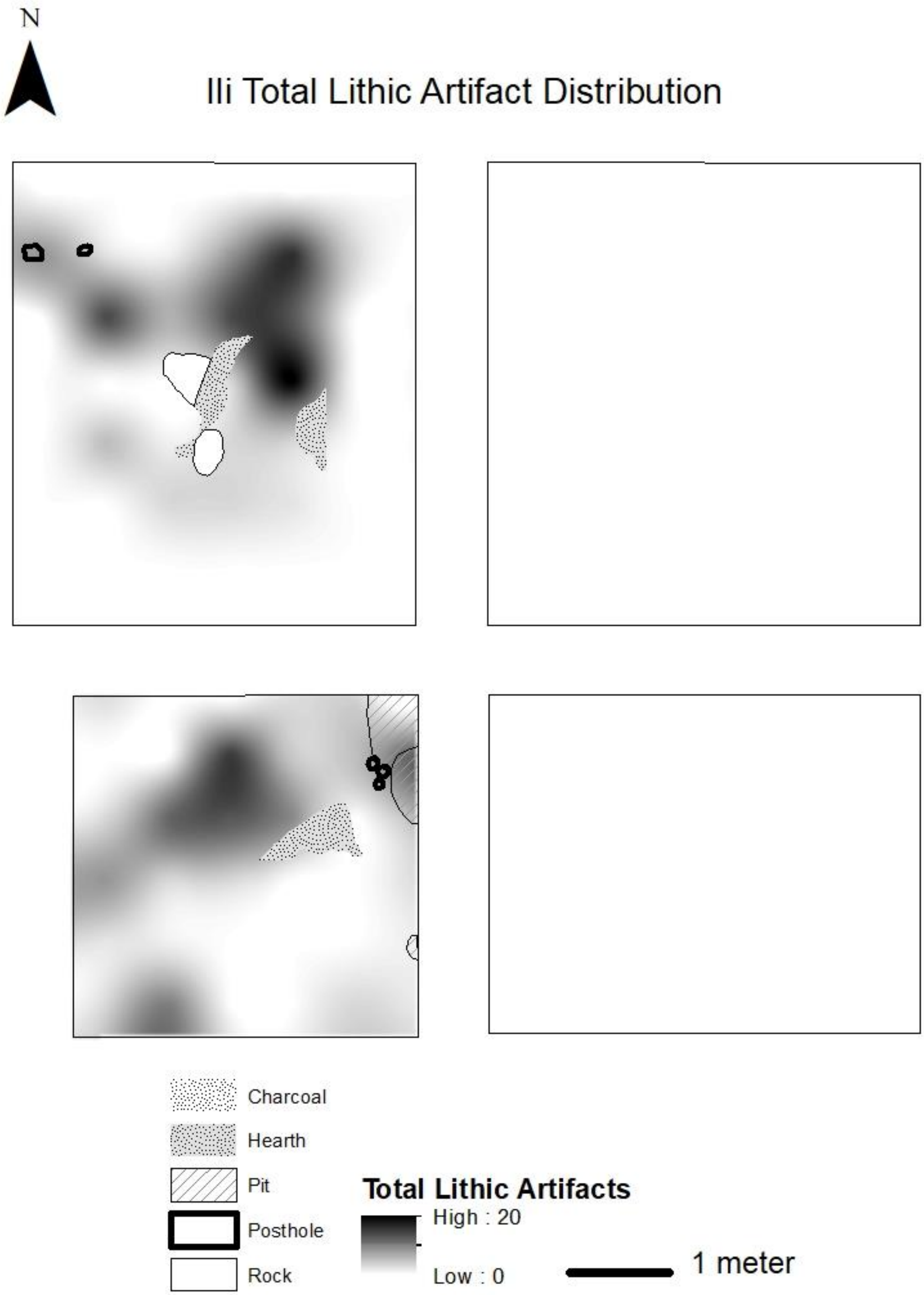


Figure A.26: Spline map showing the total lithic artifact distribution from floor IIi.

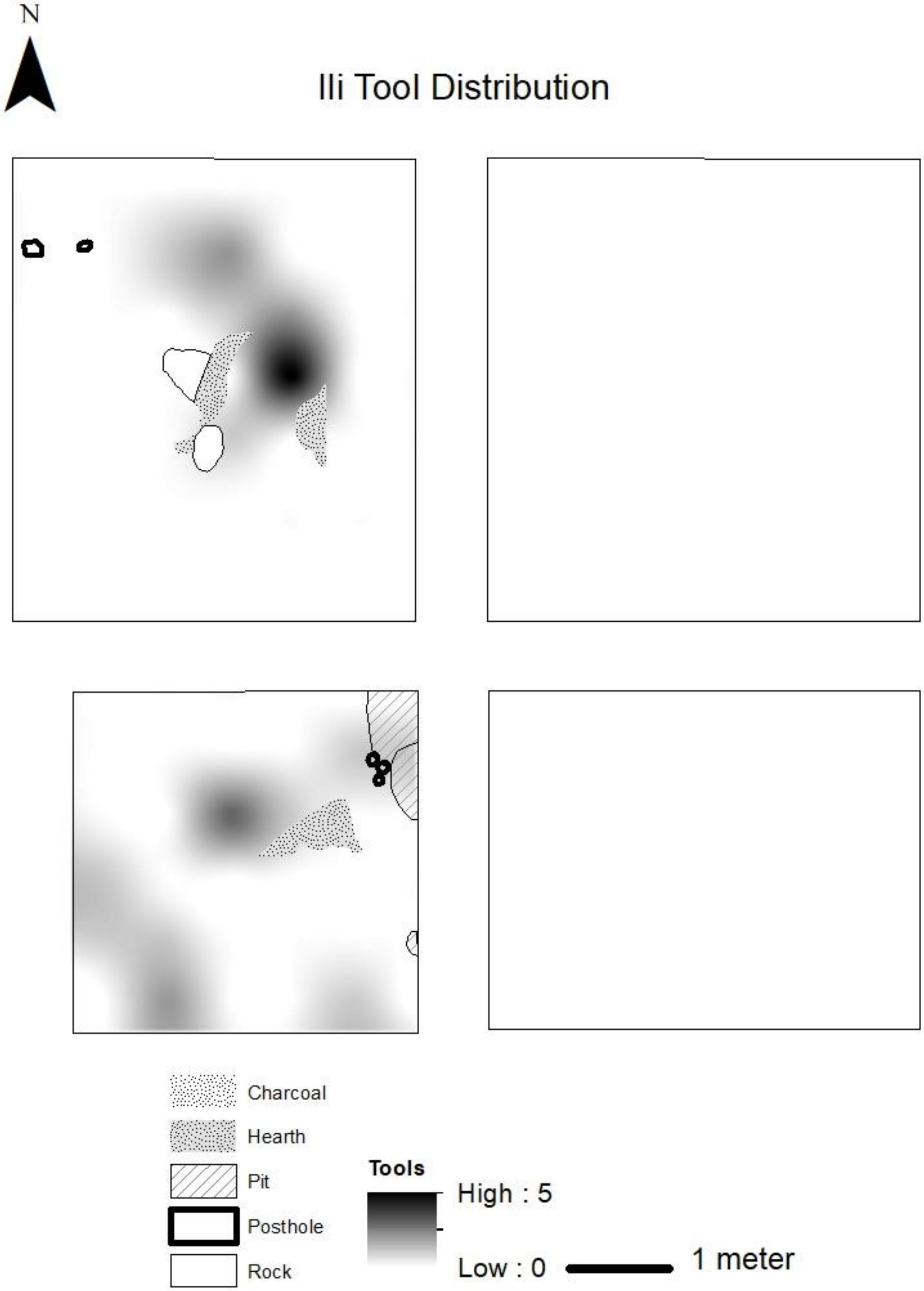


Figure A.27: Spline map showing the lithic tool distribution from Floor IIi.

Figure A.28: Spline map showing the distribution of lithic debitage separated by size class from floor IIi.

Percent Change from IIj to IIi

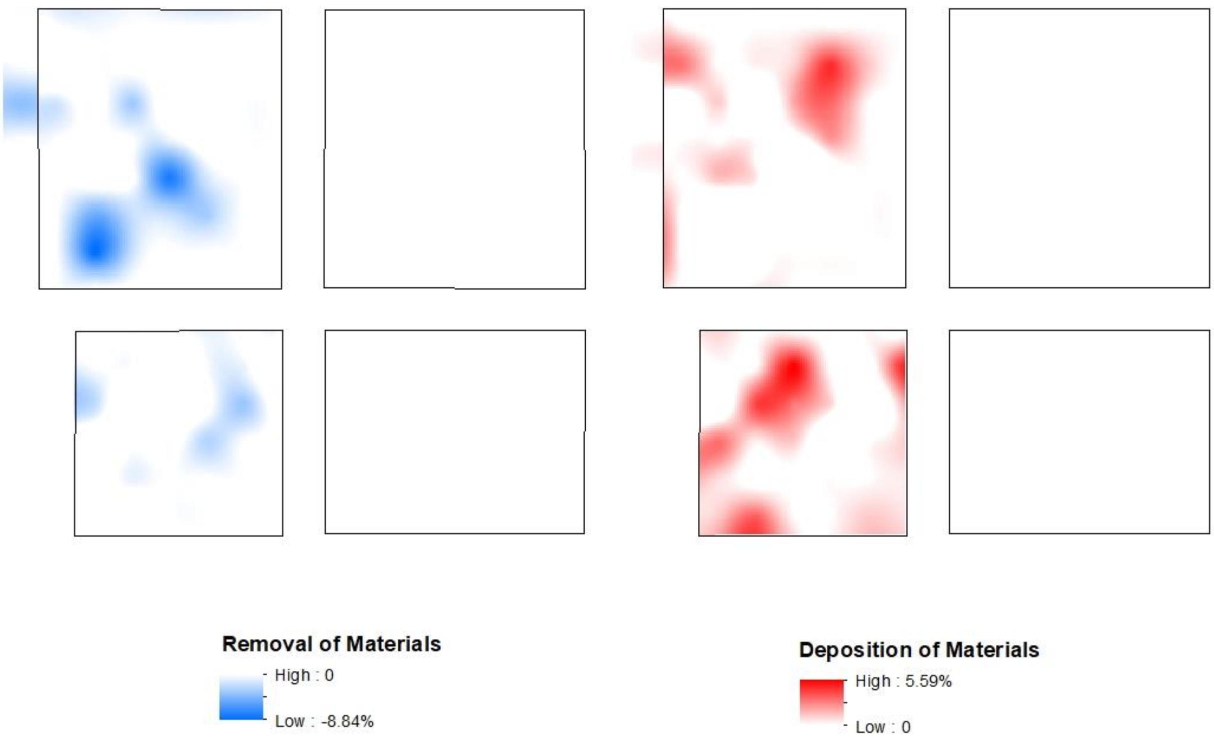


Figure A. 29: Spline map showing the percent change of total lithic distribution between floors IIj to IIi.

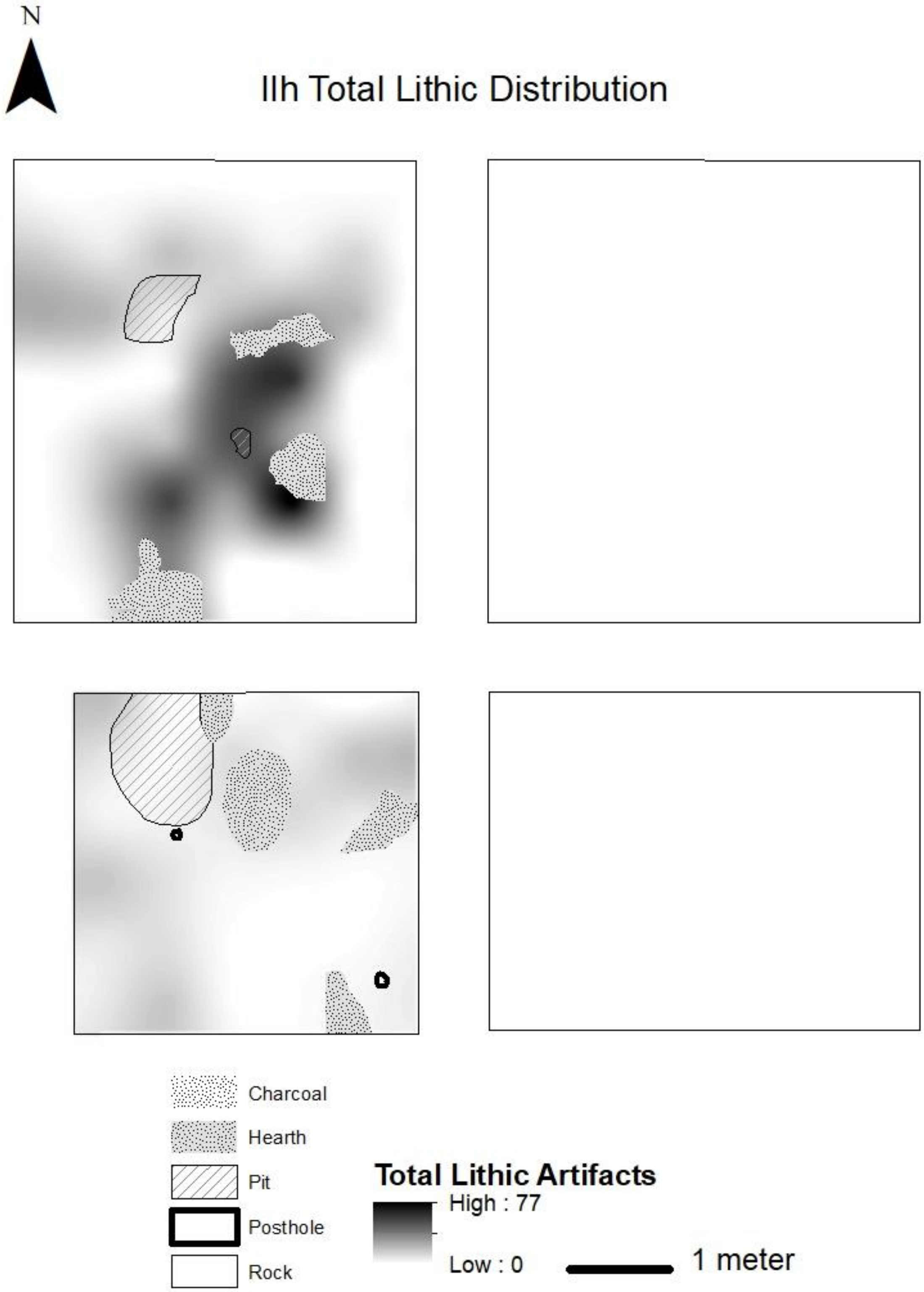


Figure A.30: Spline map showing total distribution of lithic artifacts from floor IIh (levels 1 and 2).

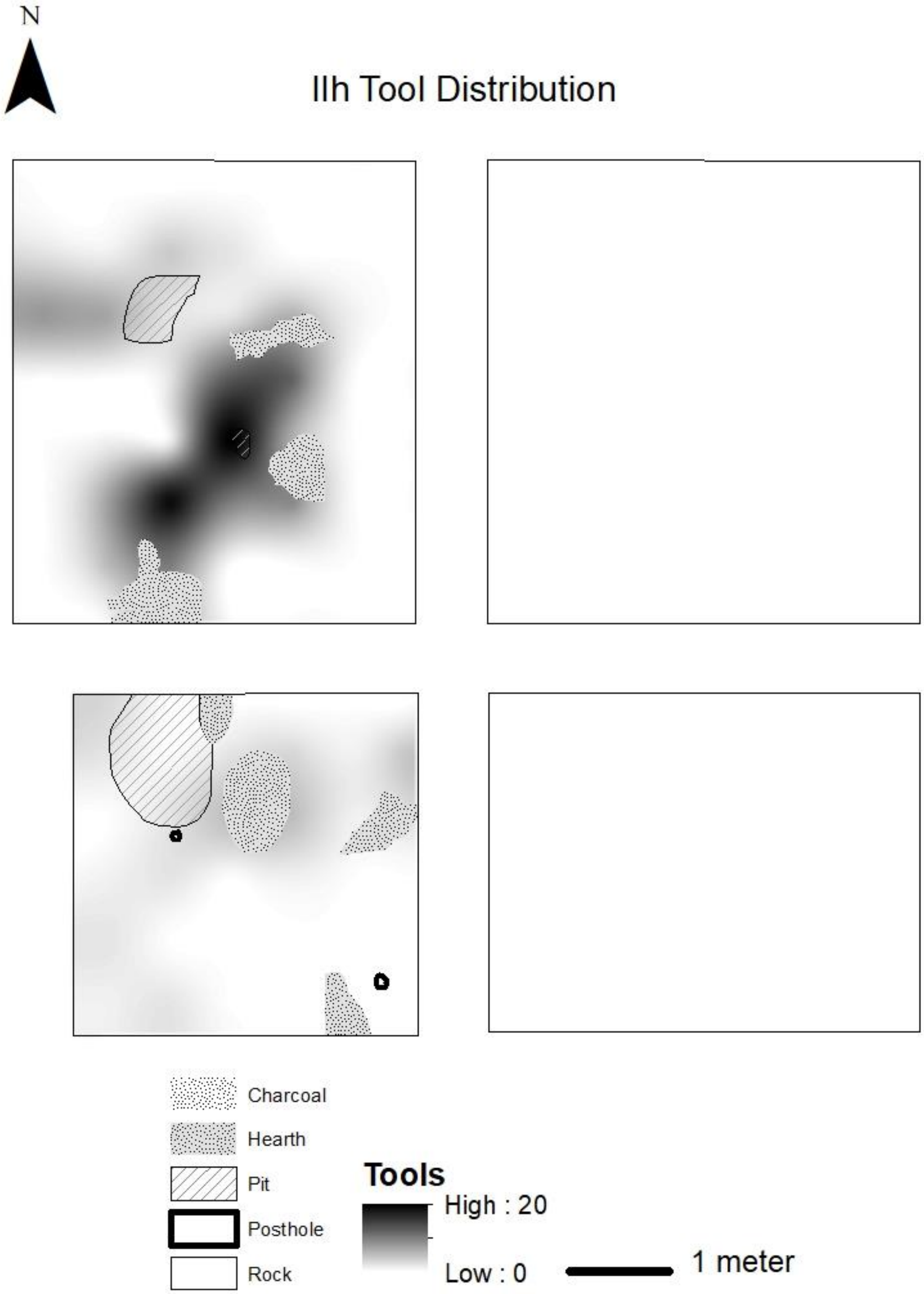


Figure A.31: Spline map showing lithic tool distribution from floor IIh (levels 1 and 2).

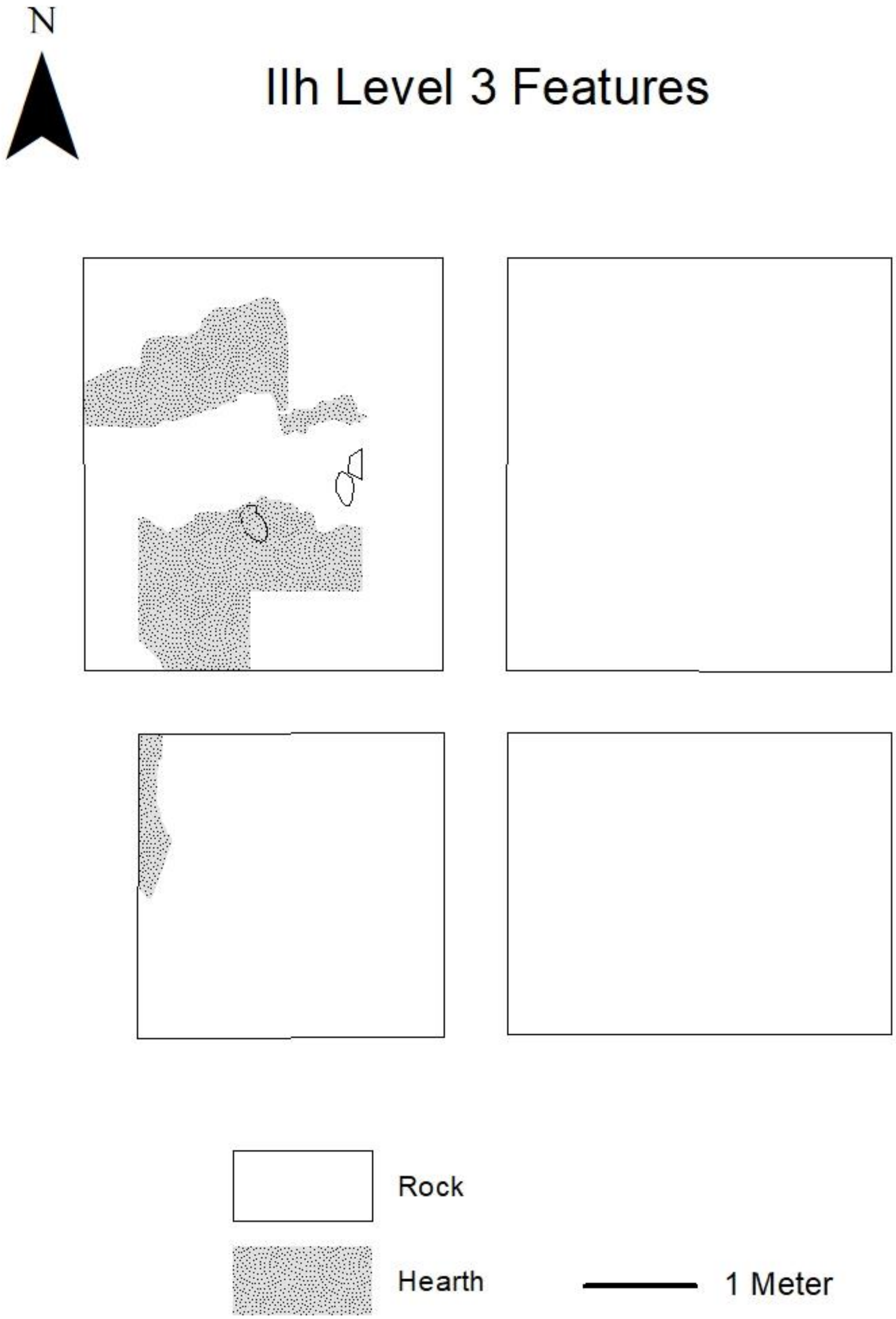


Figure A.32: Features located during possible feasting event from IIh (Level 3).

Figure A.33: Spline map showing the debitage distribution separated by size class from floor IIh (level 1 and 2).

Percent Change from IIi to IIh (levels 1 and 2)

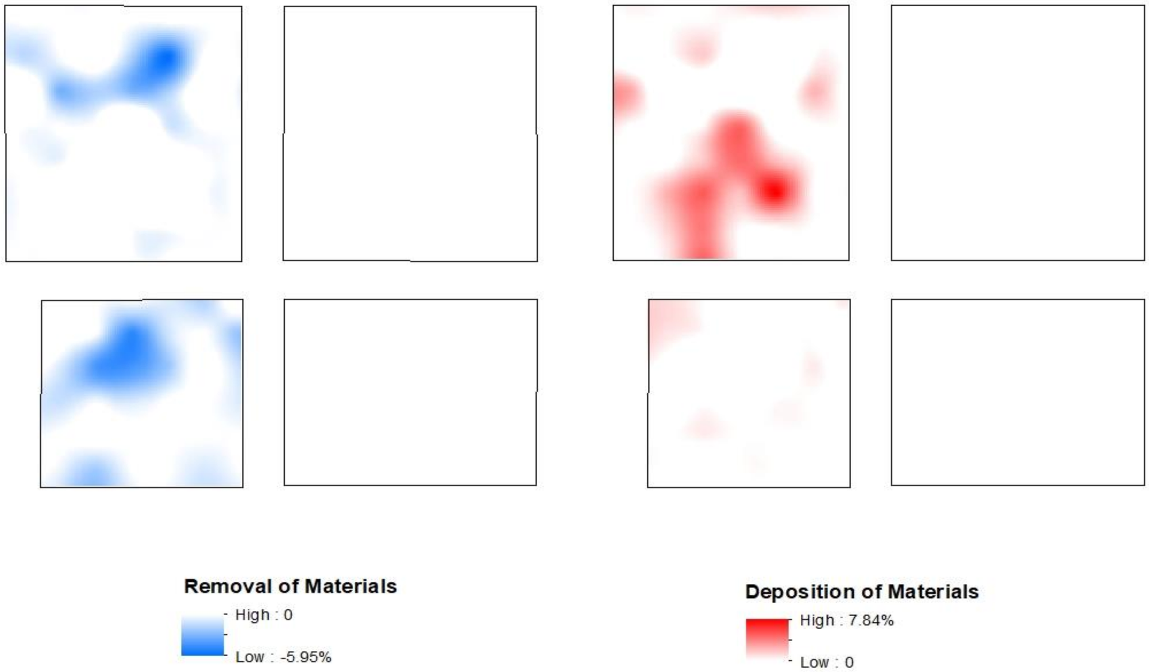


Figure A.34: Spline map showing the percent change of the total lithic distribution from floors IIi to IIh (levels 1 and 2).

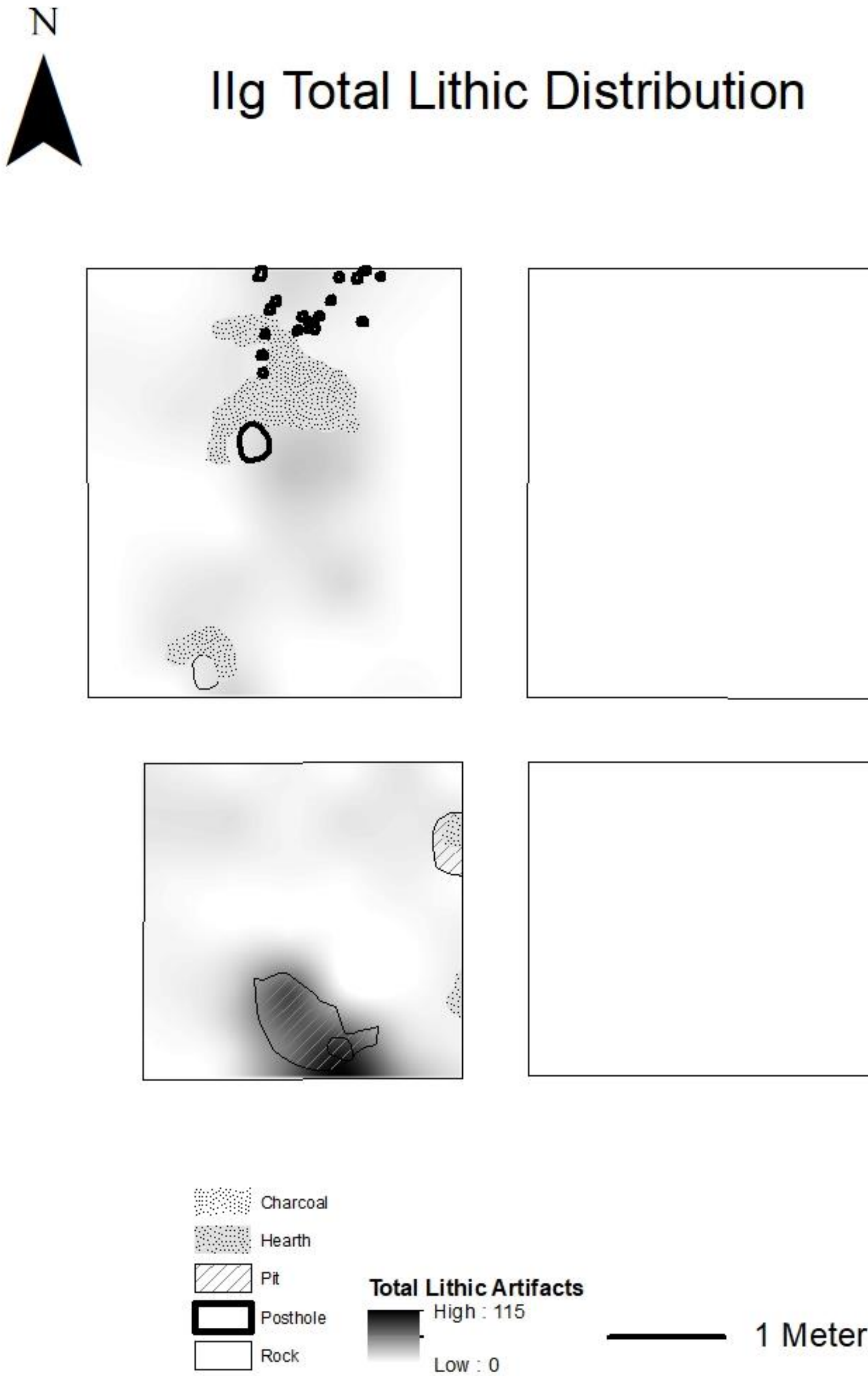


Figure A.35: Spline map showing the total lithic artifact distribution from floor IIg.

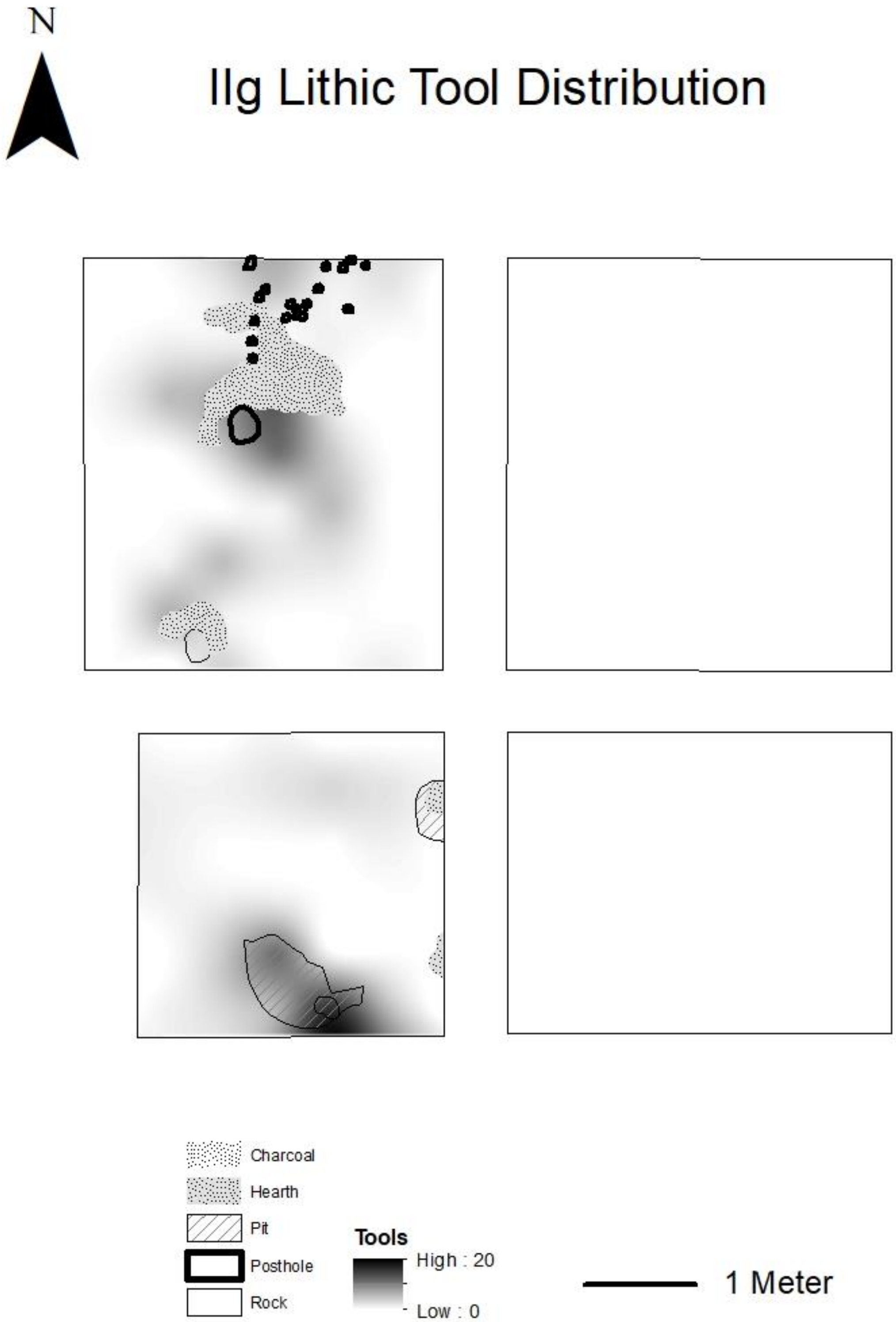


Figure A.36: Spline map showing the lithic tool distribution from floor IIg.

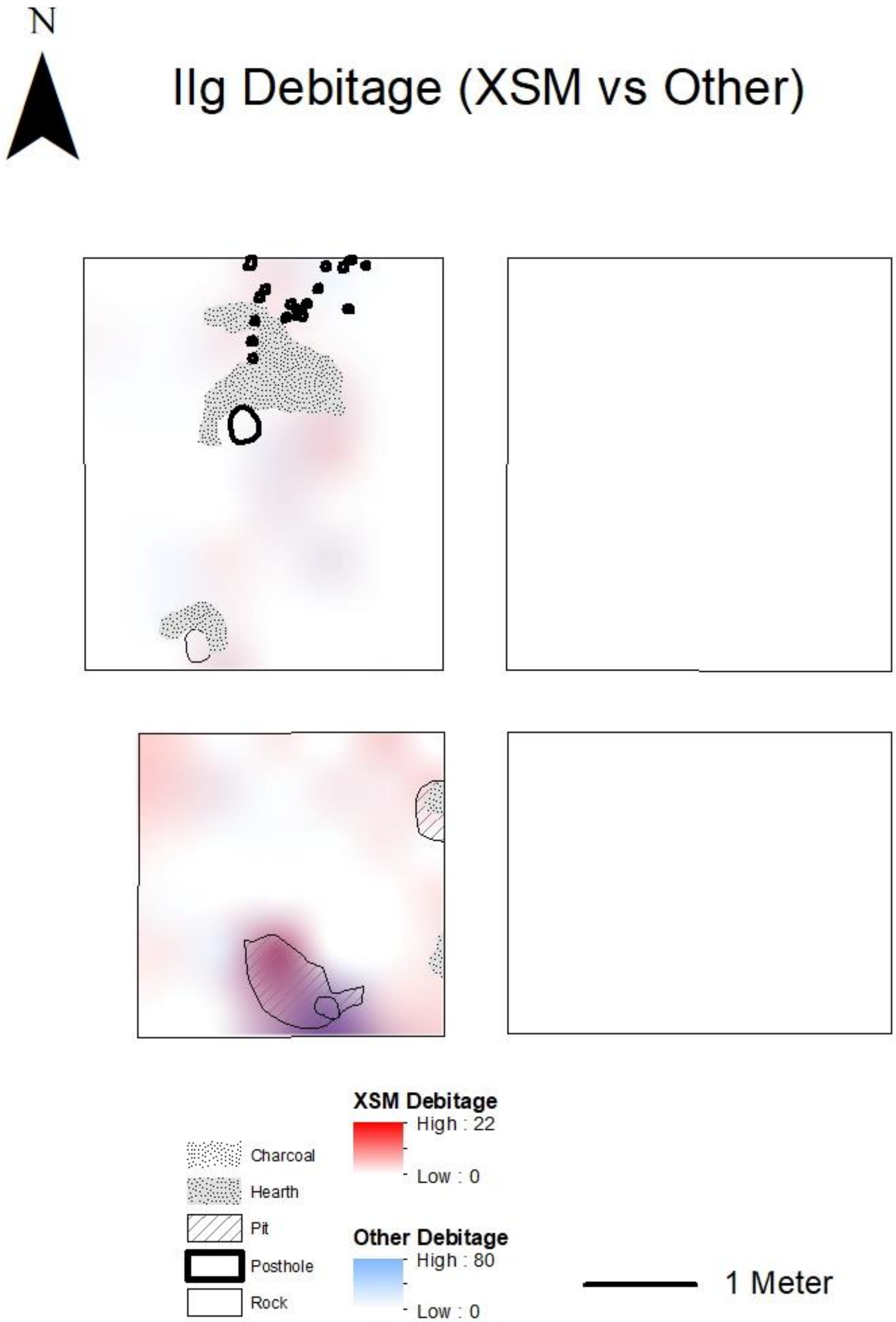


Figure A.37: Spline map showing the debitage distribution separated by size class from floor IIg.

Percent Change from IIh to IIg

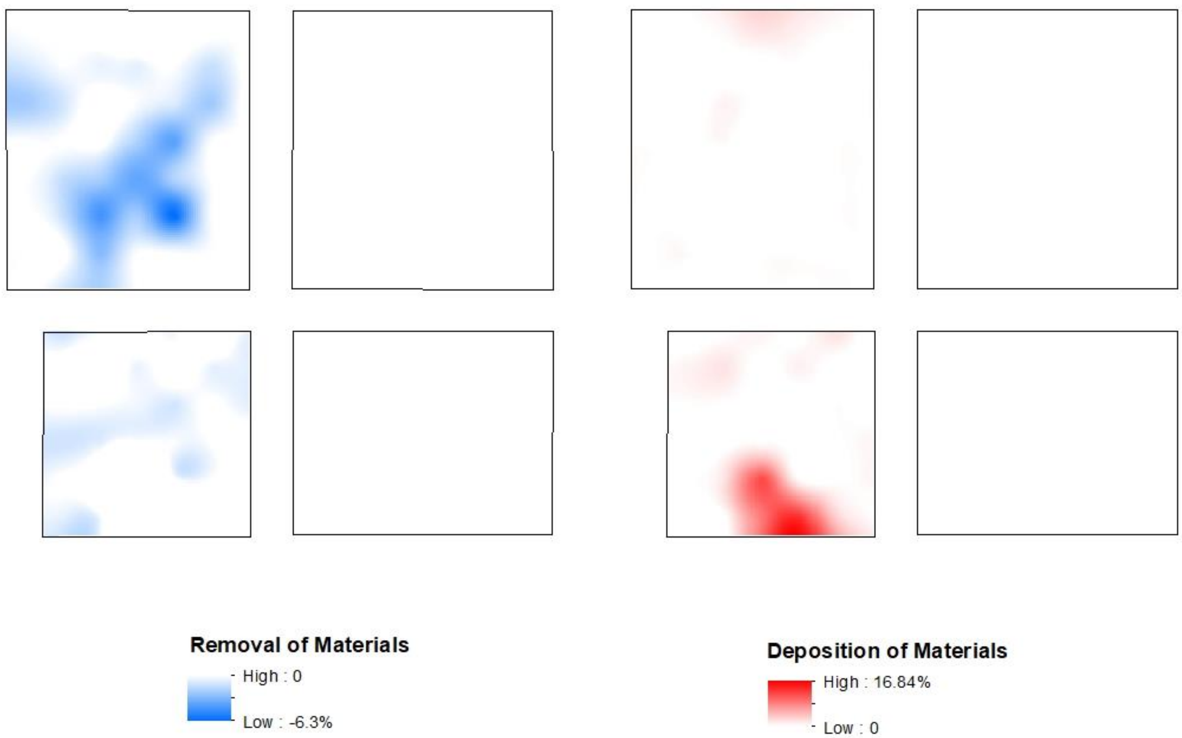


Figure A.38: Spline map showing the percent change in total artifact distribution from floors IIh (levels 1 and 2) to IIg.

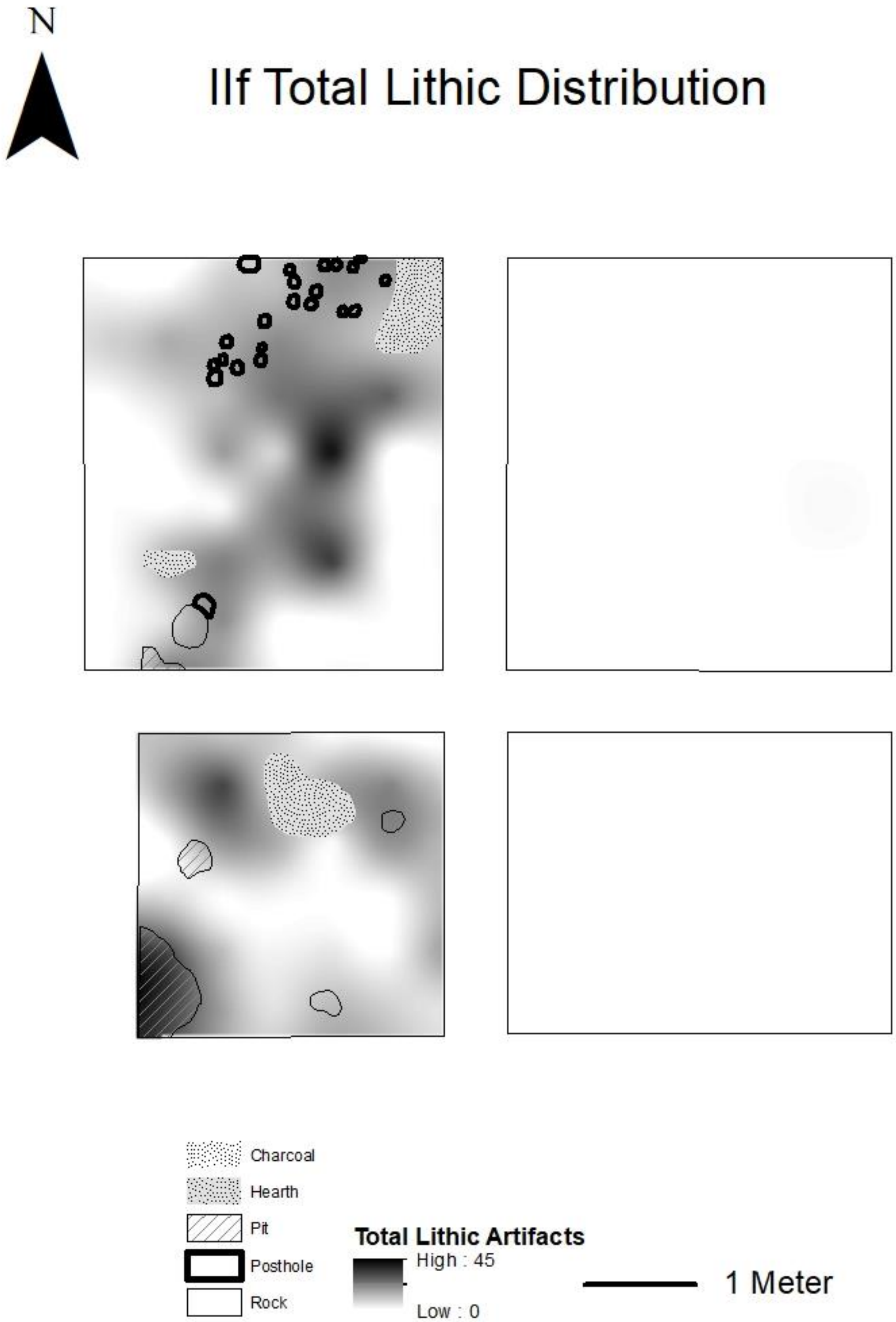


Figure A.39: Spline map showing the total lithic artifact distribution from floor IIf.

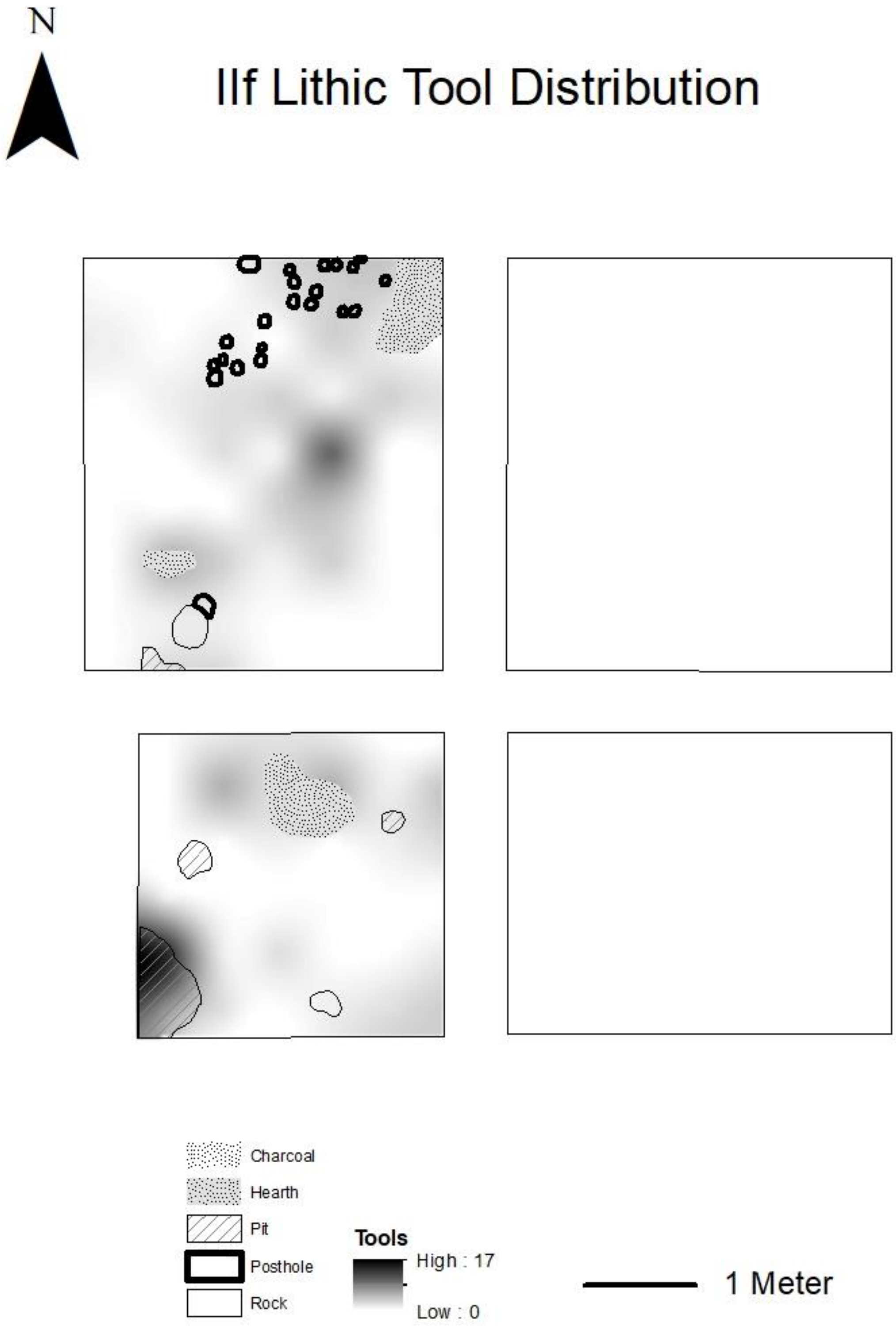


Figure A.40: Spline map showing the lithic tool distribution from floor IIf.

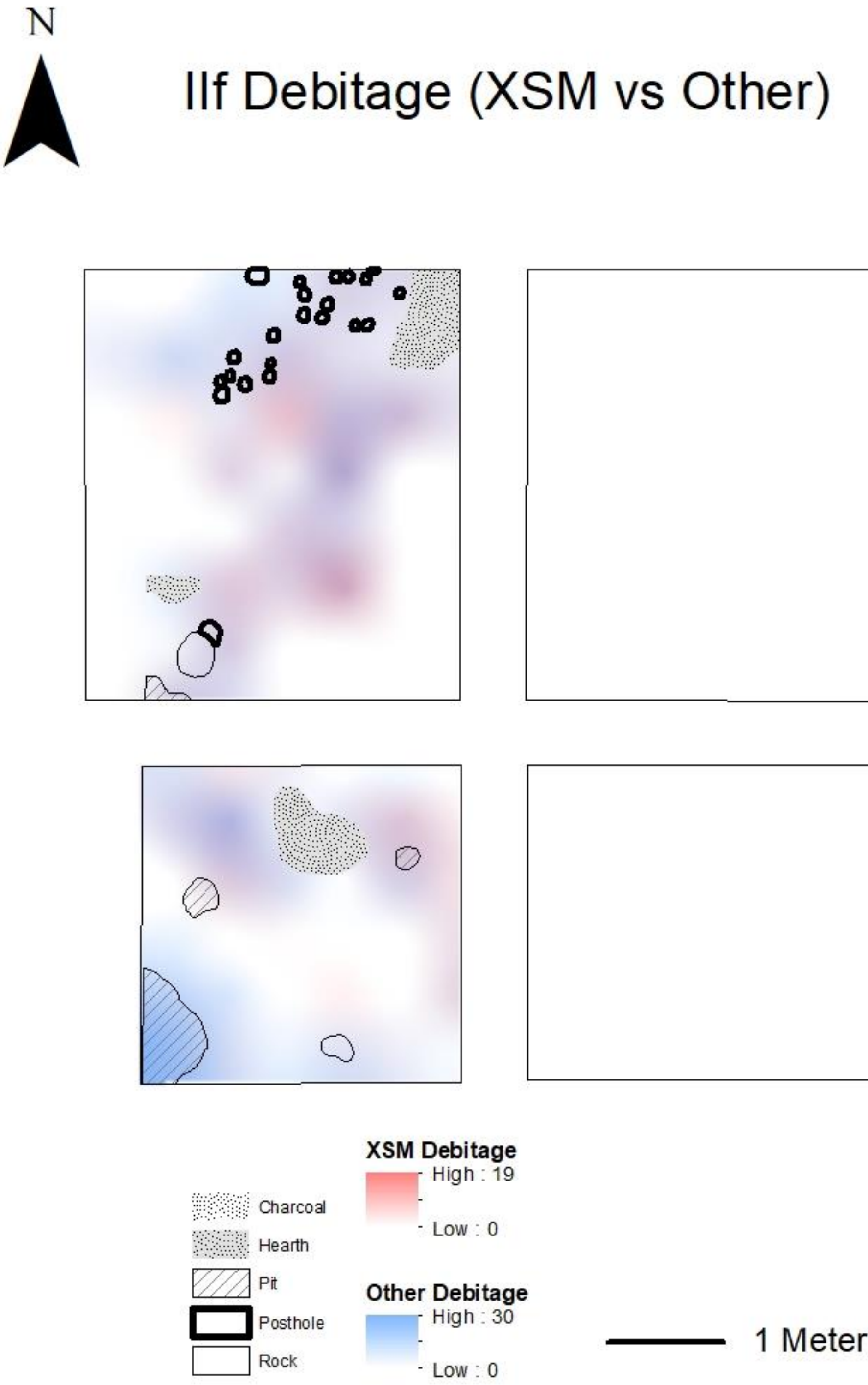


Figure A.41: Spline map showing the debitage distribution separated by size class from floor IIf.

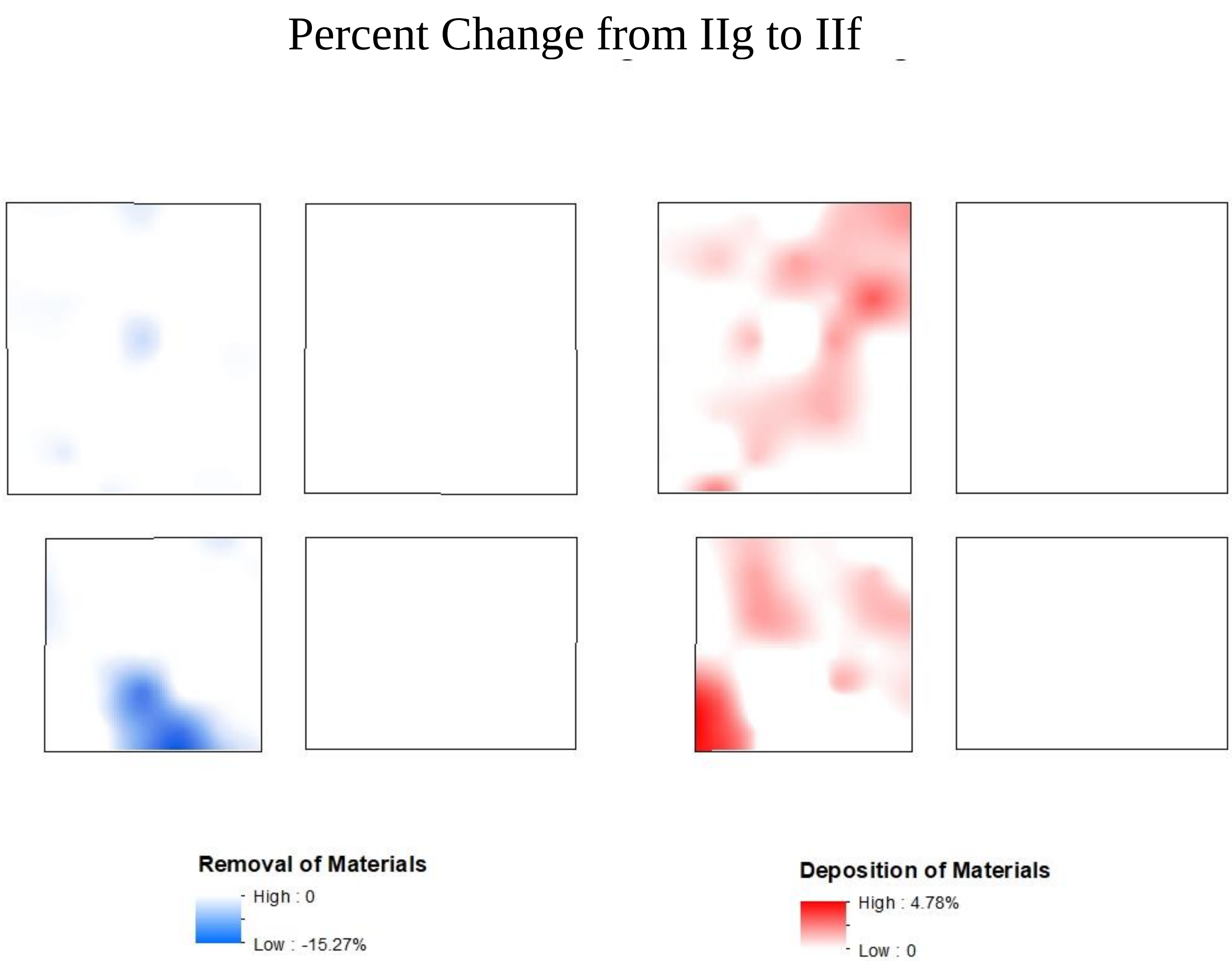


Figure A.42: Spline map showing the percent change of total lithic artifact distribution between floors IIg and IIf.

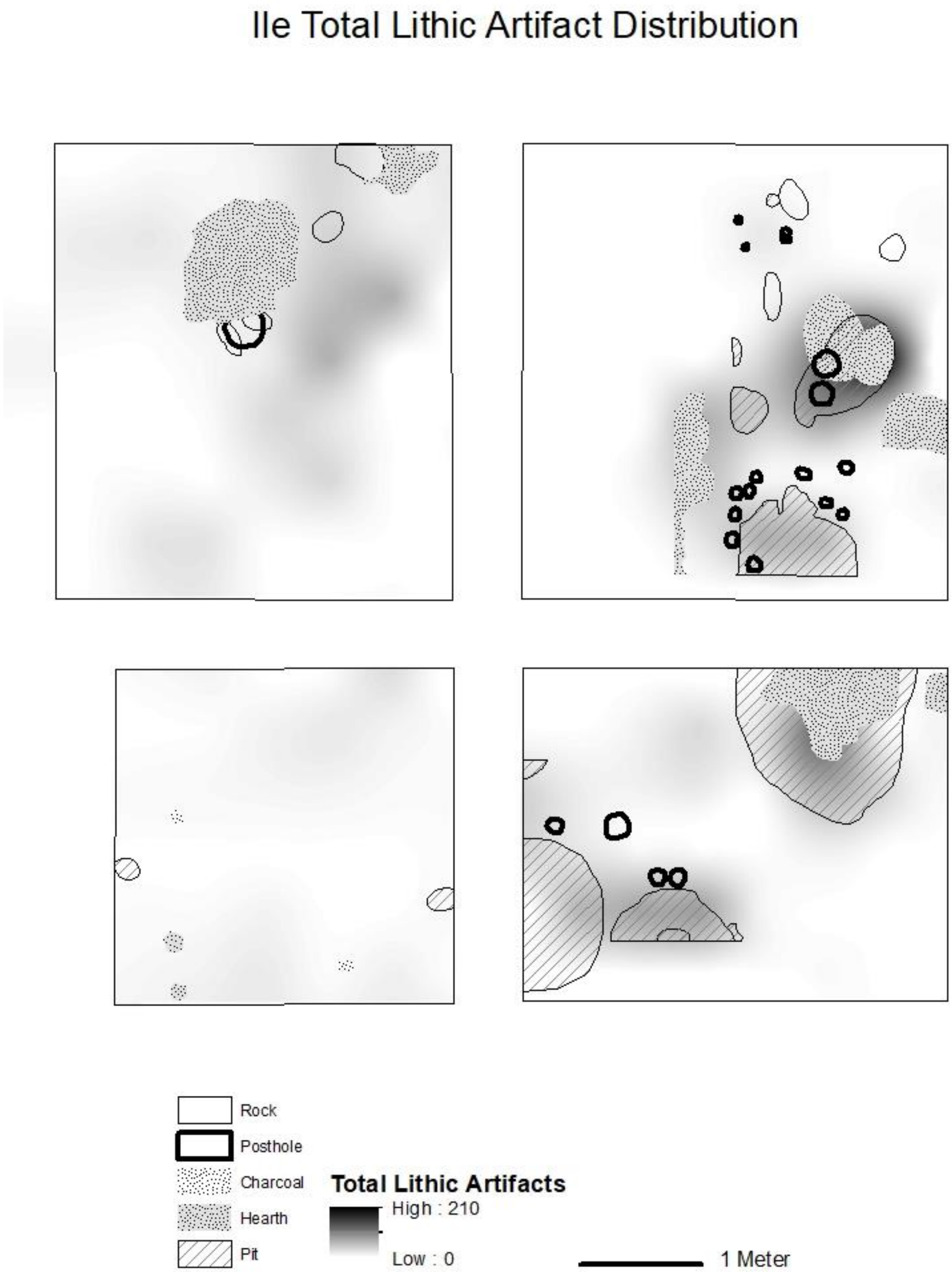


Figure A.43: Spline map showing the total lithic artifact distribution from floor IIe.

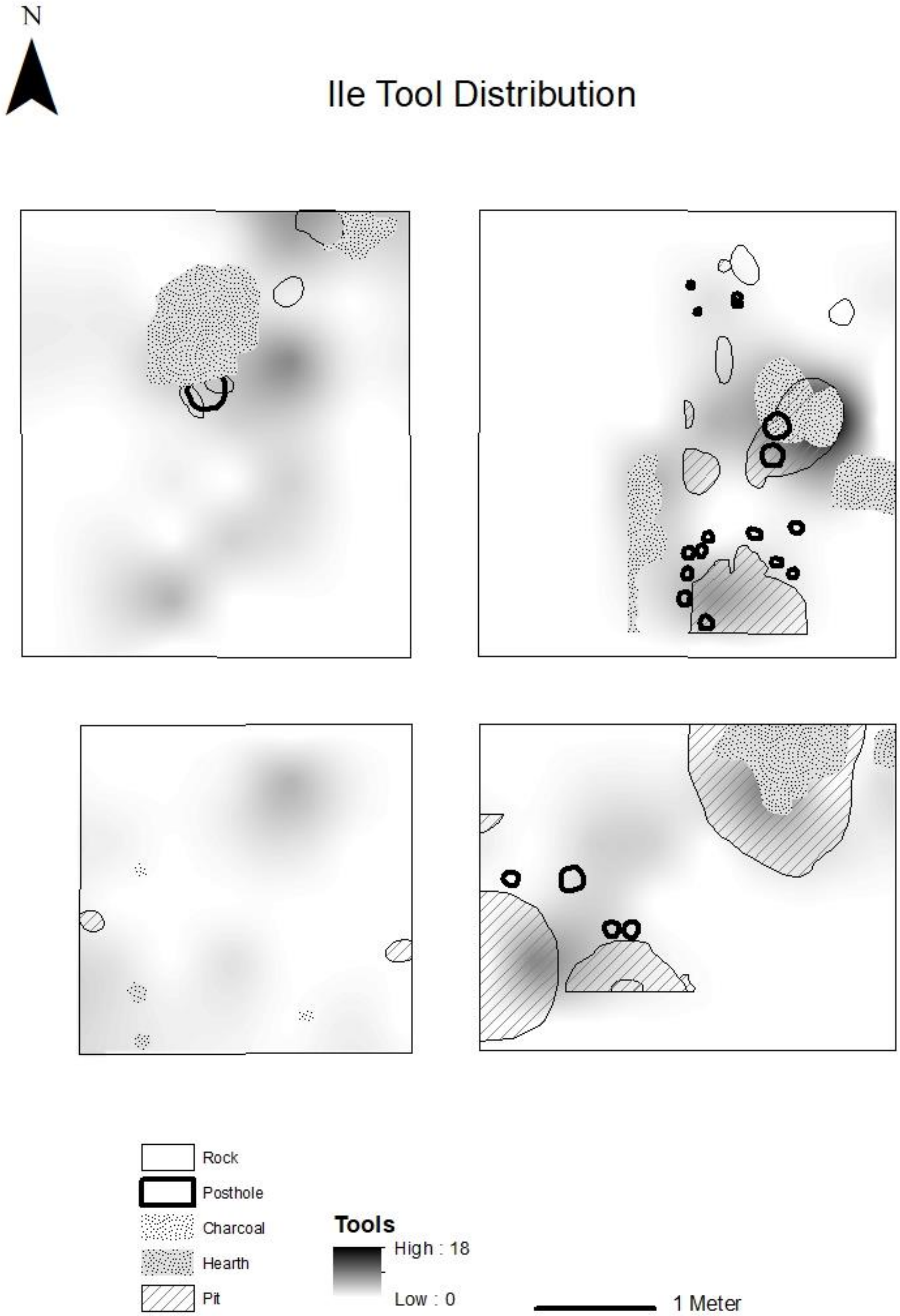


Figure A.44: Spline map showing the distribution of lithic tools from floor IIe.

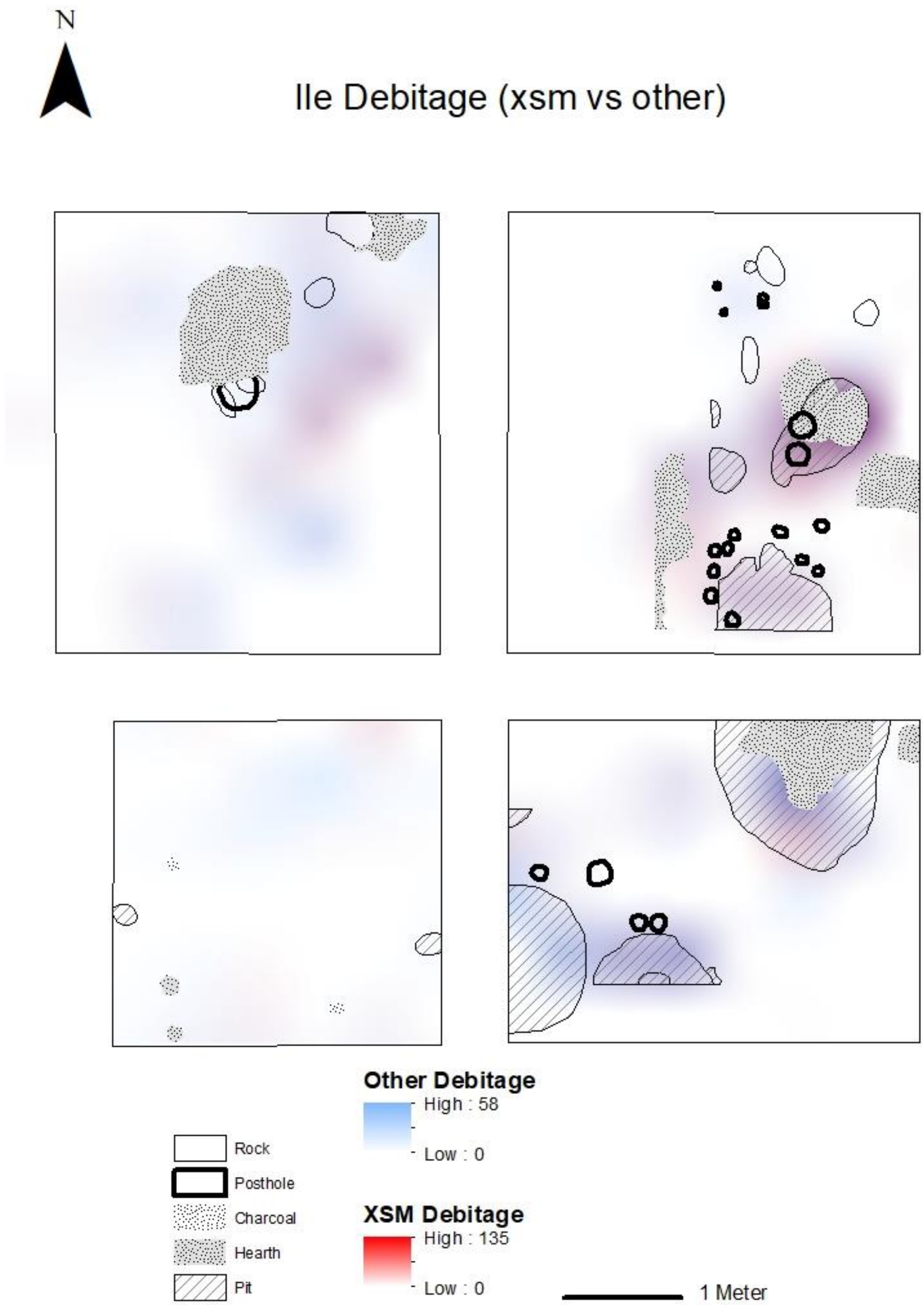


Figure A.45: Spline map showing the debitage distribution separated by size class from floor IIe.

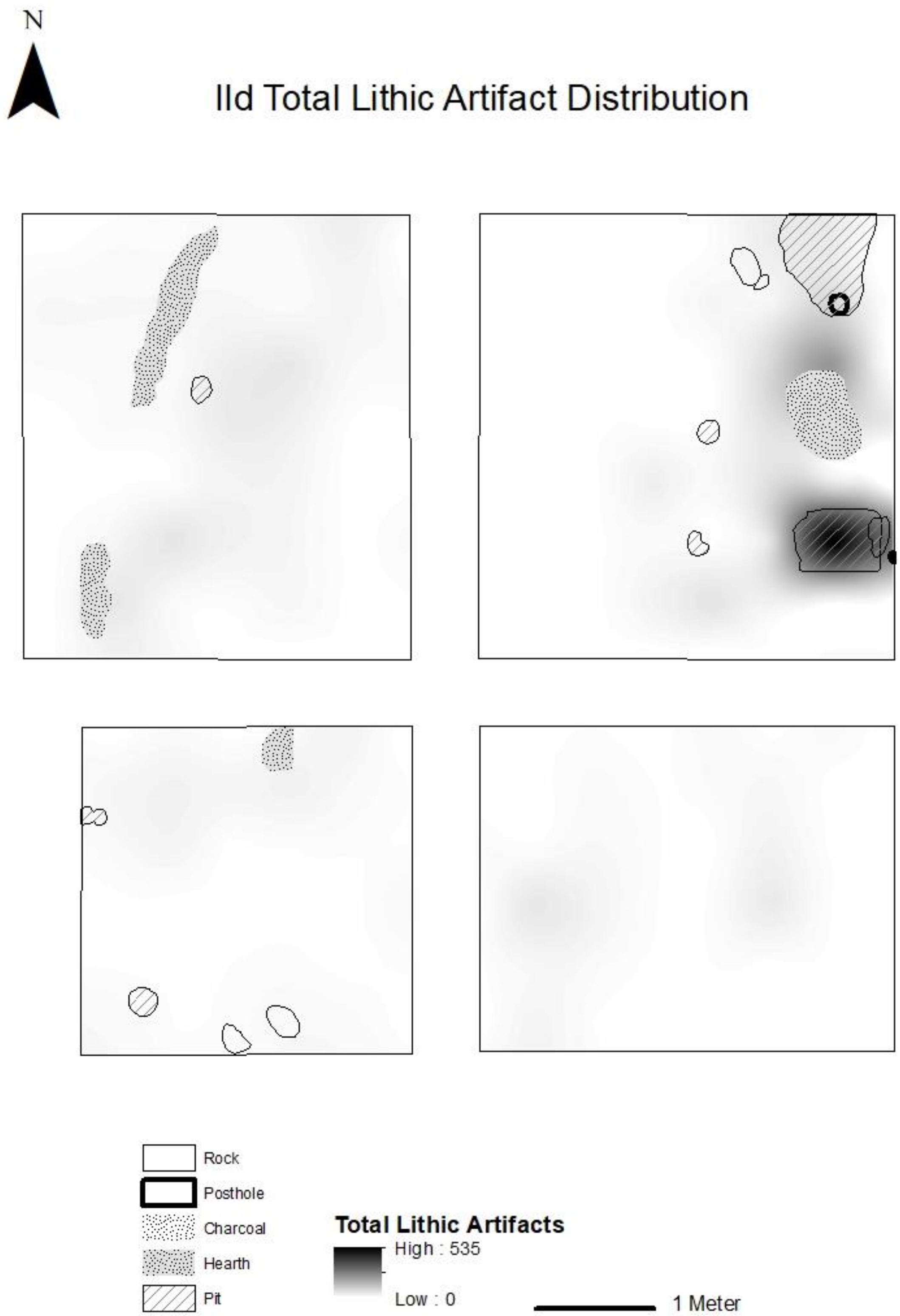


Figure A.46: Spline map showing the total lithic artifact distribution from floor IId.

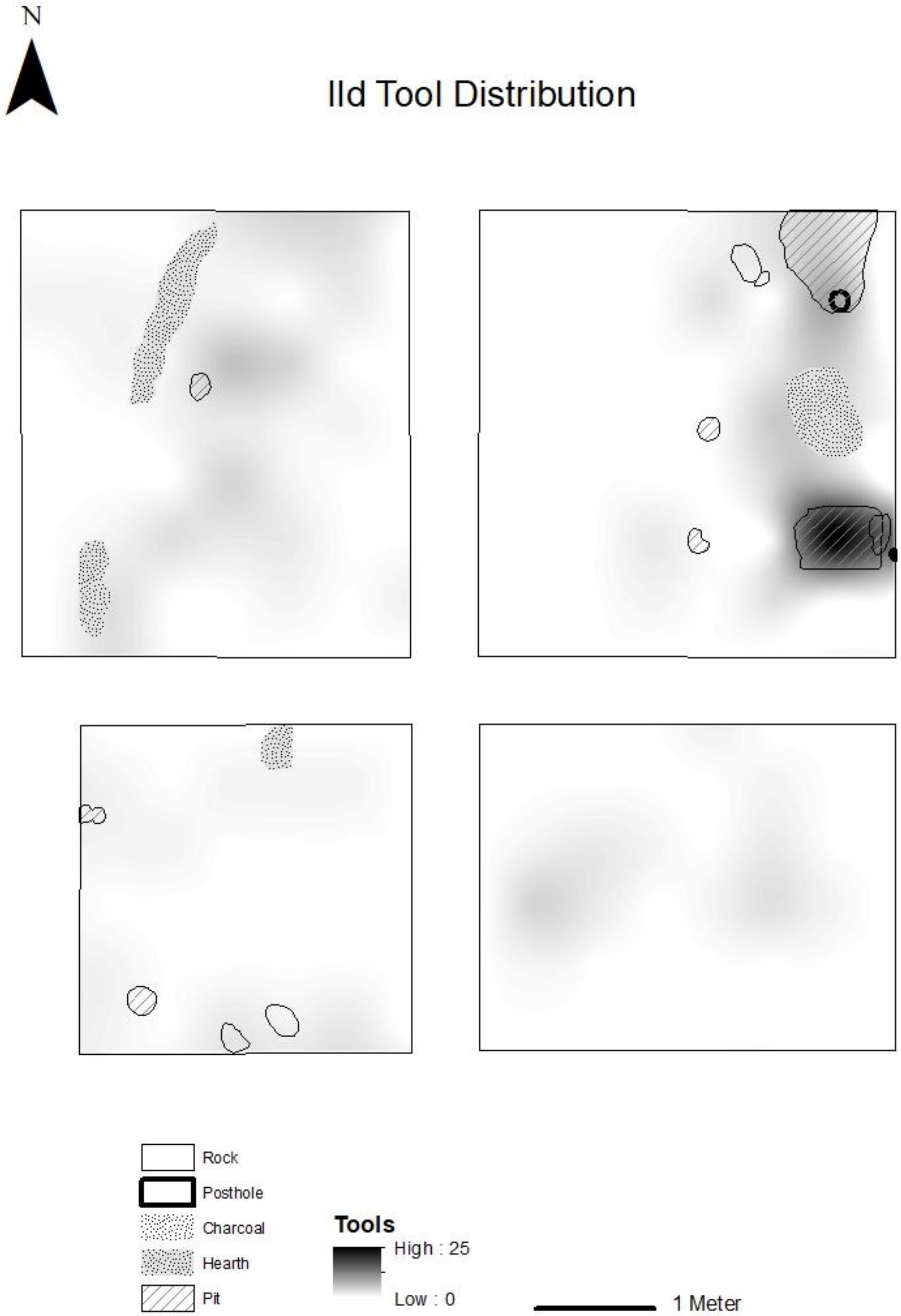


Figure A.47: Spline map showing the lithic tool distribution from floor IId.

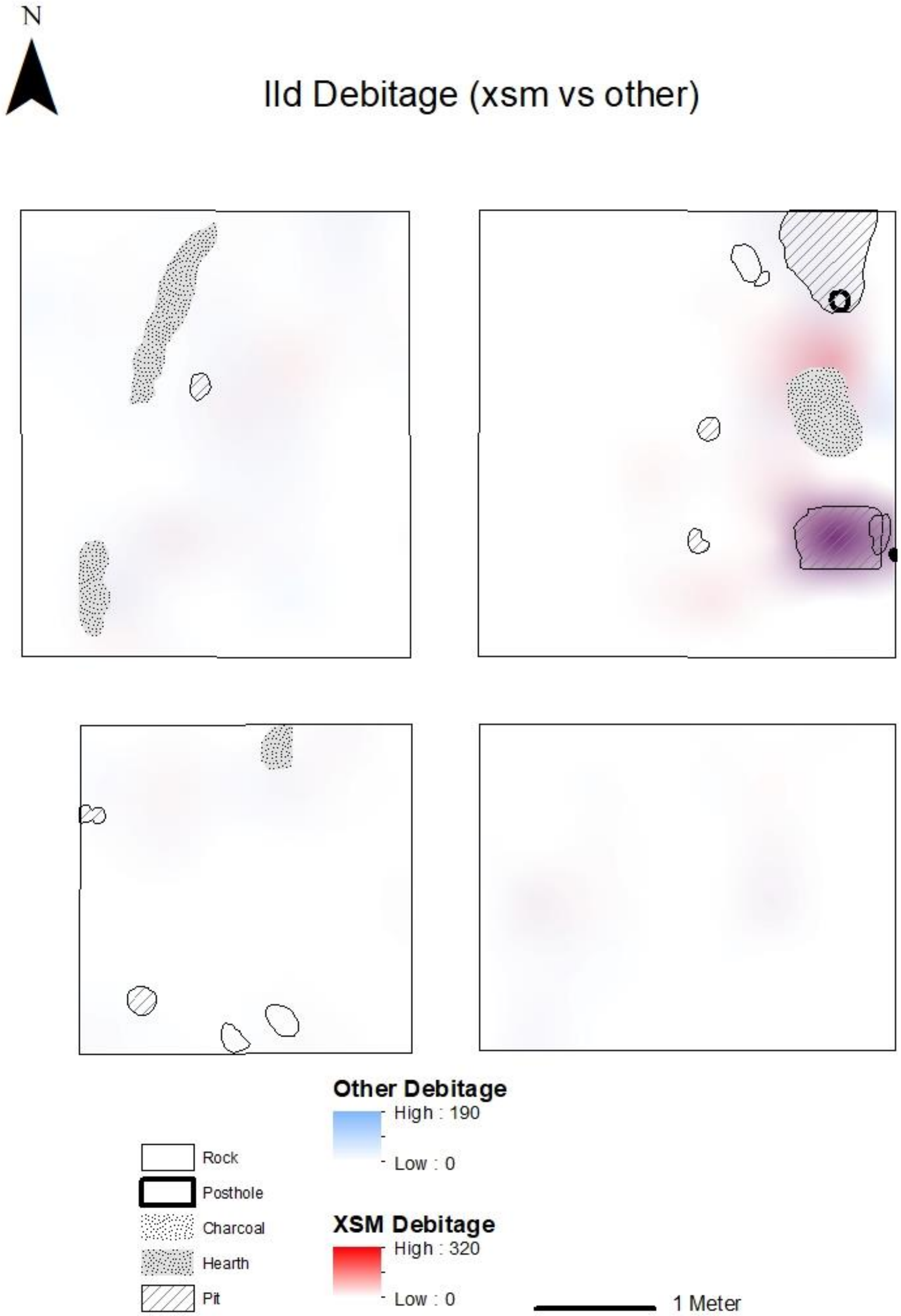


Figure A.48: Spline map showing the debitage distribution separated by size class from floor IId.

Percent Change from IIe to IId

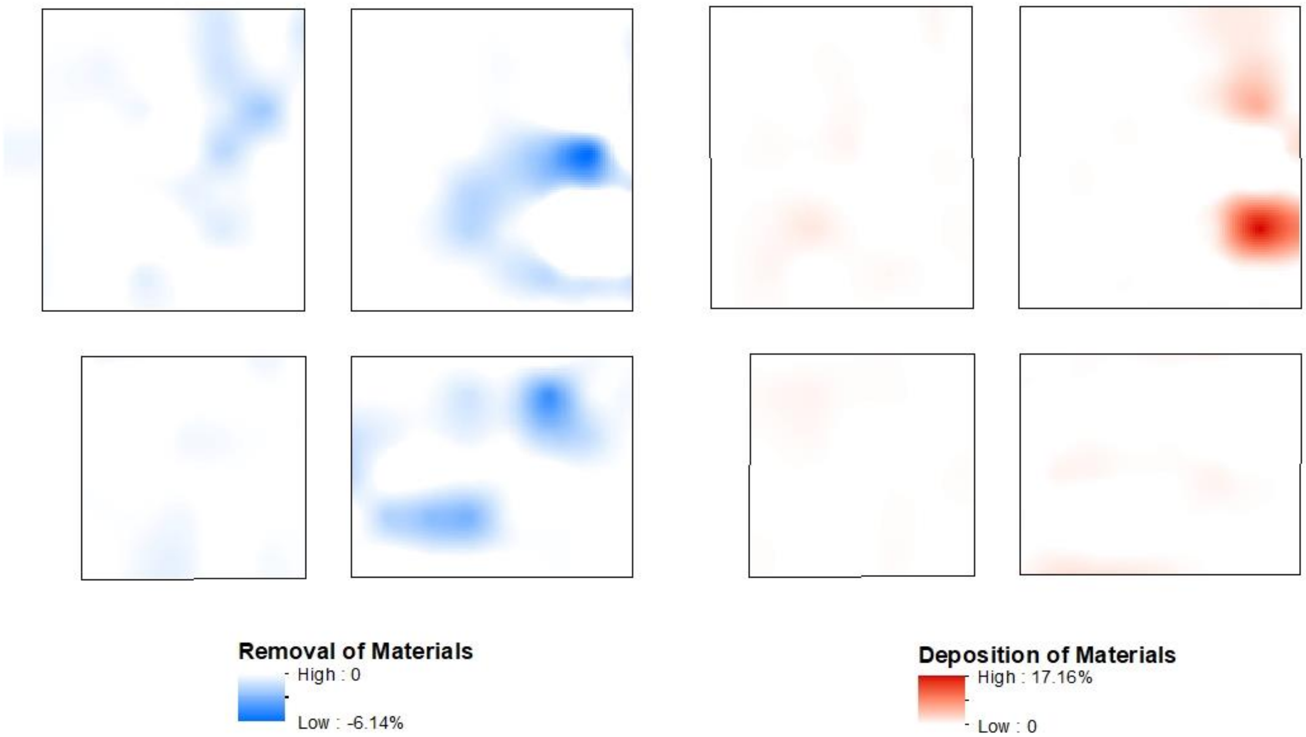


Figure A.49: Spline map showing the percent change of the total lithic artifact distribution from IId to IIe.

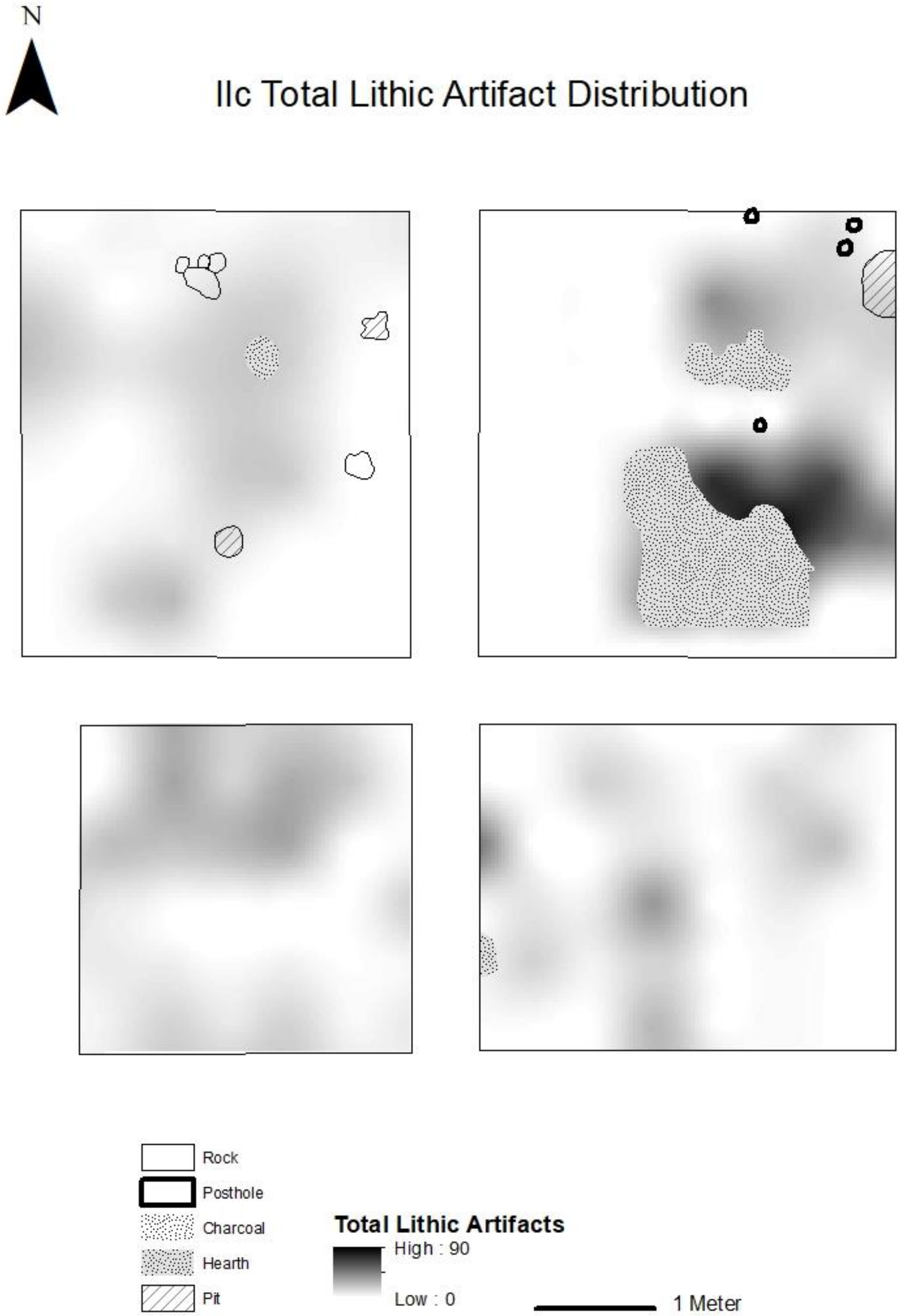


Figure A.50: Spline map showing the total lithic artifact distribution from floor IIc.

IIc Tool Distribution

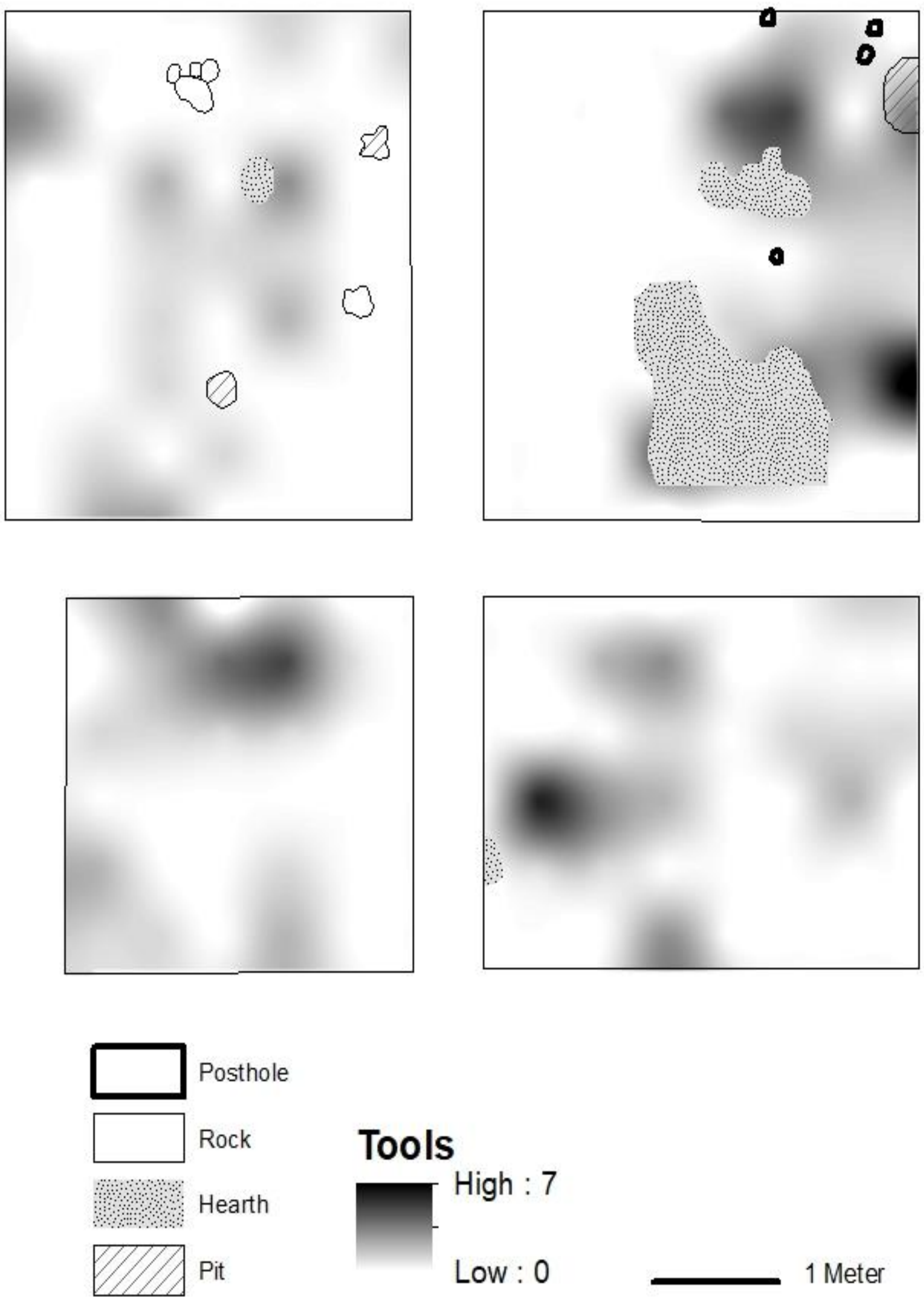


Figure A.51: Spline map showing the lithic tool distribution from floor IIc.

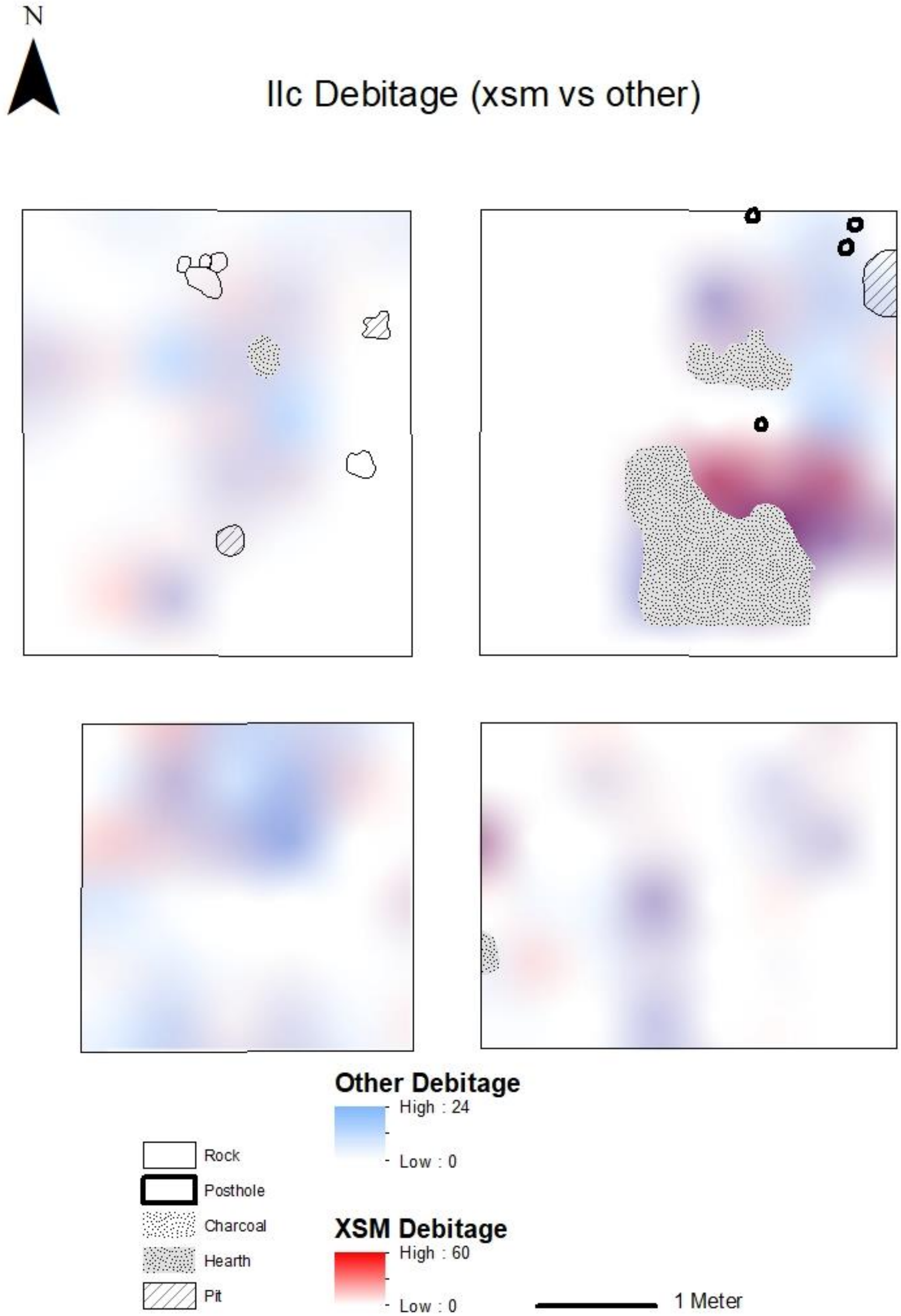
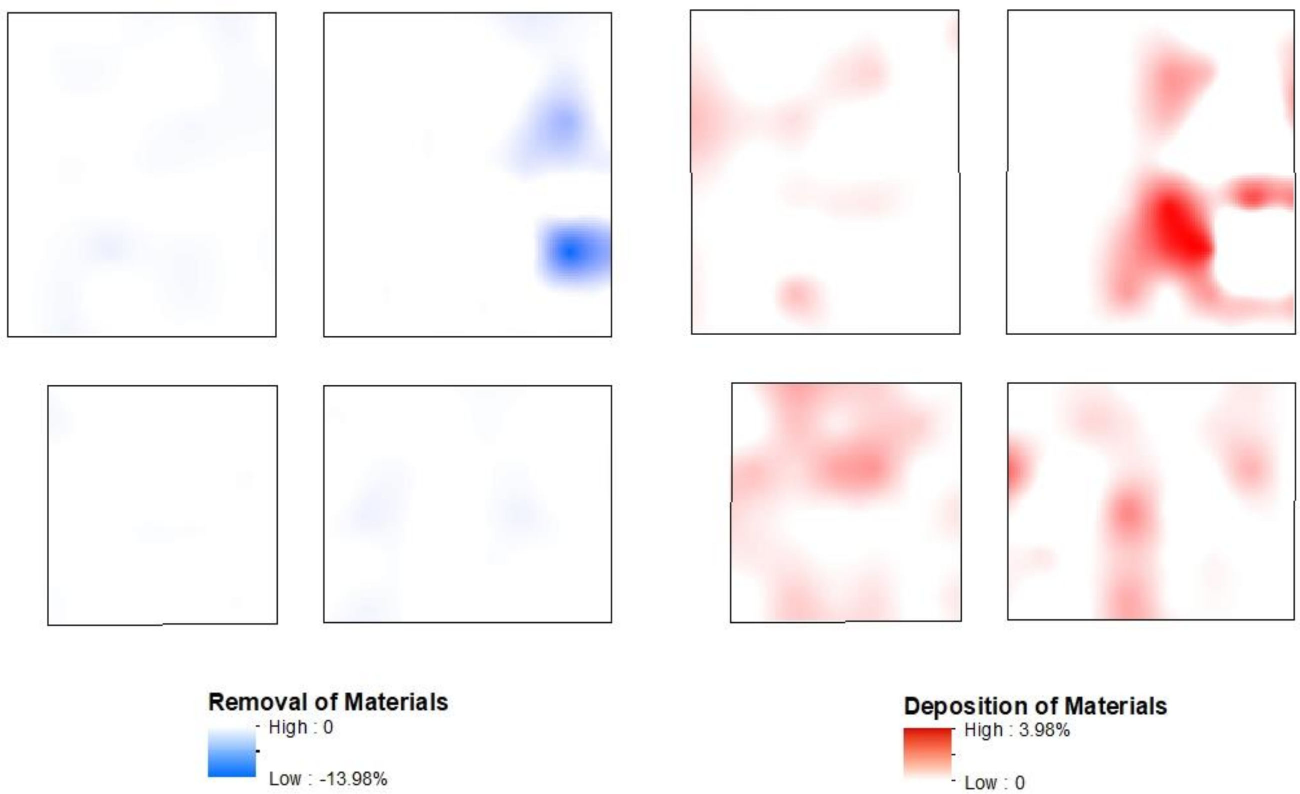


Figure A.52: Spline map showing the debitage distribution separated by size class from floor IIc.

Percent Change from IId to IIc



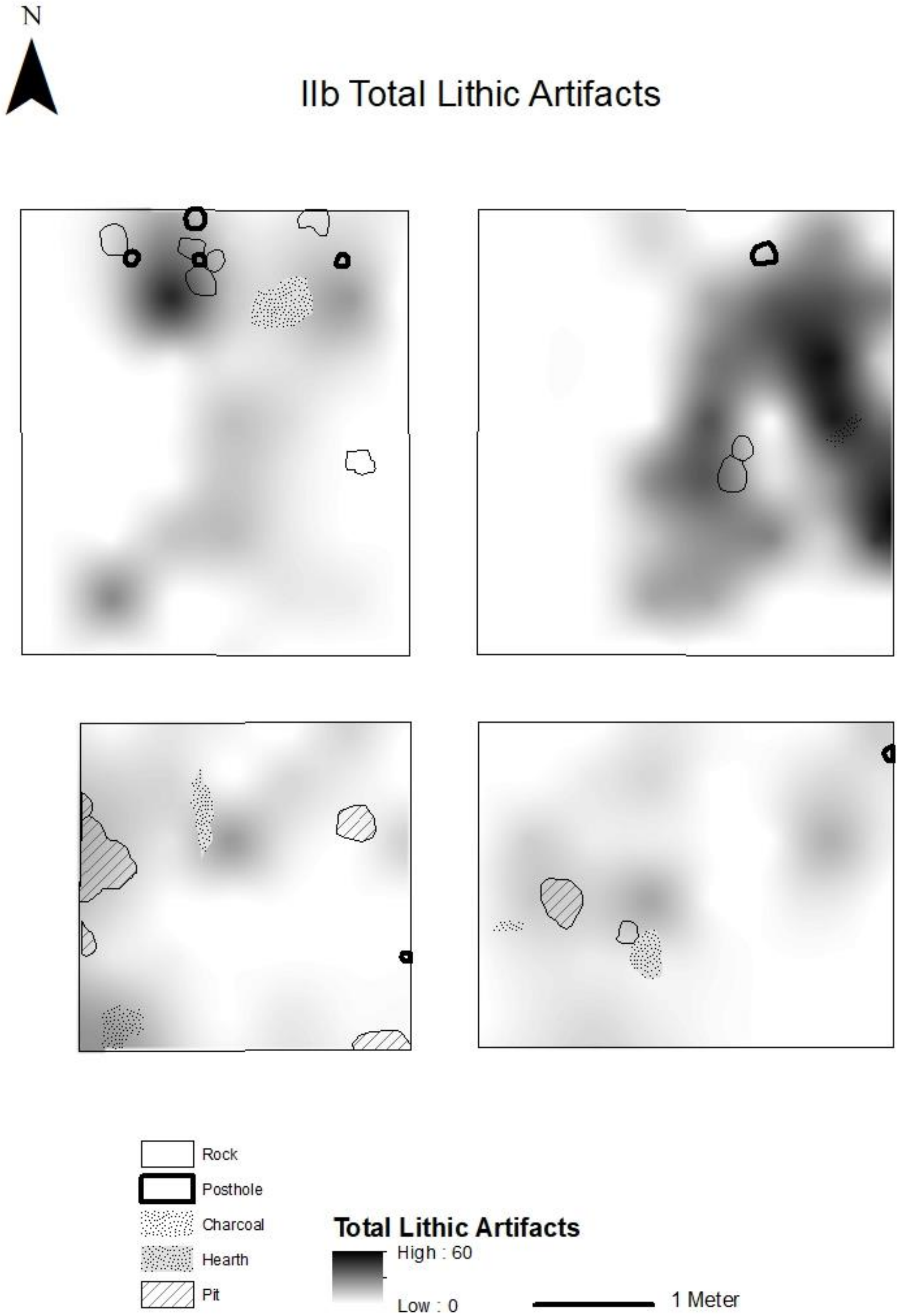


Figure A.54: Spline map showing the total lithic artifact distribution from floor IIb.

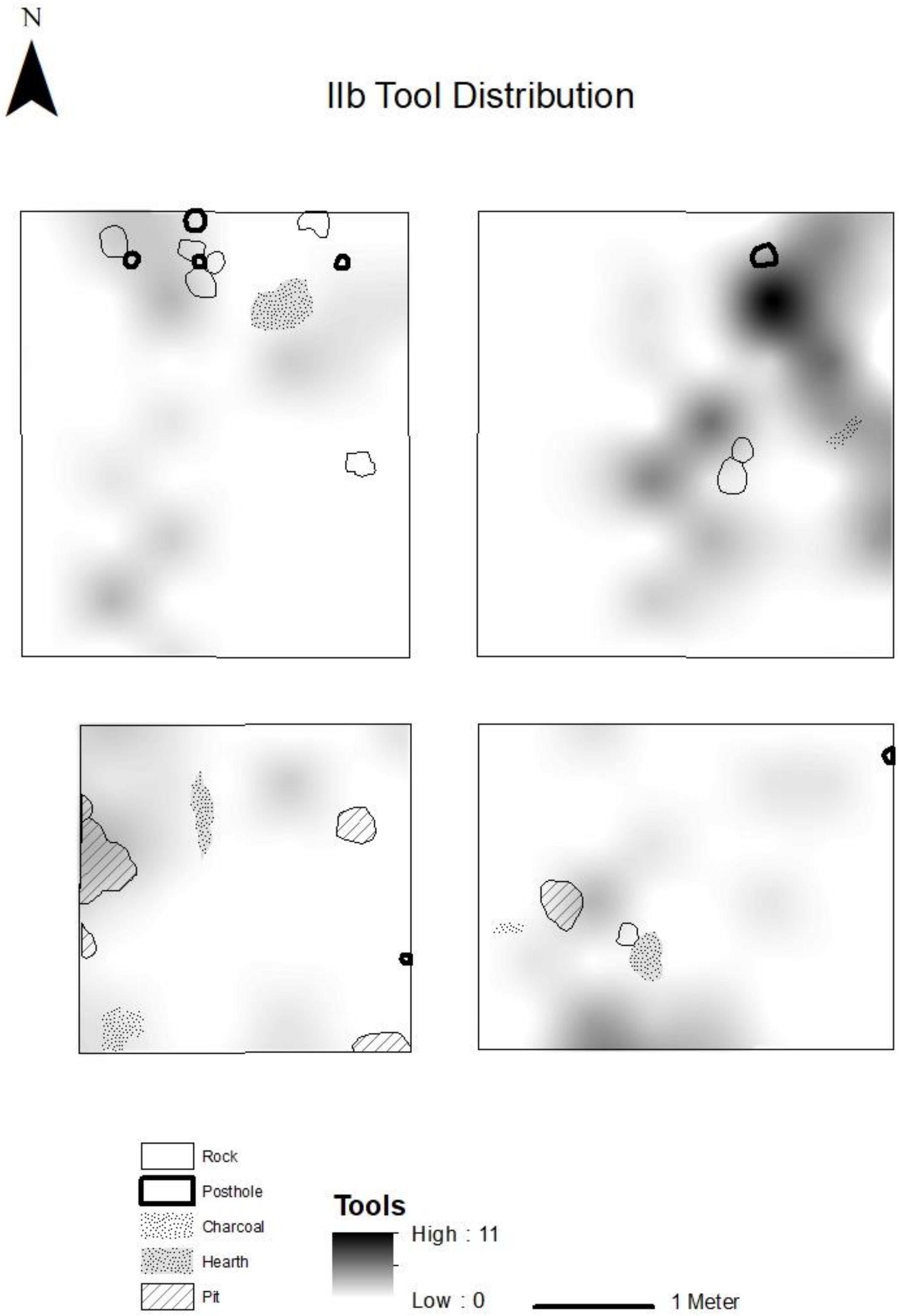


Figure A.55: Spline map showing the lithic tool distribution from floor IIb.

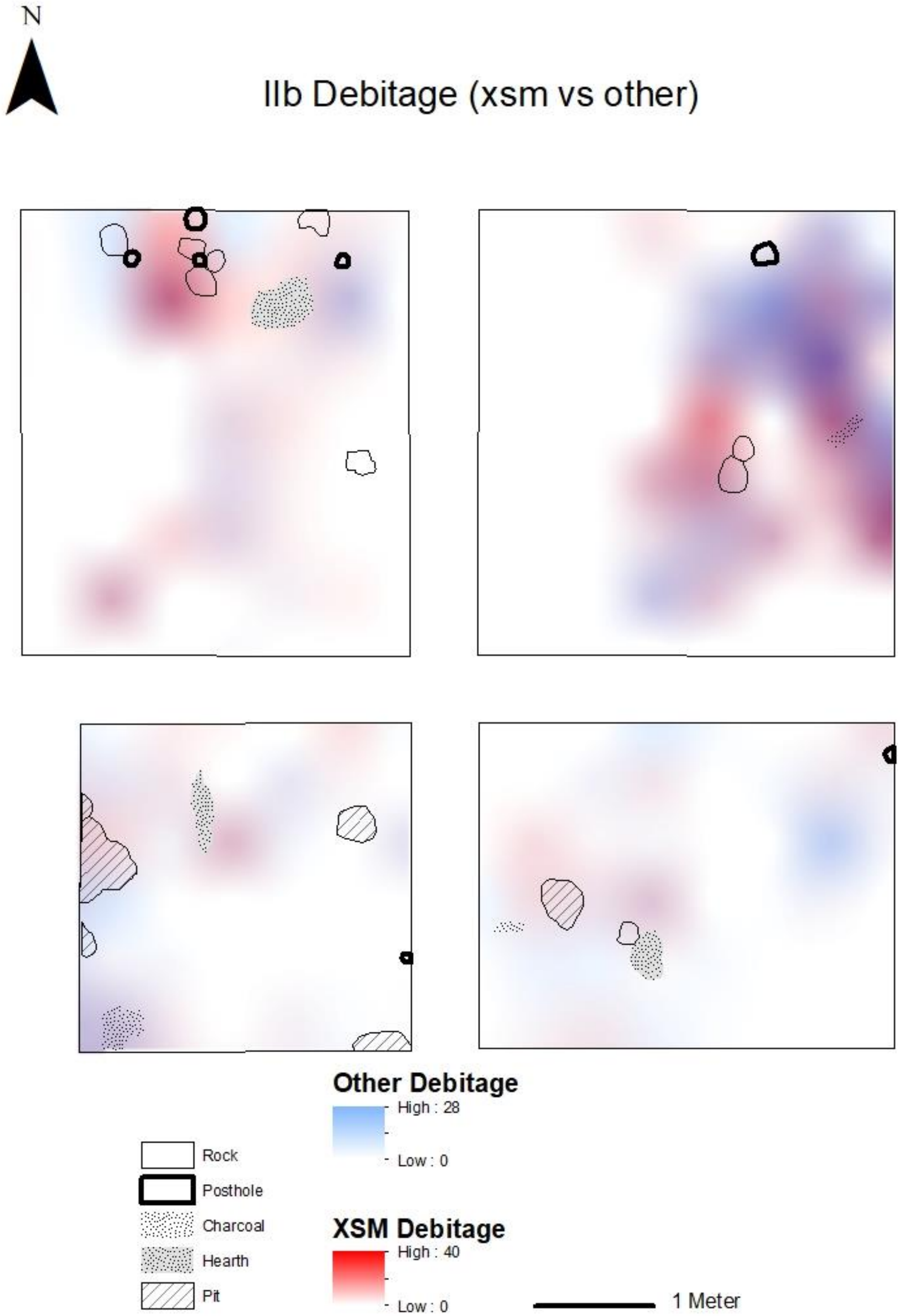


Figure A.56: Spline map showing the debitage distribution separated by size class from floor IIb.

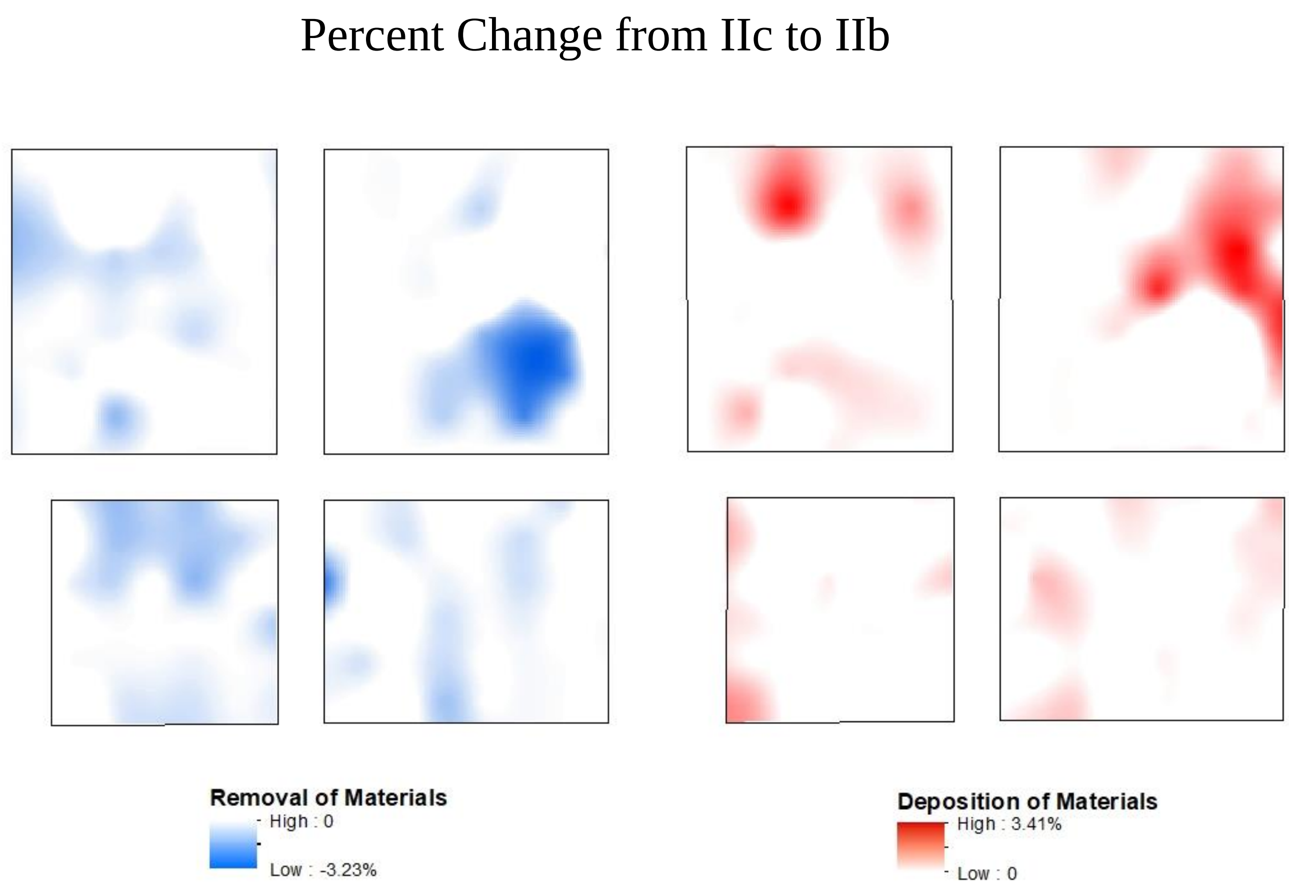


Figure A.57: Spline map showing the percent change of the total lithic artifact distribution from floor IIc to IIb.

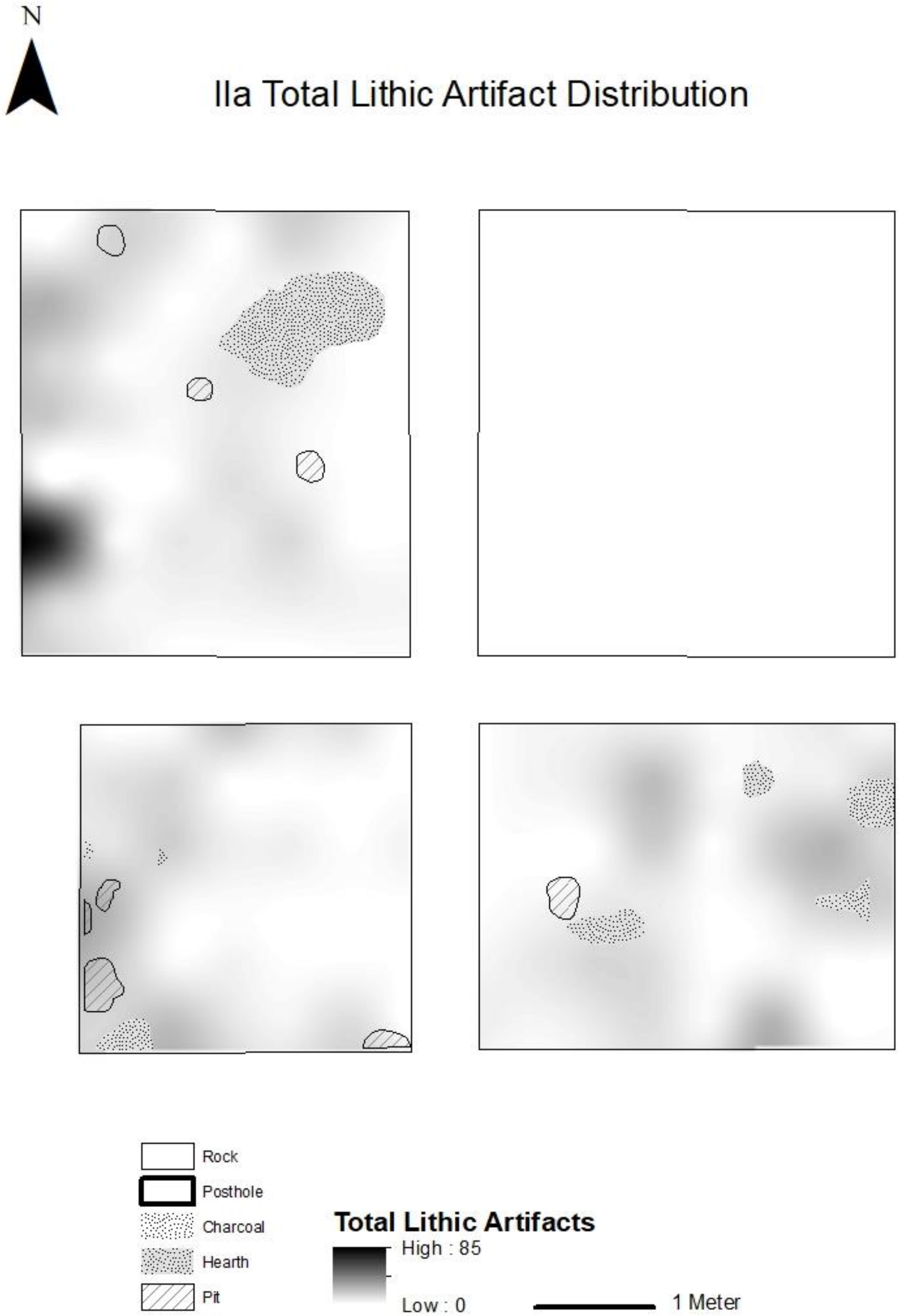


Figure A.58: Spline map showing the total lithic artifact distribution from floor IIa.

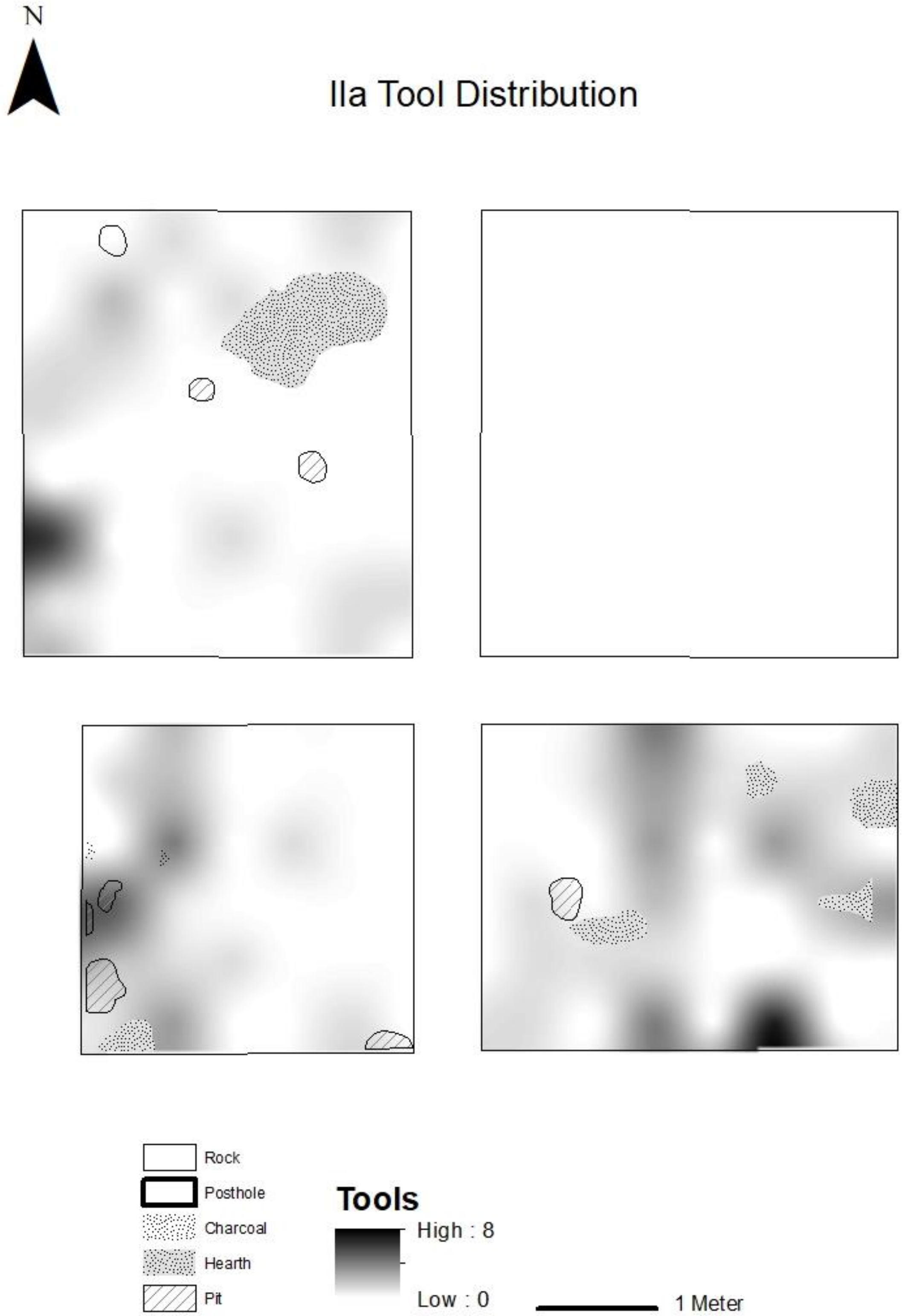


Figure A.59: Spline map showing the lithic tool distribution from floor IIa.

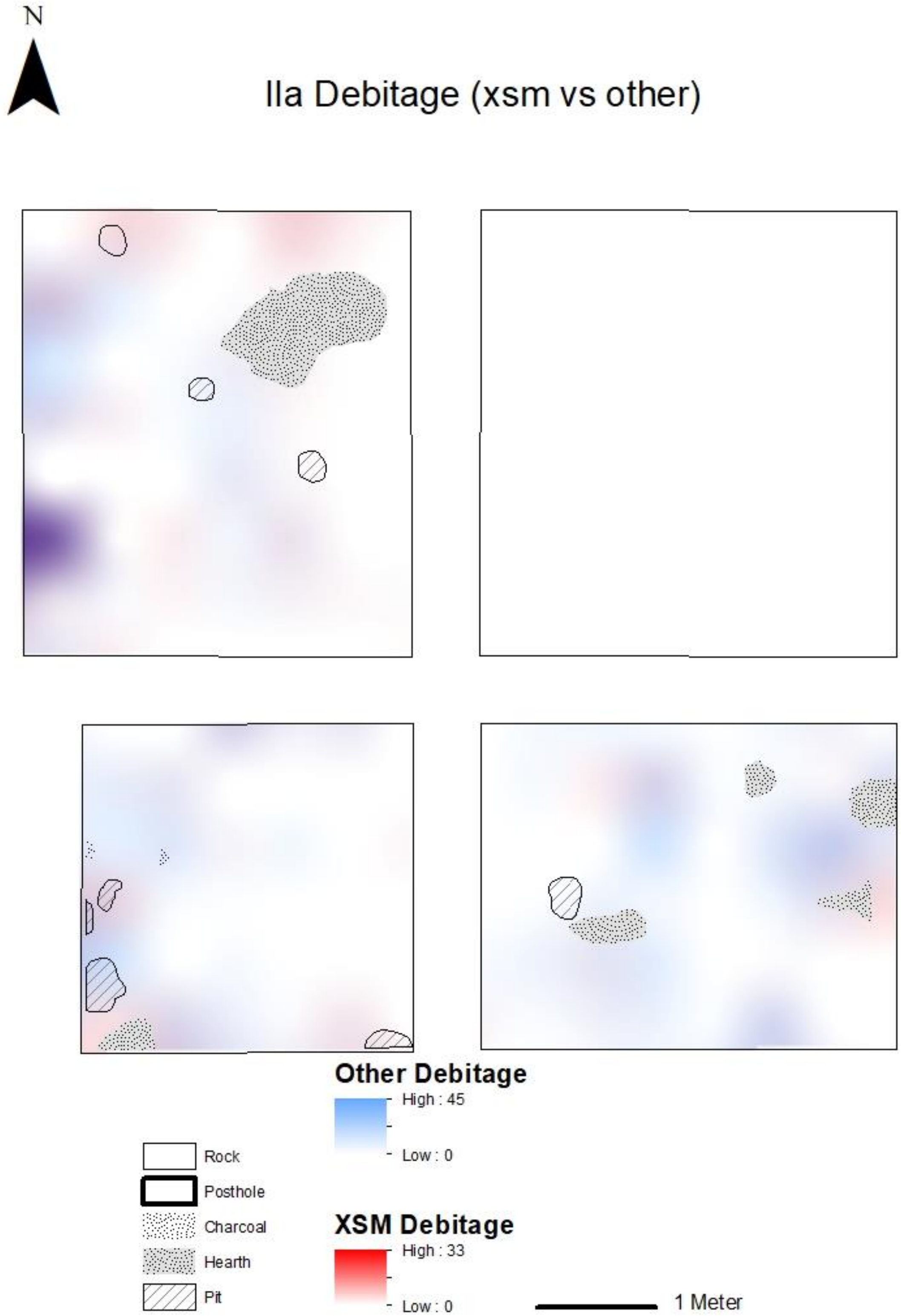


Figure A.60: Spline map showing the debitage distribution separated by size class from floor IIa.

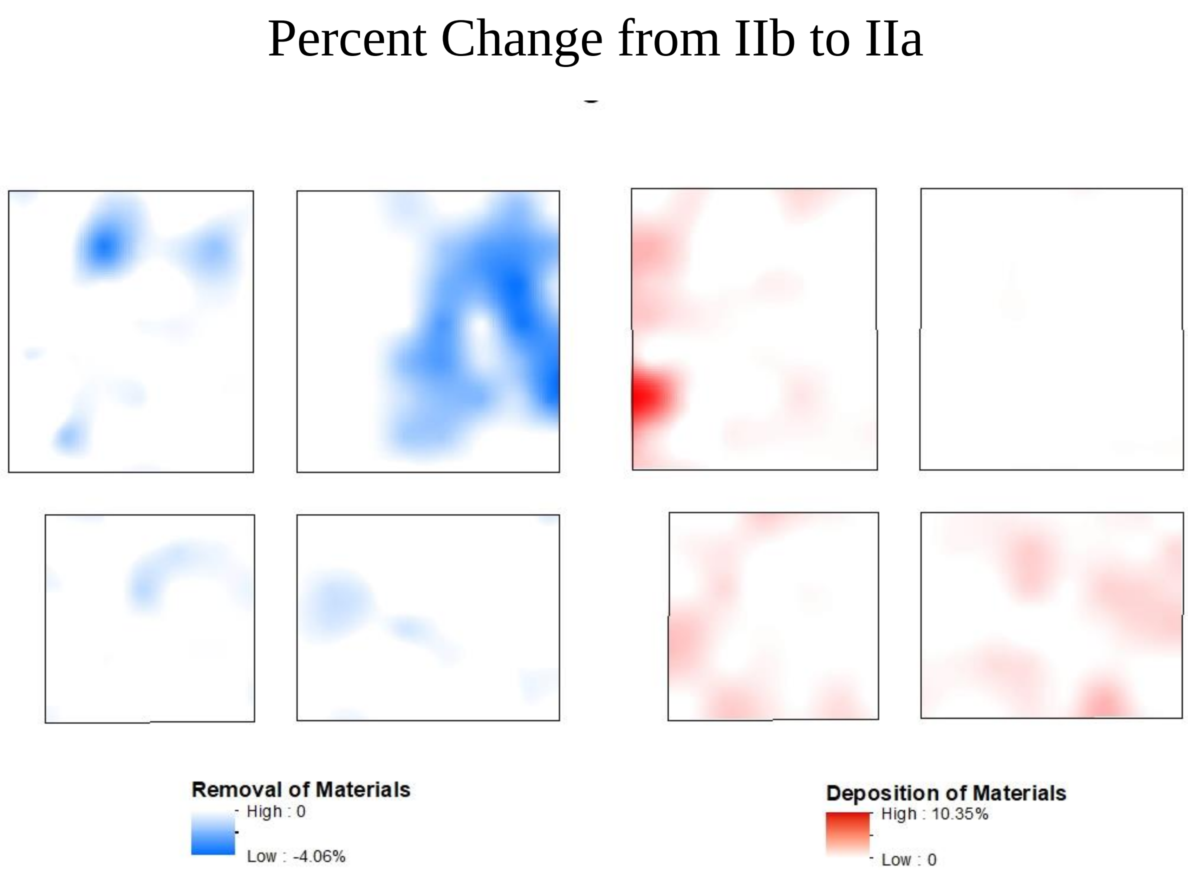


Figure A.61: Spline map showing the percent change of the total lithic artifact distribution between floors IIb and IIa.

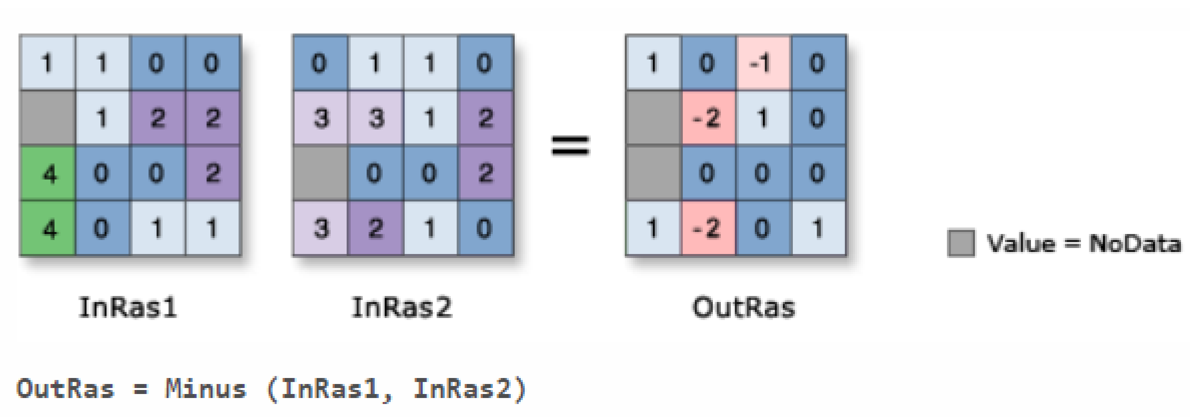


Figure A.62: Schematic of the "minus" tool used for comparing the differences in lithic distributions between subsequent floors.

Table A.4: Table of lithic tool categories and examples of tools.

Hide-work/Sewing	Heavy Duty (wood/antler/bone working)	Hunting/Butchery	Groundstone	Ornamental Items	Knapping
Small piercer	All scrapers (minus end scraper)	All bifaces	Abrader	Beads	Hammer stones
End scraper	Key-shaped uniface	All projectiles	sandstone saw	pead cores	cores
Spall tool	notch	All choppers	abraded cobble	pendants	anvils
Retouched spall tool	denticulate		abraded cobble spall	pipes	battering stones
End scraper on Kamloops point	pieces esquille		mortars	eccentrics	
Stemmed scraper	Used flake on a break		mauls	zoomorphic/anthropomorphic items	
Slate scraper	retouched truncation		polishing stone	nephrite artifacts	
scraper-like biface	key-shaped biface		metate		
	borers/drills/perforators		stone bowl		
	sawed gouge		ochre grinding stone		
	adzes		cube		
	celt		mano		
	retouched truncation on a biface		disks		
	side-notched bifacial drill		vessels		